FORMATION AND DEVELOPMENT OF DIGITAL COMPETENCIES IN THE CONDITIONS OF DIGITALIZATION OF SOCIETY

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Abstract. *The active development of the digital economy in all countries of the world presupposes the availability of specific digital competencies among employees. The purpose of the study is the formation and development of digital competences, which the digital society requires from the population. The research methodology involves the use of various methods and techniques, including: the historical method - for researching the development of digital competencies; graphic method - for a schematic representation of research results; comparative method - for comparing competencies in different countries; methods of analysis and synthesis - to create the Levels of digital competence proficiency scale and others. Researched the classification that exists in the EU contains three main categories of DSC for students / citizens: digital competence; special digital skills; digital skills for ICT professionals. The main competence areas of DigComp have been systematized. A Model of formation and actualization of needs for the development of digital competencies has been developed, which includes the following components: needs, conditions, motives and incentives, voluntary and coercive measures aimed at the formation and actualization of these needs. The main strategic directions for the development of digital competences in the conditions of digitalization of the economy have been developed. A general scheme for assessing the impact of digitalization of the economy on the demand and supply of jobs is proposed. The methodological approaches can help find answers to special and specific questions, in particular about the impact of digitalization of the economy on competencies and their combinations, the emergence of new professions, understand the expectations of the labor market by studying its demand for professional skills rather than skills listed in standard job descriptions, as well as develop substantiated proposals for improving labor market and field policies in Education.*

Keywords: digital economy; digital society; digital competences; digital skills; workplace; employee.

The digitalization of the economy and society requires not only technical and technological changes, but also the transformation of employee competencies in accordance with modern requirements for the professional qualification level of employees of the digital economy. Approval of the Concept for the Development of the Digital Economy and Society of Ukraine for 2018-2020 [1] and the approval of the action plan for its implementation contributed to the introduction of measures to overcome the "digital divide" and "acquisition of digital competencies by citizens", but the issue of ensuring the development of digital competencies of the population remains extremely relevant. In order to solve the tasks of increasing the level of digital literacy of the population and developing digital skills and digital competencies, including by defining a system and describing the components of digital competence and ensuring legal regulation of these issues, the Concept for the Development of Digital Competencies (hereinafter referred to as the Concept) was adopted and an action plan for its implementation was approved [2].

The general provisions of the Concept define digital competence based on the interpretation of competence in the Law of Ukraine "On Education" as a dynamic combination of knowledge, skills, ways of thinking, attitudes, values, other personal qualities that determines the ability of a person to successfully socialize, conduct professional and / or further educational activities (information and communication competence is included in the list of key competencies that are formed in the process of complete general secondary education), namely: digital competence is a dynamic combination of knowledge, skills, ways of thinking, attitudes, other personal qualities in the field of information and communication and digital technologies, which determines the ability of a person to successfully socialize, conduct professional and / or further educational activities using such technologies.

The Concept also presents the concept of information and communication competence, which means confident, critical and responsible use of digital technologies for one's own development and communication; the ability to safely use information and communication tools in education and other life situations, adhering to the principles of academic integrity [3]. This concept is close to the definition of

digital competence in the DigComp 2.0 document [4]. In the text of the Concept, the terms "digital skills" and "digital competencies" are used in all subsequent provisions without disclosing the content and specifying the difference. How different equivalent concepts of "digital skills", "digital competencies", "digital literacy" are used in the Concept to reveal certain features of the process of acquiring digital knowledge. In the description of the Digital Competence Framework for Ukrainian citizens [5], developed in accordance with the Concept, two more definitions of digital competence (pp. 5-6) and in the glossary (pp. 52-53) are proposed, which differ from the definitions provided in the Concept. Consequently, there is a "conceptual confusion".

The development of the categorical apparatus continues, researchers use similar terms, such as information and communication competence, information and digital competence, digital competence, ICT competence, etc. In the study of the European Foundation for Education (ETF) [6], the definitions of digital skills and competence (DSC) and digital and online learning (DOL) are applied.

The classification that exists in the EU contains three main categories of DSC for students/citizens:

- *digital competence,* also called digital literacy, encompasses a set of basic digital skills that includes information literacy and data literacy, online communication and collaboration, digital content creation, security and problem-solving. Digital competence is the ability to apply these digital skills (knowledge and attitudes) confidently, critically and responsibly in a defined context (e.g. education). Since 2006 digital competence is one of the eight key competencies in the EU for lifelong learning;

- *specialist digital skills* – *a* set of specific digital skills for workplacers, including the use and maintenance of digital tools such as 3D printers, CAD software and robots;

- *digital skills for ICT professionals* – a set of advanced, highly specialized, digital skills for ICT professionals, such as programmers and cybersecurity experts, who are expected not only to use but also improve existing information and

communication technologies and create innovative new solutions [6].

According to the DigComp and DigComp 2.0: The Digital Competence Framework for Citizens [4], digital competence is the confident and critical use of ICT tools in the areas of employment, employment, education, leisure, inclusion and participation in society, which is vital for participation in modern society and economy (European Parliament and the Council, 2006). The digital competence system for citizens, also known by the acronym DigComp, was first published in 2013 by the European Commission. This document (Digital Competence System for Citizens) was aimed at increasing the digital competence of citizens, assisting in the development of appropriate policies that support the formation of digital competence, as well as planning initiatives in the field of education to improve the digital competence of specific target groups.

According to the Framework of updated key competencies for lifelong learning [7]:

- *Competencies are a combination of knowledge, skills and attitudes* where: knowledge consists of facts and figures, concepts, ideas and theories that are already established and support understanding of a particular field or subject; skills are defined as the ability and ability to perform processes and use existing knowledge to achieve results; attitudes describe dispositions of perception and disposition regarding ideas, person or situation, encourage appropriate reactions or actions;

- *Literacy is the ability* to discern, understand, express, create and interpret concepts, feelings, facts and opinions orally and in writing, using visual, sound and digital materials in different disciplines and contexts;

- *Digital competence is the* confident, critical and responsible use and interaction with digital technologies for study, professional activity (work), participation in society. Includes digital and information literacy, communication and collaboration, digital content creation (including programming), cybersecurity, and problem-solving.

