

# Digital Economy Competencies as a Vital Necessity of a Modern Successful Specialist

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## ABSTRACT

A comparative analysis of foreign and Russian approaches to the interpretation of the definition of "digital economy" is provided in this study. The article shows the need for mastering knowledge and skills that correspond to the digital economy competencies with a focus on the IT sphere by future and current specialists to ensure their demand in the modern labour market. Their correlation with end-to-end technologies of the digital economy is also shown. In conclusion, the author's opinion on the creating and substantiation of the hierarchy of the digital economy competencies in terms of their importance in the successful specialist's activities is presented.

**Keywords:** *information technologies, digital economy, end-to-end technologies, digital economy competencies*

## 1. INTRODUCTION

One of the strategic area of economic development at the present stage is the formation of the digital economy, which is beneficial to the activities of business entities. It allows to obtain finance with the use of digital technologies, develop e-commerce and services, develop communications with counterparts with the prompt release of up-to-date information for a wide range of users. The digital economy leads to a change of people's daily lives, industrial relations, economic and education structure. Its development requires the formation of new competencies which each business entity must have. There are a lot of requirements, including improving the IT skills and advanced soft skills, for specialists.

In international practice, there is still no generally accepted definition of the digital economy. Some foreign sources focus on technologies and related changes in the ways of interaction between economic agents, on digitalization, and on the benefits of introducing digital technologies into the activities of business entities in describing of the digital economy.

The European Commission associates the digital economy with the process of digitalization which is understood as the process of disseminating new information, a general-purpose technology. The digital economy is an economy dependent on digital technologies [1].

Avi Goldfarb and Catherine Tucker do not use the term digital economy, but digital technologies considered as representation of information by bits in listing the benefits of digital economic activity. The use of technologies helps to reduce the costs of searching and replicating, reducing transport costs, and control costs [2].

This concept is also viewed in terms of digital markets that facilitate the trade of goods and services through electronic commerce on the Internet [3].

The Russian approach to understanding the digital economy is similar to the foreign one. The digital economy is an economic activity based on digital technologies, involving the availability of electronic goods and services produced by e-business and e-commerce. The digital economy is characterized by the main feature as the formation of added value through the generation of digital economic benefits [4].

The legal enforcement of the digital economy in the Russian Federation is presented in the form of the Strategy for the Development of the Information Society for 2017 - 2030, according to which "the digital economy is an economic activity in which the key production factor is digital data, processing large volumes of information and using the analysis results which can significantly increase the efficiency of various types of production, technologies, equipment, storage, sale, delivery of goods and services in comparison with traditional forms of management". The Strategy is the first strategic document that determines the directions for the development of the information society in Russia and consolidates the earlier trend in the intensive use of information and communication technologies by public authorities, businesses and citizens.

End-to-end technologies are the tools for transforming the existing industrial economy into a digital one. In [5], the concept of end-to-end digital technologies is considered as technologies used for collecting, storing, processing, searching, transmitting and presenting data in electronic form, the functioning of which is based on software and hardware tools and systems that are in demand in all sectors of the economy, creating new markets and changing business processes. The Order of the

Government of the Russian Federation of July 28, 2017 N 1632-p defines the list of end-to-end digital technologies which includes big data, neurotechnologies and artificial intelligence, distributed ledger systems, quantum technologies, new production technologies, industrial Internet, robotics and sensor components, wireless communication technologies and technologies of virtual and augmented reality.

In order to implement the Strategy, the national program “Digital Economy of the Russian Federation” has been developed, within the framework of which seven roadmaps have been formed and are being implemented in the areas of end-to-end digital technologies presented above. These maps contain an analysis of both the existing technological groundwork and the strengths and weaknesses of each of the technologies and subtechnologies, and also determine the further development.

The objectives of the program can be described as backbone due to the fact that today, the technological development of states and their transition to the digital economy is becoming a determining factor in the leadership in the international market, both in the field of information technology and in traditional sectors of the economy.

The interest on the part of the state in the development of these technologies, their introduction into the daily business processes of state institutions, business and citizens’ life, providing financial incentive for the development of the digital economy at the state level will lead to increased requirements for employees.

According to the authors, the success of promoting the digital economy depends on the quality of the formation of the specialists’ competencies at the interface of several broad areas of knowledge, especially economics and information technology. A modern specialist should have certain knowledge and skills that meet modern requirements for the communication skills, self-development, creative, critical thinking, information management skills, which are the digital economy competencies (digital skills). The 3 ++ generation Federal State Educational Standard of higher education of the Russian Federation are clearly focused on the development of the future graduates’ competencies through the development of the soft skills that are the same in all educational standards and some general professional competencies. For example, the soft skill YK-1 (the ability to search, critical analysis and synthesis of information) and YK-6 (the ability to build own self-development) are unambiguously correlated with the corresponding digital economy competencies presented in [6].

