

Study of Digital Skills Using ICT in the Development of the Digital Economy

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Abstract: The active development of science and technology became the basis of significant changes, which provide for the rapid introduction of ICT in all spheres of economic relations and human life. Such innovations have led to a change in socio-economic activity, which today is defined by digital transformation. The development of the digital economy inevitably affects a person, the demands placed on his abilities, skills and knowledge. The hypothesis regarding the allocation of digital skills in the structure of human capital, the acquisition of which allows the effective use of new electronic services and ICT in work and everyday activities, is becoming dominant in the world. Therefore, we consider it relevant to study the essence and components of digital skills, which can become the basis for comparing their level in different countries. Accordingly, the purpose of this study was to reveal the theoretical and methodological foundations of digital skills and to find out the relationship between the level of digital skills of the population and the competitiveness of the country in the conditions of digitalization of its economy. To achieve the goal, several general scientific and specific methods of cognition were used, including analysis and synthesis, content analysis and the method of classification and analytical grouping, statistical method, economic forecasting. As a result of the study, it is proposed to distinguish the following components in the structure of digital skills: technical and computer skills, communication skills, security skills, media information and data analysis skills, and the ability to solve digital-based problems. It was revealed that the level of development of digital skills depends on the pace of development of the national economy, its competitiveness, the activity of implementation and dissemination of innovative activities. This assumption is confirmed by comparing DSGI (The Digital Skills Gap Index) and GCI (The Global Competitiveness Index).

1 INTRODUCTION

The active development of research and innovation activities led to the rapid introduction of information technologies into all spheres of human life. Such innovations radically change established connections and ways (mechanisms) of activity, and require relevant knowledge necessary for the use of information and communication technologies (ICT) in business, management, everyday life, etc. Gradual digitization and penetration of ICT into the economy are changing, firstly, the classifier of professions; secondly, the requirements put forward in the labour market, which, along with non-cognitive abilities, require new progressive skills that must correspond to modern types of labour activity; thirdly, the

organization of everyday life, for example, participation in distance learning or e-government, online payment of utility services and regulation of digital finances, registration in the medical protection system, etc. It's required at least elementary skills in using computer and digital devices, that is, modern digital society needs a digitally competent population. Thus, today almost all aspects of work or daily activities relate to digital skills. Accordingly, the dominant point of view regarding the expediency of selecting certain skills in the structure of human capital, which are beginning to be called digital skills and become a key factor in determining uniqueness and professionalism, is becoming dominant.

Quarantine restrictions, because of Covid-19, the peculiarities of conducting economic activities in the conditions of the deployment of a full-scale war

proved not only the possibility of performing remote work, but also clearly demonstrated the advantages of the spread of electronic methods of communication, electronic trade, e-banking, etc. However, the community's further acceptance of the gains of digitalization and their active development is possible only based on the development of digital skills, since the population must possess at least a minimum amount of digital knowledge and skills that will allow them to use new electronic services.

2 LITERATURE REVIEW

The rapid pace of digital transformation of society and the economy not only leads to the intensification of the development of digital skills of the population, but also leads to their extensive study in the scientific literature, as evidenced by numerous publications. The analysis of the latter allows us to outline four main areas of research in this direction, in particular:

- clarifying the impact of digital skills on employment and income of the population, as well as their relationship with economic development in general;
- analyzing the digital divide between different regions or countries and outlining ways to overcome it;
- developing new training and educational programs that provide for the formation of digital skills and competencies;
- fixing the relevant digital skills in specific professions.

Individual elements of the first area are presented in the scientific works of Lura Rexhepi Mahmutaj and Nora Jusufi [1], which are aimed at studying the importance of digital skills for stimulating innovation. The authors conclude that taking specific measures to form and develop the digital skills of company employees is a strategic step that can increase competitiveness, growth, efficiency and sustainability in a business environment based on the use of digital technologies.