The core knowledge, abilities, skills and attitudes related to digital competence are as follows:

- knowledge of how digital technologies can support communication, creativity and innovation. Awareness of their capabilities, limitations, impacts and risks;
- understanding of the general principles, mechanisms and logic of digital technologies;
- knowledge of basic functions and the use of various devices, software and digital networks;
- knowledge of legal and ethical principles related to the use of digital technologies;
- digital competence involves the ability to use digital technologies to support creativity, active citizenship and social inclusion, collaborate with others to achieve personal, social or commercial goals;
- skills include the ability to use, access, filter, evaluate, create, program and share digital content [7].

Thus, as evidenced by the above approaches to defining the concepts of "digital skills", "digital competence", "digital literacy", in most cases there is an equation of digital competence with digital literacy, although digital competence implies the ability to apply digital skills, and digital literacy is the ability to distinguish, understand, create and interpret digital materials based on knowledge and attitudes. In turn, digital skills imply the availability of digital literacy for the use, maintenance, creation of digital tools, information and communication technologies, as well as the use, creation, programming and exchange of digital content. To understand the differences in the level of ownership and scope, regulatory and research documents propose definitions for different professional groups and their specification for ICT workers. In the adopted Concept, key concepts need to be specified in order to avoid tautology and understanding of the main ideas and provisions of this conceptual document.

Along with the lack of a unified approach to defining the concept of "digital competence", there are different approaches to their classification and allocation of

levels. As an element of the ET 2020 strategy, the European Commission's Joint Research Centre (JRC) has developed two reference frameworks to support the coherent conceptualisation and development of the DSC among EU Member States (Table 1.3).

Table 1.3. European DSC Framework for Citizens, Teachers and Educators

Structure and tools	Target group	Content
Digital competence system for citizens (DigComp 2.1). Self-assessment tool and techniques developed with the JRC	For all citizens	Conceptualization of digital competence for citizens regarding lifelong learning (21 competencies grouped into 5 areas). Progression model based on 8 levels of knowledge
Digital Competence Framework for Educators (DigCompEdu) Self-assessment tool and guidelines developed with the JRC	Teachers and teachers	Conceptualization of digital competence for teachers (22 competencies grouped into 6 areas). Progression model based on 6 levels of knowledge

Source: [6]

For both frameworks, each competency has a descriptor with examples of activities and digital technologies; It also includes a range of levels of knowledge (6 for teachers and 8 for citizens) that can be used to develop individual progression models. In May 2017, DigComp 2.1 (current version) expanded the initial level of three knowledge to eight more detailed. DigComp combines basic DSC into five areas of competence (Table 1.4), including 21 competencies assessed at eight levels of knowledge, described in terms of learning outcomes, with use cases [6].

Table 1.4. DigComp areas of expertise

Field	Description
Information literacy and data literacy	To formulate information needs, search for and access to data, information and content in digital environments and move between them. Create and update personal search strategies
Communication and collaboration	To interact through a variety of digital technologies and understand the appropriate digital communication tools for a given context
Digital content creation	To create and edit digital content in various formats to express yourself through digital means
Security	To protect devices and digital content, understand the risks and threats that exist in the digital environment. Be aware of security measures and due attention to reliability and confidentiality
Troubleshooting	To identify technical problems in the operation of devices and the use of the digital environment and solve them (from troubleshooting to solving more complex problems)

Source: [6]

DigComp 1.0 Framework had three skill levels: basic, intermediate and advanced (advanced), in DigComp 2.1 their number was increased to 8 (Table 1.5). A wider and more detailed range of knowledge levels supports the development of learning materials.

At the initiative of the Ministry of Digital Transformation of Ukraine, experts adapted the European conceptual and reference model of the Digital Competence Framework for EU Citizens (DigComp 2.1) to the national, cultural, educational and economic peculiarities of Ukraine.

Table 1.5. The main keywords characterizing the skill level

Level in DigComp		Complexity of tasks	Autonomy	Cognitive domain
1.0	2.1			
Base	1	Simple tasks	With the head	Remember
	2	Simple tasks	Alone or with a supervisor if necessary	Remember
Medium	3	Well-defined and routine tasks and simple problems	Yourself	Understanding
	4	Tasks and clearly defined non-template problems	Independently and according to their needs	Understanding
Advanced	5	Tasks and problems of varying degrees of complexity	Manages the work of other users	Application
	6	The most difficult corresponding tasks	Able to adapt to others in a complex context	Evaluation
Highly specialized	7	Complex problems with limited solutions	Integrates to promote professional practice and guide others	Creation
	8	Complex problems taking into account the influence of many interacting factors	Offers new ideas and processes on the ground	Creation

Source: [6]

In the Digital Competence Framework for Ukrainian citizens, the level of competence proficiency is conditionally divided into a set of six areas of competence: basics of computer literacy; information literacy, ability to work with data; creation of digital content; communication and interaction in the digital society; security in the digital environment; problem solving in the digital environment, lifelong learning [8].

In contrast to the areas of competence, DigComp distinguishes zero level – the basics of computer literacy and 6 levels of digital competence (Table 1.6).

Table 1.6. Levels of digital competence proficiency

Proficiency levels		The complexity of the tasks	Autonomy of work	Cognitive domain
Base	A1	Simple tasks	With the head	Remember
	A2	Simple tasks	Alone or with a supervisor if necessary	Remember
Medium	B1	Clearly expressed and template tasks, simple problems	Yourself	Understanding
	B2	Tasks and clearly defined non-template problems	Independently and according to their own needs	Understanding
High	C1	Tasks and problems of varying degrees of complexity	I manage the work of other users	Application and evaluation
	C2	Complex tasks with a limited range of possible solutions	Integrated contributions to professional practice and management of other users	Evaluation and creativity

According to the classification of digital skills used by the International Telecommunications Union [9] in the process of analyzing the state of the global telecommunications / ICT sector and monitoring the information society, basic, standard and advanced digital skills are distinguished.