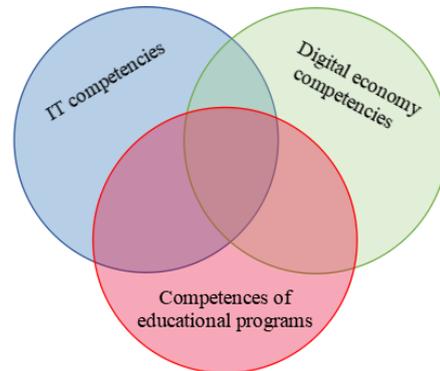
The purpose of the presented work is to determine the place of the IT competencies and skills in the conditions of the formation and functioning of the digital economy, as well as to show the need for the formation of the successful specialist’s digital economy competencies.

**2. METHODS**

This research is based on the use of theoretical and sociological (empirical) research methods. The application of the theoretical method allowed to analyze the transformation of the idea of the digital economy, to analyze modern professional standards and the requirements of the state and employers for employees, and to analyze changes in educational programs, publications and scientific discussions on this issue. The empirical method was applied in the process of observing and comparing the data obtained over the authors’ long-term practice, interviewing representatives of professional communities and university graduates for a deeper understanding of the described problem.

**3. RESULTS AND DISCUSSION**

It is necessary to emphasize that the digital and IT skills represent different, but significantly overlapping sets. At the same time, not all the digital and IT competencies are reflected in educational standards in different areas, as evidenced by the list of “training courses and specialties of higher education which are associated with the formation of two or more key digital competencies” [6]. Figure 1 shows the intersection of sets of the IT competencies, digital skills, and competencies of educational programs.



**Figure 1** The intersection of sets of the IT competencies, digital skills, and competencies of educational programs

As noted above, the soft skills intersect with the digital skills. The digital economy competence related to critical thinking in a digital environment (see point 3.5) is complementary to YK-1 from the Federal State Educational Standard of Higher Education. Information and data management and its critical analysis intersect (but are not identical) with YK-2 (development and implementation of projects) because it is necessary to analyze the obtained information from various sources to determine the optimal way to solve the problem within the framework of available resources and limitations.

The competence related to communications and cooperation in a digital environment is complementary to

YK-3, YK-4 and YK-5, which involve the interaction of people not only in a virtual environment, but also in reality. With the formation of these competencies, a full perception of the intercultural diversity of society is achieved (YK-5), and digital technologies are only tools.

The competence “self-development in conditions of uncertainty” is a part of YK-6, which should be implemented not only in conditions of uncertainty, although the degree of uncertainty is rather a philosophical question in this case. Educational standards of higher education are aimed at the future specialist’s comprehensive development, therefore, they often assume the formation of broader competencies than the digital skills.

The digital economy cannot exist without the development of the IT skills. Let us present the connection between the digital economy competences and IT competencies in more detail.

### ***3.1. The competence “Communications and cooperation in a digital environment”***

The competence implies the person’s ability to use various digital tools in a digital environment that allow to achieve the goals in cooperation with others. One of the conditions for interoperability is ubiquitous wireless Internet access. It is implemented by the end-to-end technology “wireless technology” through the end-to-end digital technology “Wireless Technology” roadmap.

In our opinion, the formation of this competence is impossible without the following specialist’s IT skills:

- work with e-mail (further we will number them, IT-1);
- the information security skills closely connected with the norms of corporate culture (IT-2);
- development of the digital culture and the ability to communicate on various digital platforms (IT-3);
- ability to organize and conduct teamwork based on the use of modern methodologies and software solutions and to create documents using Web 2.0 technologies (IT-4);
- creation and use of corporate sites based on modern content management systems (IT-5);
- use of professional knowledge bases in the subject area (IT-6).

We will comment in more detail on the presented above skills.

Email remains an important element in both business and personal communication. At the same time, in Russia, there is a transition from the use of paper media to the transmission of information via e-mail, for example, distribution of utility bills, transfer of information from public authorities, mandatory reading of mailings in the corporate environment, etc. The use of e-mail, along with cell phones, is a necessary element when registering a user for various services on the Internet.

At the same time, it remains one of the most popular ways of spreading malware and fraudulent activities, as

evidenced, for example, in a report published by Trend Micro Research [7]. This requires serious efforts and attention to develop future specialists’ knowledge and skills that contribute to ensuring information security of corporate and private information, and the formation of the digital culture that is closely related to the organizational culture. The interculturalism is clearly visible in various studies, for example, in [8, 9]. This, in turn, makes it necessary that specialists should receive training in the culture of digital communications, the use of e-mail, communication on digital platforms and in social networks, both in terms of communication with contractors and data security.

The ability to communicate on digital platforms presupposes the development of the ability to select the most effective platform (forum, telegram channel, online conferences, etc.), register on them, perform, save materials, etc. The development of this skill may be realized through online classes and online consultations, which has been proven during the transition to telecommuting caused by the spread of COVID-19.