The second direction of research on digital skills is quite comprehensively revealed in the study of Sophie Lythreatis, Sanjay Kumar Singh, Abdul-Nasser El-Kassar [2], who define the digital divide as a significant social problem of our time, which has recently been significantly deepening. The authors identified nine factors that influence the gap and determined that among them, it is education and the formed digital skills that have the greatest impact on

digital inequalities of different categories of the population or territories.

Presenting the third direction, the team of authors [3] focuses their research on clarifying the changes inherent in the education system after Covid-19. During 24 trainings on digital technologies, they determined that mastering digital technologies is associated with the digital competencies of scientists. Therefore, higher education institutions should implement a policy to form an innovative climate, which will allow the formation of digital skills of teachers themselves and thereby improve the educational process and promote their acquisition by applicants.

The last direction of studying digital skills is due to the active development of the digital economy, which puts forward radically new requirements for employees. In particular, the study by Sebastian Saniuk, Dagmar Caganova, Anna Saniuk [4] identified key areas of knowledge and skills of workers that are necessary for the implementation of the Industry 4.0 concept. Important attention was also paid to the need to combine enterprises with scientific institutions and technology parks, which will allow the formation of the necessary skills and bringing new ideas to industrial organizations.

Thus, the growing importance of digital skills of the population, firstly, is determined by ensuring effective adaptation to changes in the labor market, increasing labor productivity, developing innovations and introducing new technologies. Secondly, it requires the acquisition of new professional skills and abilities that become an integral element of modern work, which is determined by the rapid involvement of ICT and digitalization processes. Thirdly, it determines the need to continue scientific research in the direction of clarifying new horizons of the use of digital skills, which will allow to outline the directions of involving ICT and digital technologies and devices in professional and everyday activities.

3 UNDERSTANDING DIGITAL SKILLS AND THEIR MAIN COMPONENTS AND LEVELS

The rapid development of ICT and their integration into the economic system determines not only the emergence, but also the constant development of digital skills, which affects the increase in the number of scientific attempts to substantiate their theoretical and methodological foundations. In the scientific community, digital competences, or as they were

originally called, digital literacy, began to be studied at the end of the 20th century. In 1997, Paul Gilster introduced and argued for the first time the concept of "digital literacy", under which he understood the ability to disclose and use information in various formats obtained from a wide range of sources and presented with the help of a computer [5, p. 1]. In the future, the rapid pace of digitization significantly changed not only the components of digital literacy, but also transformed them into digital competencies, which today are actively analyzed at the theoretical level (in particular, there are other names of new competencies, for example, e-skills or 21st century skills) and develop based on dissemination numerous educational programs, courses, trainings, etc.

In a more general sense, digital skills are skills and knowledge that allow the use of technological and digital tools in personal and professional spheres, which involves the ability to search, create, evaluate, and use digital information [6, 7]. In accordance with our beliefs, digital skills should be understood as skills and abilities that are formed throughout a person's life and allow to achieve effective professional and creative self-realization based on the use of digital tools and services, which are necessary for the creation and distribution of digital content, search and protection of information, communication and interaction, assessment of potential risks and formation of a motivational development strategy.

It is worth emphasizing that digital competences and digital skills are not identical concepts, but their interrelation is undeniable, since together they reflect a person's ability to use modern digital technologies in their activities. However, digital skills are a basic and narrower concept, as they reflect specific practical abilities that allow performing tasks involving new devices or technologies. In turn, digital competences should be identified not only with digital skills, but also include a set of knowledge, attitudes and responsibilities that allow for the effective, safe and ethical use of digital technologies in various areas of human life. That is, digital skills are the basis of digital competences or the basis on which broader and more complex components are formed.

The main feature of digital competences is their dynamic nature, because they constantly need to be developed and updated as a reaction to the emergence of new technologies and further digitalization. For example, if previously the main skills of digital skills were associated with the ability to perform basic hardware and software operations, use e-mail and find the necessary information, then in the last five years their transformation and skills that allow

success today involve the use artificial intelligence, Big Data, blockchain, cloud computing, Internet of Things, etc. [8]. Therefore, one of the important factors in the development of business activity and the economy as a whole is the introduction of new technologies and digitalization, which, according to researchers, should lead to a change in approximately 44% of the skills of workers over the next five years [9], among which special priority is given creative thinking; analytical skills; technological literacy, which characterizes digital skills; continuous education and the desire for self-education; stress resistance, flexibility.