Basic skills: sending emails with attached files; Copy or move files or folders Use copy and paste tools to duplicate or move information within a document. Transfer files between your computer and other devices.

Standard skills: connection and installation of new devices; creating electronic presentations using presentation software; use basic arithmetic formulas in spreadsheets, search, download, install and configure software.

Advanced skills: writing a computer program using a specialized programming language.

Different approaches to the classification of digital competence levels complicate the comparability of the obtained research results on the development of digital competencies both at the national level and in international comparisons.

Strategic directions for the development of digital competencies in the context of digitalization of the economy

Theoretical and scientific-practical generalizations and assessments contributed to the development of a model for the formation and actualization of needs for the development of digital competencies (Figure 1).
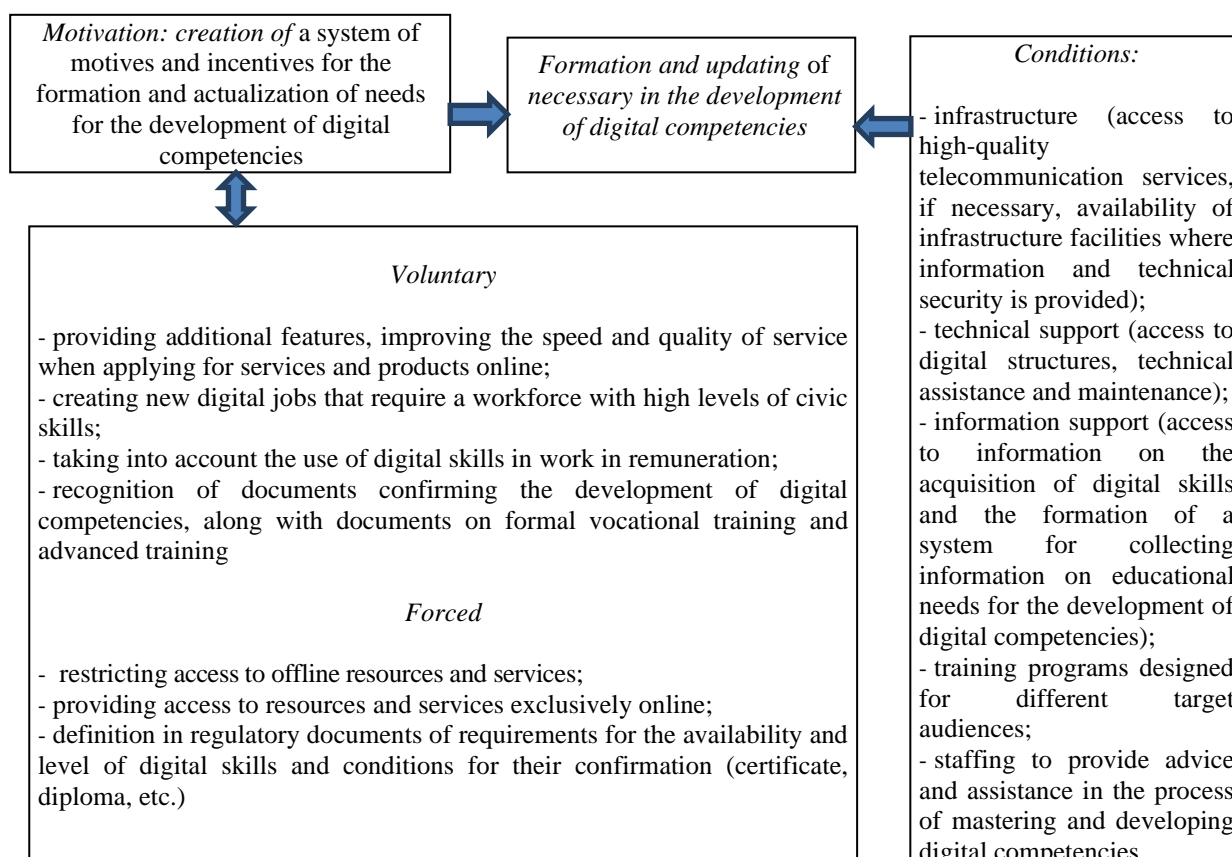
Figure 1.6. Model of formation and actualization of needs for the development of digital competencies

Source: [27]

It includes the following components: needs, conditions, motives and incentives, voluntary and coercive measures aimed at the formation and actualization of these needs. The terms mean information and technical support, infrastructure, educational products, consulting support. When meeting the request for acquisition and development of digital skills, it is important to take into account the age of the audience, locality (rural, urban, not controlled by the Ukrainian authorities territory, territory close to the demarcation border), level of digital skills, level of education, specific need that formed the request for training, status and sphere of employment. When forming the need for the development of digital competencies, a significant role is played by the state, employers, various business entities that restrict or terminate offline access to benefits, services, consultations or provide exclusively online access to them.

Limited access during the pandemic to offline administrative services, banking services has updated the acquisition of digital skills by the population to obtain information from websites or applications, submit information to government agencies or services online, information on the consumption of utilities and their payment, download and print official documents and payment documents. A separate challenge for internally displaced persons of retirement age was mastering the "Dii vdoma" application in conditions of poor-quality Internet connection when living in rural areas or in summer cottages.

Thus, restricting offline access or exclusive provision of access to benefits, resources, services, online work, in particular as a result of automating the provision of public services or creating digital jobs, creates the need to develop digital skills for both employees and consumers. An effective measure that does not restrict the rights of citizens to choose and access public services, but contributes to the choice of online consumption of services, is to provide additional opportunities, increase the speed and comfortable conditions of service when applying online for services and products. Employers have a wide range of tools for actualizing the need for the development of digital competencies of employees both at the stage of recruitment, selection, selection of personnel, in particular in the process of developing workplace models and requirements for candidates and the list of necessary documents for a vacant position to participate in the competition, developing job descriptions, and in the process of using, training, stimulating, promoting personnel by including in the provisions and plans the mandatory availability of digital skills and a document on the development or level of digital skills.

Creating the necessary conditions and implementing tools to motivate the actualization of needs for the development of digital competencies will overcome the main barriers to their acquisition: irrelevance of training and lack of interest in educational products and limited access to the Internet and devices.

The use of digital, ICT technologies by employers, the development of digital skills and competencies of employees create conditions for the accumulation of human capital in the country, the production of innovative products (services).

Innovative products (services) are associated with the use of new approaches to staff motivation, namely a combination of competence and digital.

The competence approach involves material remuneration, development of professional qualities (skills, competencies) of staff; recognizes the employee as the main value of the company, ensuring the competitiveness of both the employee and the company. Therefore, its use ensures the accumulation of human capital and harmonizes the interests of the employee with the strategic goals of the company. At the same time, the information economy determines the movement of jobs into the information space. It is possible to ensure the coherence of the interests of staff and the organization under such conditions using a digital approach to its management.

The digital approach involves the transfer of social and labor relations into the digital space, that is, the interaction between employees and between the employee and the employer online using digital devices; is based on the use of digital personnel management systems. It becomes more relevant with the advent of virtual offices. For example, Sococo, Workplace platforms that create a single information space for a digitally distributed team. Thanks to modern virtual offices, distributed teams can collaborate remotely on the implementation of complexCTs[15]. Therefore, the digital approach simplifies and speeds up the communication system both within the enterprise and with stakeholders. Competency and digital approaches are closely interrelated and complementary, both emphasizing intangible incentives; stimulate the improvement and development of digital competencies of employees, motivate to professional development.

The specificity of employment in the digital economy is that it is aimed primarily at accumulating personal human capital and is characterized by a high level of freedom of choice and mobility. The blurring of the line between work and leisure forms a new model of work, in which the favorite thing for a smart worker becomes more important than entertainment. Such a model requires new approaches to the formation of a model of motivation. The best option is to combine a competence approach with a digital one.

The state policy has significant strategic potential to ensure the effectiveness of digital skills acquisition by the population through the adoption by the Cabinet of Ministers of Ukraine of Digital Literacy Programs (Resolution No. 849 of 29.09.2019). The main implementing entity of the Program is the Ministry of Digital Transformation of Ukraine. The activities of the Ministry should ensure the achievement of the following goal: "A Ukrainian who wants to have digital skills, can acquire them freely." Indicators of the effectiveness of its implementation are determined: more than 6 mln. Ukrainians will be covered by the digital skills development program; 70% of citizens who have completed the program will have skills at a basic level. To achieve this goal and implement the Program, the Ministry of Digital Transformation of Ukraine launched a national online platform on digital literacy of the population of Ukraine [16].

International comparisons on innovation capacity, digital literacy, digital skills, etc., are driving countries to lead. Of particular interest are the components of the Competitiveness Index "innovation capability" and "skills", as they reflect Ukraine's position on the quality of personnel and the level of readiness to develop and implement innovations.

The indicator "capacity for innovation" includes a country's position on the quantity and quality of formal research and development; the level of favorable environment in the country in establishing cooperation, interaction, creativity, diversity and confrontation; the ability to turn ideas into new products and services. According to this indicator, Germany is leading (86.8 points), and Ukraine (40.1 points) is ranked 60th, which is 2 positions lower than in 2018 [17]. The indicator of "skills" assesses the quality of the workforce, as well as quantitative and qualitative indicators of the country's educational system. In particular, attention is focused on the development of digital literacy, interpersonal skills and the ability to think critically and creatively.

In terms of skills, Switzerland leads in the ranking (86.7 points), Ukraine scored 69.9 points and took 44th place, which is two positions higher than in 2018 [17]. When comparing the results of Ukraine with the indicators of Poland according to the

above indicators, it should be noted that the latter territorially borders on Ukraine, belongs to the post-Soviet countries and is characterized by a more developed economy. According to the Global Competitiveness Index, Poland ranked 37th. The analysis of the components of the "skills" indicator shows that in many components Ukraine has positions higher than Poland. This indicates the availability of skilled labor and labor potential.

According to the Report [9], there are significant differences in the level of digital skills between generations, in particular, the gap in basic skills reaches 30 percentage points, in standard skills – 40 percentage points. This digital skills gap by age category leads to the strengthening of state policy on the implementation of special digital literacy programs for older people and the dissemination of "Digital Entrepreneurship" programs for different age categories.

A new direction that will be possible thanks to the 5G network is the Internet of skills, which allows people to interact in real time over long distances – both among themselves and with machines. An example of the application of the Internet of skills is remote interactive learning through a combination of machine interaction methods and the expansion of communication capabilities [18]. Such systems realize the possibility of human interaction with a robot, virtual devices, artificial intelligence.

Flexible employment, which is actively expanding in the context of digitalization of the economy and quarantine restrictions during the COVID-19 pandemic, provides more opportunities for self-actualization and provides for high requirements for the educational and qualification level of employees. It should be emphasized that in all countries there is a steady tendency to increase the share of highly skilled category of workers in the structure of employees. Recently, as a result of digitalization processes, a digital economic space has been formed, which requires other mechanisms of interaction between labor market actors and other skills from employees. This determines the need for workers to master digital skills. At the same time, a digital skills gap is being created between employed and unemployed persons (according to a report by the International Telecommunication Union (ITU) in the world) [9].

In general, regardless of the status of a person in the labor market, the share of those with basic skills is higher than those with standard skills [9]. It is quite expected that the unemployed are lagging behind in all ICT skills, in the future the gap can only grow. Basic and standard skills are easy to master, but they are not needed if a person has the status of unemployed. At the same time, digital skills are a prerequisite for those who are self-employed or self-employed.