Table 1: Different approaches to defining the components of digital skills.

Author or Organization	Components of Digital Skills
UK Ministry of Education [10]	Digital foundation skills, communicating, handling information and content, transacting, problem solving, being safe and legal online.
European Commission for Science and Knowledge [11]	Information and data literacy, communication and collaboration, digital content creation, safety, problem solving.
Ester van Laar, Alexander J.A.M. van Deursen and others [12]	Information, communication, collaboration, critical-thinking, creativity, problem-solving.
Bertrand Audrin, Catherine Audrin, Xavier Salamin [9]	Technology use, cybersecurity, content management, communication and collaboration, critical inquiry, responsibility, well-being, identity and development.
Krylov Denys [13]	Information skills, ability to the communication process, security, ability to solve problem situations, ability to create modern content environments.

Table 1 presents different approaches to the selection of structural elements of digital skills, which demonstrates the lack of unanimity on this issue. First, this is due to the recent allocation of such new skills in the structure of human capital, as well as the lack of a unified understanding of their essence and

importance for the development of the economy and the opportunities that ICT discloses for economic activity. The digital skills correspond to the modern development of the economy, which is undergoing changes due to the active implementation of ICT, should form the following elements:

- 1) technical and computer skills, which are the basis for the formation of digital skills, since they are aimed at creating skills and abilities that allow the effective use of technical and digital and software tools, including computer networks, Cloud services; create modern content environments;
- 2) the ability to the communication process, which involves the ability to choose the most successful method of communication and the ability to use modern Internet tools necessary for communication in the form of individual or collective communication for the purpose of data exchange in the digital environment (in this aspect, different methods of communication can be distinguished depending on the purpose, for example, video conferences, e-mail, forums, social networks, chats, blogs, etc.);
- 3) security skills that form an understanding of the need to protect information in a modern digital society and are also designed to create a few measures to ensure the protection of personal data and individual information, guarantee their confidentiality, and manage risks. In this case, the key aspects are the creation of reliable passwords, the use of legal content, compliance with the rules of the culture of behavior on the Internet, the creation of backup copies and the use of modern cloud storage methods;
- 4) media information skills and data analysis, which form a set of knowledge, abilities and skills that allow, firstly, to find, including using digital tools, the necessary relevant information, to carry out its systematization and critical analysis, with further interpretation, storage and processing; secondly, to interpret static information and other universal indicators;
- 5) the ability to solve problems based on digital technologies, which is based on making decisions about the involvement of appropriate digital tools and a creative approach to the use of existing technologies and solving technical problems, as well as the identification of digital needs and resources.

Along with highlighting the components of digital skills, it is advisable to highlight their levels, which is presented in Figure 1. This logic is due to the need to acquire various digital skills depending on the performance of the assigned tasks. The basic level of digital skills facilitates everyday life, establishes interaction with others, allows you to receive commercial and financial services, as well as e-government services. The intermediate level also characterizes general digital competences, but, in comparison with the basic level, enables the performance of a significant number of digital tasks in professional activities. Only a small percentage of people in the world have a high level of digital skills, which characterizes the skills of artificial intelligence, Big Data, coding, cybersecurity, Internet of Things [19]. The holistic analysis of digital skills should include an assessment of each of its components at three main levels.

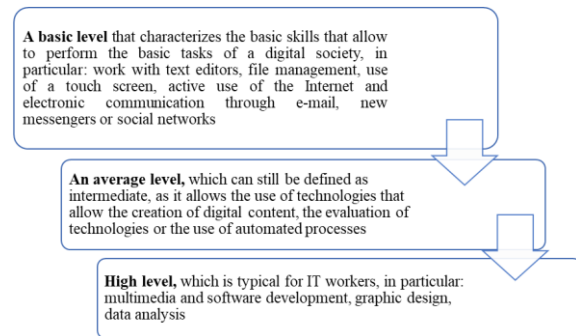


Figure 1: The main levels of Digital Skills.