Possession of digital skills is a component of an individual's competitiveness in the labor market. They are especially relevant for freelancers, as many jobs have gone digital and can be done at home or in a public space. This implies the constant updating of digital skills. However, all risks regarding the timeliness and completeness of mastery are borne by self-employed persons, unlike those who are employed. This is facilitated by increasing the level of access to the Internet for households, which, according to the report of the International Telecommunication Union (ITU) in the world in 2018, was 60% [9].

According to the forecasts of the Institute for the Future (The Next Era of Human-Machine Partnerships, 2017), citing the US Bureau of Labor Statistics, modern students will change 8-10 jobs by the age of 38, and a significant part of them will join freelancers. It was expected that by 2020 the number of freelancers in the United States will reach 50 million people [19]. This is due to the fact that the actual work activity is becoming more mobile and flexible. It can be assumed that the number of freelancers will increase due to an increase in digital employment due to increased mobility, primarily digital. The Internet through mobile devices connects not only people with each other, but also people with technical accessories.

There is a digital gap in the skills of the population depending on the level of development of the country, which is associated with the branching and accessibility of digital infrastructure for the population. At the same time, the share of the population, particularly in the least developed countries, that has an Internet connection is constantly increasing. The data of the Report [9] show a significant lag in the population of the least developed countries (LDCs) in basic and standard digital skills by 19 and 20 percentage points respectively. At the same time, LDCs

have people with programming skills. It should be noted that a small part of the population of both developed and least developed countries has mastered advanced digital skills. It can be assumed that with the development of information and communication infrastructure in LDCs and ensuring wide access to it for the population, as well as corresponding prices for digital devices, the share of the workforce with digital skills will increase.

The development of digital technologies puts forward new requirements for the educational, qualification and professional level of human resources, thereby developing innovative human capital. Carriers of innovative human capital have a high level of intelligence and digital skills, but this is not enough. The competence of an innovative worker is determined on the basis of the thesis "a person should be smarter than a computer", that is, an employee must combine intuitive and logical thinking, produce innovations, be able to make unprogrammed decisions, learn quickly, easily assimilate new technologies and produce new knowledge. According to T. Frey's forecasts, by 2030, more than 2 billion "traditional" jobs will disappear in the world, which will replace the new ones demanded by the digital society [20]. He identifies 14 skills needed in a new society, including: the ability to adapt to a new environment, find problem points, develop effective feedback mechanisms, new theories, establish processes, etc. T. Frey has developed a classifier of 162 new future professions for the preparation of vacancies that do not yet exist in 11 areas of activity in the digital society [21]. Skills for these professions can only be formed using digital technologies for training specialists.

Every year, the pace of skills aging is accelerating due to changes in technology and digitalization. Solving this problem requires the expansion of lifelong learning. This concept is becoming even more relevant in the context of the formation of the digital economy, due to fundamental changes in the process of labor and business processes. The concept of lifelong learning should be implemented within the framework of the strategy for the development of smart specialization. Constant updating of existing skills and mastering new ones is a necessity for the carrier of human capital, as it provides support for the level of its competitiveness. The concept

of lifelong learning is implemented in the form of formal, informal and informal learning. Higher education institutions can offer all types of education or a combination of them. In particular, universities can offer non-formal education through the placement of their own courses on educational platforms or other open resources, as well as through seminars, trainings, workshops, hackathons. A person acquires information education through self-study during professional, social activities, etc. An educational institution may participate in public, cultural and other events held in the region.

The results of an expert survey [12], conducted by specialists from the Institute of Industrial Economics of the National Academy of Sciences of Ukraine, show that the national system of formal education partially ensures the formation of digital skills. The main disadvantages are the use of outdated technologies in the education system and its lagging behind the pace of development of digital technologies, the inconsistency of educational standards with professional ones.

This involves the implementation of the following measures:

- monitoring the need for personnel with digital skills and establishing the level of met demand (executors: State Employment Service of Ukraine in cooperation with IT clusters, IT companies);

- introduction of adult education for mastering basic and standard digital skills (executors: Ministry of Education and Science of Ukraine, State Employment Service of Ukraine, Ministry of Social Policy of Ukraine, volunteer organizations); introduction of digital entrepreneurship trainings into higher and vocational education (executor: Ministry of Education and Science of Ukraine);

- spreading the culture of digital entrepreneurship among the population;

- implementation of the programs "Digital literacy" and "Digital entrepreneurship" for persons who have the status of unemployed and are trained with the assistance of city and regional employment centers (executor: State Employment Service of Ukraine);

- implementation of digital entrepreneurship support programs (executor: State Employment Service);

- supporting the implementation of teaching practices in educational institutions on a mixed basis using ICT (executor: Ministry of Education and Science of Ukraine);

- harmonization of professional and educational standards taking into account the digital needs of the labor market, formation of models of employees' competencies for sectors of the digital economy.

The development of a model of competence of employees in a particular area is closely related to the content of standards of professional activity. The structuring of the content of the professional standard is based on a competence approach, which involves the formation of requirements for the knowledge and skills of the employee, ensuring the quality performance of the main labor functions in the relevant field of professional activity. The structural elements of the professional standard are labor functions, professional competencies (by labor action or group of labor actions), general competencies, subjects and means of labor, requirements for knowledge and skills of the employee, etc. [23].

According to the Methodology for the development of professional standards [23]:

professional competences – a set of knowledge, skills and abilities, professionally significant qualities of a person that ensure the ability to perform at a certain level labor functions defined by the relevant professional standard;

professional standard – approved in the established line requirements for the competencies of employees, which serve as the basis for the formation of professional qualifications;

General competencies 2012 universal competencies that do not depend on the subject area are important for the successful professional and social activities of a person.

The competence model includes the analysis of work functions and the definition of abilities that are required for their implementation, followed by grouping them into thematic blocks and filling them with competencies.