Therefore, the development of digital skills in the structure of human capital is the only way to preserve the competitiveness of not only a person as a specialist in a certain field, but also the national economy in a changing digital environment.

That is, society is gradually moving to a qualitatively new level of development - digital, which can be considered as the next step of the information technology revolution or the fourth industrial revolution (Industry 4.0). Such changes involve increasing the level and requirements for digital skills and human knowledge, which is the basis for the involvement of broad sections of the population in ICT and digital transformation, as well as the development of social integration. The socio-economic development of the 21st century determines the priority of the economy intangible factors of production, which should be included human and intellectual capital, innovative activity, intellectual properties operating based on knowledge sharing and evaluation. So, knowledge and digital

skills, which today are embodied in human capital, act as the main factor of innovative development. That is, dominant the position of T. Sakaya becomes that we are entering a new stage of civilization, at which the driving force is the values created by knowledge [14].

4 ANALYSIS OF THE DEVELOPMENT OF DIGITAL SKILLS IN UKRAINE AND THE WORLD

We are convinced that the level of development of digital skills depends on the pace of development of the national economy, its competitiveness, the activity of implementing and spreading innovative activities.

The problem of developing basic digital skills today faces all countries of the world, including economic scientists in the EU and the USA. The very innovative directness and focus on the development of knowledge and digital memory ensured the economic advancement of the “Asian tigers” - Japan, South Korea, Taiwan, Hong Kong, Singapore. And the rest of the “Intellectual Island” program in a short period of time achieved great results, which allowed them to take leading positions in many world ratings, and lead to transformation Economical innovations from commodity production to intellectual and creative ones, which to set the pace of world development. The WILEY publishing house in 2021 evaluated DSGI (The Digital Skills Gap Index), which integrally combines three components, namely: Digital Skills Institutions, Digital

Responsiveness, Government Support, each of which consists of separate sub-indices [15]. Singapore has the highest level of DSGI – 7.8; the second position is occupied by the USA – 7.5; third place – Finland, which is the best among European countries – 7.5 (Fig. 2).

We also analyzed The Global Competitiveness Index, which reflects the country's ability to ensure a high level of prosperity and depends on how effectively the country uses existing and potential resources. GCI contains 12 sub-indices, which are ranked into four main blocks (Enabling Environment, Human Capital, Markets), each reflects separate elements of competitiveness. According to the GCI, in 2019, the top three were Singapore and the United States [14]. That is, our assumption is confirmed that countries with high growth rates are characterized by the presence of a higher level of digital skills. In the analysis of European countries (Fig. 2), we observe certain deviations, but in general the trend remains: countries with a lower DSGI score have a lower GCI rating. That is, due to the low rates of economic development of Eastern European countries (Turkey, Romania, Ukraine, Moldova) have lower indicators. We believe that there will be a downward trend in the coming years level of DSGI in Ukraine, because the consequences of full-scale will become evident military invasion of Russia. As a result, not only her suffered socio-economic infrastructure, but social ones will also be felt damages, which, first, are determined by the loss of the most valuable resource - man and his capital. In this aspect, the following circumstances can be defined, these are:

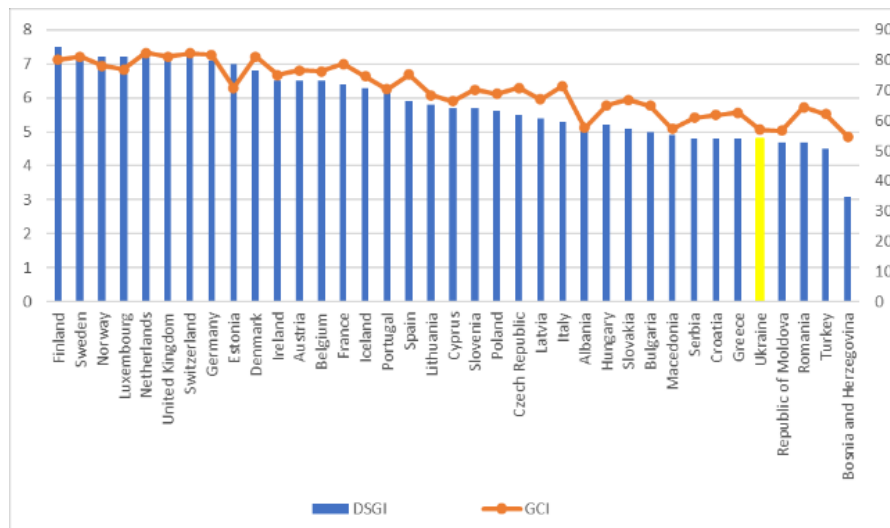


Figure 2: Indicators of DSGI and GCI indices for European countries.

- 1) killed on the battlefield;
- 2) forced migrants who went abroad to in search of safe living conditions;
- 3) lost opportunities for development, because education and self-study during the war are not priority types activity.

But we believe that the Ukrainian government needs to pay attention to the development and distribution among the broad segments of the digital population skills, because they make it possible to develop the economy on the latest foundations, which will be able to provide a breakthrough to the post-industrial society.

Therefore, the world community understands the benefits that the economy and society receive from the development of digital skills. So, EDSC fully supports the goals of the European Program for the Development of Digital Skills, which provide for the achievement of the following level:

- by 2025, 70% of the population aged 16 to 74 should acquire a basic level of digital skills;
- by 2030, 80% of the population aged 16 to 74 should acquire a basic level of digital skills, which is the goal of the European Digital Decade [17].

Thus, digital skills not only change the usual way of working, but also create the basis for sustainable economic growth. After all, the gradual integration of modern complex technologies and Artificial Intelligence into production processes is becoming evident. Accordingly, the establishment of effective coordination involves the use of digital tools, the use of which requires at least an average level of digital skills. Accordingly, the use of digital skills becomes a prerequisite for achieving success, which determines the outline of factors that encourage the development of new competencies, namely:

- 1) the opening of new opportunities, because having at least an average level of digital skills is a guarantee of success in a changing external environment that is evolving quite quickly from the mass use of personal computers to Artificial Intelligence;
- 2) the ability for professional growth and constant self-improvement, since the competitiveness of a specialist is determined by his skills in using ICT and other digital technologies, which develop at a fairly fast pace and therefore require their constant study;

- 3) creativity and the ability to innovate, allowing to implement new ideas, to encourage innovations;
- 4) increase in productivity and efficiency, which is achieved on the basis of the use of new equipment and technologies, which, in addition, allow to simplify production processes and save time for performing other tasks;
- 5) achievements of remote employment;
- 6) use of educational and informational online resources;
- 7) development of new types of entrepreneurship, in particular Internet trade;
- 8) the ability to learn new things and adapt to new requirements of the time.

In general, the emergence of the digital economy demonstrated not only a shortage of highly skilled workers with new skills, but also an insufficient level of digital skills among the general population. In particular, the Ministry of Digital Transformation of Ukraine periodically analyzes the acquisition of digital skills among the adult population based on four levels: 1) no skills, which characterizes the lack of digital skills in such four areas as information, communication, solving life problems and creating digital content; 2) low skills, which imply a lack of digital skills in one of the four areas of competence; 3) basic skills – the level of mastery of digital skills in all four areas at a level no lower than "average"; 4) above basic skills – the level of mastery of digital skills in all four areas at a level no lower than "above average". The disadvantage of such a study is that the proposed methodology differs somewhat from global standards, which makes it impossible to compare Ukrainian and Western assessments. However, the conducted research demonstrated positive changes, which predict a reduction in the share of the population that does not have any skills in using digital technologies, which in 2023 was only 7.2% as opposed to 15.1% in 2019 [18]. In terms of age, of course, the largest percentage of the population that does not have digital skills belongs to the age group of 60-70 years and is 17.4%. This is understandable, because the older generation is quite skeptical about innovations and their active use. It is necessary to note the positive trend in the development of above basic skills, as the share of the population with this level of digital skills has increased by almost 50% over the past four years (Fig. 3).