The whole set of learning outcomes forms a model of competence. All models of competencies of modern employees should include digital competencies, including skills in using information and communication technologies, the ability to search, process and analyze information from various sources. The current Methodology for the development of professional standards should be adjusted to include digital competencies in their general list in the Sample design and content of the professional standard in subsection 4. "General competencies" for professions for which they are not professional competencies. The competence approach in the development of professional standards is focused on the direct use of professional standards in the formation of educational programs / standards and training modules (for example, one labor function - one educational program (one module), during the certification and certification of personnel, assessment and assignment of professional qualifications, when the level of competence (ability) of a person to perform one labor function or their set is established. Change of labor functions, labor actions of employees, objects and means of labor, requirements for knowledge and skills of an employee under the influence of digitalization of the economy in many industries require updating professional standards with subsequent updating of educational standards in accordance with the needs of the modern labor market.

Inconsistency of actions and non-observance of the order and priority in the development of professional and educational standards, their untimely updating lead to inconsistency of competencies of graduates of educational institutions with the needs and requirements of employers.

The model of competencies of an employee of the digital economy should serve as a criterion for the selection, hiring, selection and evaluation of personnel in order to rationally form the staff, and determine the list of those qualities of employees that need priority development. In accordance with this, it is necessary to develop appropriate programs for their effective training and advanced training.

Operating exclusively with the categories of "profession" and "digitalization" often leads to somewhat rough generalizations, which are limited only to conclusions such as "new profession", "obsolete profession" or "disappearing profession", while a

significant trend in the development of the labor market is the recombination of functions and demanded skills of the workplace and the position of the workplaces themselves within different types of economic activity. Modern intellectual analysis and big data allow you to process and operate not aggregated categories, but elementary information units, such as elements of competencies and skills, elements of functions and tasks of the workplace [24].

According to the European Training Foundation (ETF) [25], the most common among the vacancies are the requirements for the applicant to have personal qualities of adaptation / flexibility (77.4% of vacancies) and responsibility (53.0%), knowledge of economics and management (68.3%), skills of the user of office software (68.6%), as well as language competencies, teamwork skills, technical knowledge, basic skills of working with a computer, monitoring and leadership skills encountered in more than 40% of vacancies.

These data indicate the expansion of the range of vacancies that are concentrated in the segment of the digital economy and are directly related to the production, marketing, promotion of digital goods and services, e-commerce. First, these are vacancies intended for specialists in the field of programming and information technology. This is one of the most dynamic areas of activity in Ukraine. New here are the professions "big data specialist", "Java engineer", etc., which did not exist a few years ago.

Secondly, these are SEO managers, SMM managers, targeters, account managers, link builders, etc. These vacancies are specific, not typical for the labor market of the past, but the possibility of mastering the necessary competencies to perform garden duties usually does not require a second specialized higher education, it is sufficient to acquire additional competencies in related specialization through short-term professional training (courses, trainings).

In general, semantic analysis allows you to identify vacancies with meaningful names, which, according to their extended descriptions, cannot be attributed to well-known sections of the classifier of professions. The presence of such vacancies serves as an indicator of the formation and emergence of new professions on the labor

market, which is an extremely important result of applying the methodology for using big data for labor market analytics (identifying knowledge in big data) [26] for both scientific and practical spheres.

Accordingly, tracking the dynamics of the number of such professions allows you to identify new trends in the labor market and respond in a timely manner to such changes: from making changes to the classifier of professions to the possibility of forecasting the supply of new jobs in the labor market [24].

So, today big data specialists are in the top of the most common vacancies both in the world and in Ukraine. For the most part, competence requirements for them overlap with several areas of professional activity (economist, statistician, programmer), which implies higher education in one of the profiles and in parallel with professional experience or specialized courses in other professional fields. According to research, digital skills make up only 30% of the profile of a big data specialist, and non-digital and interpersonal skills make up 31% and 39%, respectively (Figure 1.7).
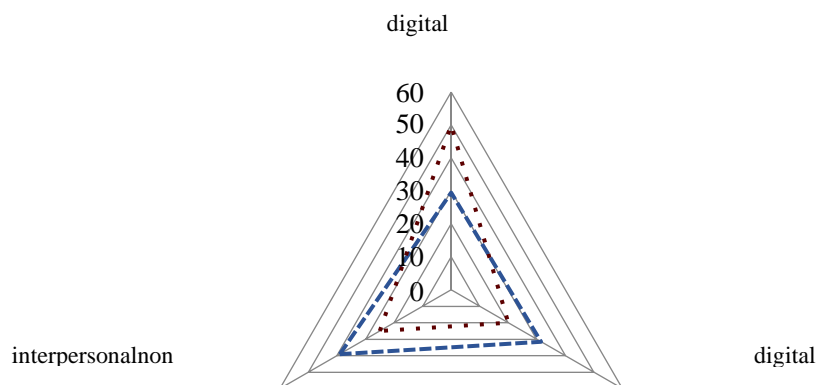
Figure 1.7. The combination of competencies for the profession of "big data specialist" (dotted line) compared to a specialist in programming (dot line)

Source: [25]

At the same time, as mentioned above, in Ukraine there is a clear tendency to complicate in the context of digitalization of certain types of professions, especially those that previously belonged to the simplest, strengthening their manufacturability

and content, which requires additional knowledge and skills from applicants. An example is the vacancy of a warehouse worker (storekeeper). Today, for an increasing number of these vacancies under the influence of the development of new automated accounting technologies and intra-warehouse logistics, the common requirements of employers are: knowledge of the principles of automated warehouse accounting, PC skills, knowledge of 1C, features of transportation of certain types of products.

The analysis of the section of "competence professions" demonstrates the spread of a segment of vacancies that require multiversatility of employees, and sometimes mergers, combining activities that were previously considered exclusively as separate professions. This is manifested in the emergence of such vacancies: administrator-accountant, driver-loader-forwarder, inspector-picker, accountant-specialist in personnel management, marketer-sales representative, etc. The emergence of this trend in the Ukrainian labor market is caused, firstly, by the global tendency to increase the multifunctionality of specialists and competence in solving complex problems, which is associated with the general tendencies of complication of mental labor activity, the introduction of new digital technologies and the gradual reduction of the able-bodied population, and, consequently, skilled labor; secondly, the intersection and increase in the interdependence of various forms of activity, which has caused the need to search for specialists whose competencies will be at the junction of various forms and spheres of work.