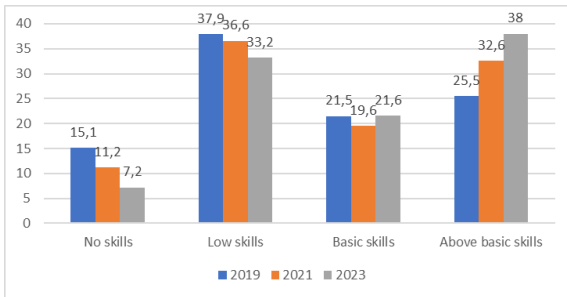


Figure 3: Dynamics of Digital Skills development among the adult population of Ukraine.

With the help of a trend line based on linear dependence, we forecast the further development of digital skills in Ukraine (see Fig. 4). Using the linear dependence corresponding to the equation $y=3.125x-6283.6$, in 2024 we should expect an increase in above basic skills to 41.4%, in 2025 – 44.5%, which can be a positive gain for the Ukrainian economy, which must go through the stage of recovery due to the destruction caused by the development of a full-scale war. The gradual growth of digital skills is significant, because such reconstruction is better to be carried out based on digital transformation.

5 CONCLUSIONS

Among the main factors affecting the level of development of Digital Skills in Ukraine are the level

of education, type of employment and financial situation. We believe that in order to eliminate the problems of Digital Skills development in Ukraine, it is advisable to form a National Strategy for the Development of Digital Skills, which should be developed for the short-term perspective, because new skills are not static, so they need to be constantly improved, as a result of the emergence of new technologies and their impact on Digital Economy and Digital Society. In addition, it is desirable to use European methods and approaches to conduct more comprehensive and thorough analyzes of the assessment of the Ukrainian level of Digital Skills, which will allow a comprehensive comparison of the achieved level of new digital skills of the population of different countries.

Therefore, the development of digital skills is the basis for accelerating the process of digitalization of society and the national economy, gradually they are becoming a mandatory attribute of modernity. Accordingly, the spread of digital skills among broad segments of the population is the key to the active implementation of ICT and a consistent transition to a higher level of development. We believe that the prospects for further scientific research in this aspect should include the development of methods or a scale for assessing digital skills. However, it is worth emphasizing that such a calculation must necessarily focus on the field of work of the owner of digital skills.

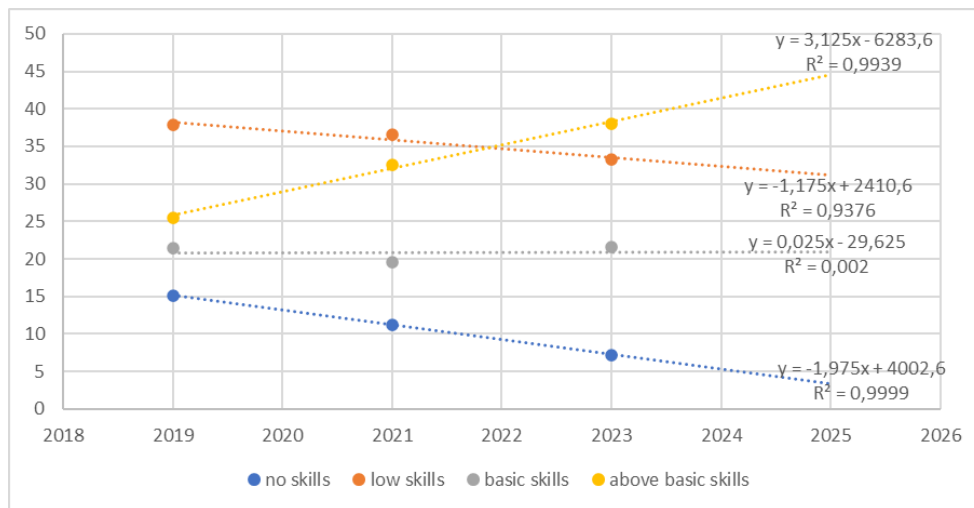


Figure 4: Forecasting the development of digital competences in Ukraine.

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