The above examples of using big data on the labor market illustrate that such methodological approaches can help find answers to special and specific questions, in particular about the impact of digitalization of the economy on competencies and their combinations, the emergence of new professions, understand the expectations of the labor market by studying its demand for professional skills rather than skills listed in standard job descriptions, as well as develop substantiated proposals for improving labor market and field policies in Education. The formation and justification of models of competencies by professions in the digital economy should take place with

the mandatory use of the results of the analysis of big data on the labor market and in accordance with its needs.

The general scheme for assessing the impact of digitalization of the economy on the demand and supply of jobs is shown in Fig. 1.8.
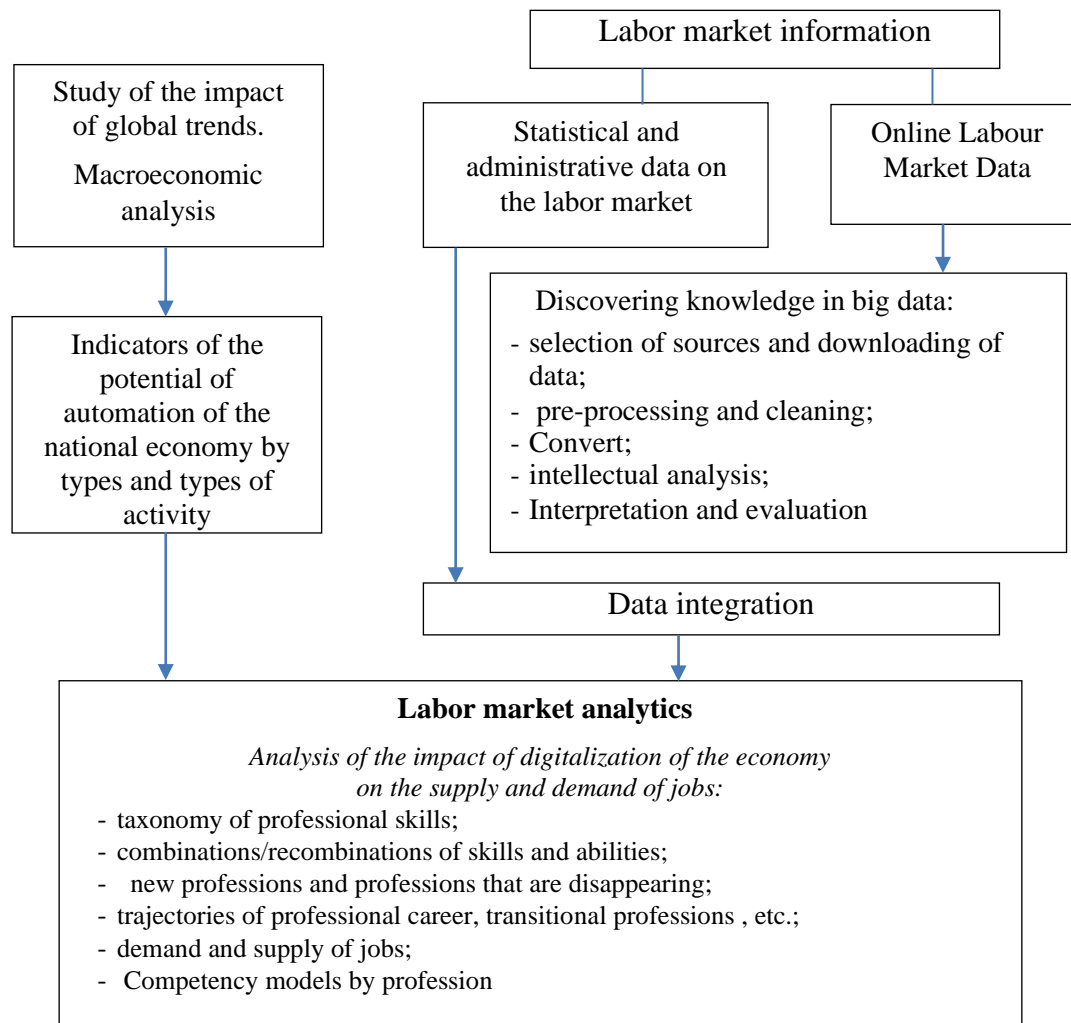
Figure 1.8. General scheme for assessing the impact of digitalization of the economy on the demand and supply of jobs

Source: [28]

Therefore, in the process of research, the classification that exists in the EU was studied, which contains three main categories of DSC for students/citizens: digital competence; special digital skills; digital skills for ICT professionals. The main areas of competence of DigComp have been systematized. A Model of the formation and actualization of needs for the development of digital competences has been

developed, which includes the following components: needs, conditions, motives and incentives, voluntary and compulsory measures aimed at the formation and actualization of these needs. The main strategic directions for the development of digital competences in the conditions of digitalization of the economy have been developed. A general scheme for assessing the impact of digitalization of the economy on the demand and supply of jobs is proposed. Methodological approaches can help to find answers to special and specific questions, in particular about the impact of the digitalization of the economy on competencies and their combination, the emergence of new professions, to understand the expectations of the labor market by studying its demand for professional skills, rather than the skills listed in typical job descriptions, as well as develop reasonable proposals for improving the policy on the labor market and the field of education.

References:

1. On approval of the Concept for the development of the digital economy and society of Ukraine for 2018-2020 and approval of the action plan for its implementation: Order of the Cabinet of Ministers of Ukraine dated January 17, 2018. No. 67-p. URL: https://zakon.rada.gov.ua/laws/show/67-2018-%D1%80.

2. On approval of the Concept for the development of digital competencies and approval of the action plan for its implementation: Order of the Cabinet of Ministers of Ukraine dated 03.03.2021 No 167-p. URL: https://zakon.rada.gov.ua/laws/show/167-2021-%D1%80#Text.

3. State standard of basic secondary education, approved by the resolution of the Cabinet of Ministers of Ukraine dated 30.09.2020 No 898 "On some issues of state standards of complete general secondary education". Official Bulletin of Ukraine. 2020. № 81. Century. 2615.

4. DigComp 2.0 The digital competence framework for citizens. URL: https://op.europa.eu/en/publication-detail/-/publication/bc52328 b-294e-11e6-b616-01aa75ed71a1/language-en.

5. Description of the Digital Competence Framework for Ukrainian citizens. 2021. URL: https://thedigital.gov.ua/storage/uploads/files/news_ post/2021/3/mintsifra-oprilyudnyue-ramku-tsifrovoi-kompetentnosti-dlya-gromadyan/%D0%9E%D0%A0%20%D0%A6%D0% 9A.pdf.

6. Digital skills and competence, and digital and online learning. European Training Foundation, Turin, 2018. URL: https://eufordigi- tal.eu/wp-content/uploads/2019/09/DSC-and-DOL_0.pdf

7. EU Framework Programme on updated key competencies. URL: http://dlse.multycourse.com.ua/ua/page/15/53

8. Ionan V. Digital literacy of Ukrainians. What opportunities does the Ministry of Digital Transformation plan to create in 2021? URL: https://nv.ua/ukr/biz/ experts/shcho-robit-mincifri-osvitni-seriali-oflayn-habi-testi-novini- ukrajini-50141070.html

9. MIS 2018: Measuring the information society ITU. URL: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-1-E.

10. Digital literacy of the population of Ukraine. 2019. Ministry of Digital Transformation of Ukraine. URL: https://osvita.diia. gov.ua/uploads/0/585-cifrova_gramotnist_naselenna_ukraini_2019_ compressed.pdf

11. Internet addiction or self-development: technology in the minds of the digital world. Advantages and threats for schoolchildren. URL: https://naurok.com.ua/post/internet-zalezhnist-chi-samorozvitok-tehnologi-v-umovah-cifrovogo-svitu.

12. Azmuk N.A. Strategic directions of balancing the development of the national labor market and the digital economy: autoref. Dis. Dr. Econ. Sciences: 08.00.03. Institute of Industrial Economics of NAS of Ukraine, Kyiv, 2020. URL: https://iie.org.ua/wp-content/ uploads/2020/08/avtoref_azmuk_maket_4_compressed.pdf

13. More than 65% of villages are not covered by broadband Internet access. Ministry of Digital Transformation. URL: https://www.epravda.com.ua/news/ 2020/07/30/663522.

14. Use of information and communication technologies at enterprises. URL: http://www.ukrstat.gov.ua/operativ/operativ2018/zv/ikt/arh_ikt_u.html

15. Azmuk N.A. Transforming Employment in the Digital Economy: Global Challenges and Adaptation Strategies: Monograph. Kyiv: Znannia, 2019.

16. National online platform for digital literacy. Action. Digital education. URL: https://osvita.diia.gov.ua.

17. The Global Competitiveness Report 2019. World Economic Forum. 2019. URL: http://www3.weforum.org/docs/WEF_TheGlobal CompetitivenessReport2019.pdf

18. The Global Creativity Index 2015. Martin Prosperity Institute. 2015. URL: http://martinprosperity.org/media/Global-Creativity-Index-2015.pdf

19. The Next Era of Human-Machine Partnerships. IFTF. 2017. URL: http://www.iftf.org/home/http://www.iftf.org/fileadmin/user_upload/downloads/th/SR1940_IFTF forDellTechnologies_Human-Machine_070717_readerhigh-res.pdf

20. Transforming how the world works. Topcoder. 2019. URL: www.topcoder.com/

21. Frey T. 162 Future Jobs: Preparing for Jobs that Don't Yet Exist. 2014. URL: http://www.futuristspeaker.com/2014/03/162-future-jobs-preparing-for-jobs-that-dont-yet-exist.

22. Report on the study of the outsourcing programming market of Eastern Europe in 2016. Top$dev. URL: http://topsdev.org/blog/obzor-rinka-freelance-2016.htm.

23. Methodology for the development of professional standards: Order of the Ministry of Social Policy No. 74 dated January 22, 2018. URL: https://zakon.rada. gov.ua/laws/show/z0165-18#Text

24. Tsymbal, O.I. Libanova, E.M. Sarioglo V.G. and others. An innovative toolkit for assessing the structure of the supply of jobs in Ukraine. Report on a scientific project. Kyiv. Institute of Demography and Social Research named after M.V. Birds, 2020.

25. ETF – Big Data LMI – Ukraine. URL: https://public.tableau.com/profile/tabulaex#!/vizhome/ETF-BigDataLMI-Ukraine/Time.

26. Mezzantsanika M., Mercorio F. Large data in the context of the labor market: an introductory guide. ETF, 2019.

27. Mihus, I. (2023). The main trends in the development of industry 4.0 and its impact on the economic security of the state: an international aspect. *Science Notes of KROK University*, (1(69), 52–59. https://doi.org/10.31732/2663-2209-2022-69-52-59.

28. Transformation of the social and labor sphere in the conditions of digitalization of the economy: monograph/ O.F. Novikova, Yu.S. Zaloznova, O.I. Amosha, O.O. Khandiy, N.A. Azmuk, Y.V. Ostafychuk, L.L. Shamileva, O.V. Pankova, I.M. Novak, A.D. Shastun, O.Yu. Kasperovych, O.V. Ishchenko, Ya.E. Krasulina, L.P. Amelicheva, V.V. Companion; for sciences ed. O.F. Novikova; NAS of Ukraine, Institute of Industrial Economics. Kyiv, 2022. 385 p.