Recently, special attention has been paid to the development of skills in project activities, work in project groups and teams. However, in our opinion, IT tools are not sufficiently studied and used to organize such work. People often use only Google services when learning. More than 50% of students who have been trained in disciplines related to project activities are puzzled by the question “What technology or service can you use to create your own kanban board?”. Therefore, we would like to recommend focusing on the application of modern methodologies, as well as software solutions and services for organization of project activities when teaching the ability to organize and conduct teamwork, projects.

The emergence of the concept and technologies of Web 2.0 [10] in 2005 opened new horizons for the Internet. Now, not just a few, but entire communities are engaged in creating content of information platforms, which leads to an increase in available information, but may negatively affect the quality. The development of such knowledge and skills may be provided by studying modern technologies for co-creation of content (Wiki technology, online editors, cloud storages, e-learning platforms) by students and by understanding the need to create classes that this skill is necessarily developed. At the same time, it raises the issue of digital culture, the understanding that information posted in the public domain should not contain mistakes, be relevant and reliable. Unfortunately, many young users do not pay due attention to these aspects, do not analyze information critically, turning into distributors of false information, with all the ensuing, often serious, consequences. As an example of the task, you can offer students to split into groups and prepare a project in groups, which will inevitably lead to the need to use Web 2.0 tools.

A corporate website is a modern necessity for any organization [11]. A successful specialist must perfectly understand the importance of a website in terms of marketing, finding new customers, customer support and ongoing business processes. It is also important to explain

the ways of creating and promoting corporate sites, to show the most popular content management systems, to try to create a site in the subject area.

Many modern states, including Russia, have been actively developing and supporting platforms for providing services to citizens and companies, as well as other interaction with them (publishing information, collecting opinions, conducting a public audit, etc.) In this regard, the skills of using services for various type of information and economic interactions provided by sites are in demand, for example:

- Business-to-Consumer, Business-to-Business, for example, online sales platforms where individuals and legal entities act as buyers respectively;
- Government-to-Citizen, for example, portals for providing citizens with government services;
- Business-to-Government, for example, marketplaces for procurement for municipal and federal agencies.

An important skill is the use of professional knowledge bases in the subject area. In this case, both knowledge bases created for a specific company [12] and specialized help systems can be used.

### ***3.2. Self-development in conditions of uncertainty***

Technology are not static. We moved from cassettes to CDs, from them to flash drives, and then to the cloud technologies in one generation. Technologies that were advanced yesterday have become commonplace today, and tomorrow they will become obsolete and will be replaced by others. Many IT skills quickly become obsolete. For example, programming technologies that were taught 15-20 years ago have been already outdated and are out of use. Does anyone remember “Lexicon” or “Norton Commander”? The opportunities that computer networks have provided have grown significantly over the decade. That is why it is necessary to create an understanding of the importance of specialists’ constant self-learning and to form an internal need for self-development. The following IT competencies are useful:

- the ability to learn on digital educational platforms independently, for example, Coursera (<https://www.coursera.org/>), Open Education (<https://openedu.ru>), etc. (IT-7);
- the ability to use educational applications for mobile devices which have become quite widespread now (IT-8).

Today, this competence is necessary for a specialist to be competitive in the labor market because he/she has to compete not only with a person, but also with programs. Robots and artificial intelligence are being introduced into the activities of various organizations, which replace the work of a person-employee. For example, the PJSC "Savings Bank of Russia" has already implemented elements of artificial intelligence in many business processes. For example, in the past, decisions on granting

a credit to a legal entity were made by people, which took several weeks. Now the credits are coordinated by artificial intelligence in just 7 minutes. The examples of activities that are already quite successfully performed by artificial intelligence are given on the resource [13]. Not only private companies, but also the state are interested in the development of this end-to-end technology. In accordance with the Federal project "The Development of Technologies in the Field of Artificial Intelligence", the state expects to spend in four years about 5 billion dollars at the current exchange rates for the development of this area.

### ***3.3. Creative thinking***

The competence presupposes the ability of a person to generate new ideas for solving the problems of the digital economy, and the ability to change existing ways of solving problems, put forward alternative options for action in order to develop new optimal algorithms. The book [14] identifies three essential elements of creativity such as a competence based on knowledge, the ability to think creatively, external and internal motivation.

It is also stated that it is necessary for the development of creativity to rely on some aspects of management practice related to the correct formulation of activities by the head, the provision of freedom of action, the allocation of real terms and resources for the task, the composition of the working group, which should be ready for interaction.

In our opinion, IT-4, IT-5, IT-6 skills are in demand, together with the ability to use specific software tools for the field of activity (IT-9) to address the above challenges. Creative thinking is largely correlated with the end-to-end technology of “neurotechnology and artificial intelligence”.

### ***3.4. Information and data management***

This competence is quite broad and involves not only the ability to use information systems, but also a deep understanding of the correlation between data.

This necessitates the ability to work with time management programs, use project management software, for example, Microsoft Office Project, Primavera Project Planner, software tools for complex ERP systems, the ability to use software tools for creating graphical models, etc. (IT-10).

We will also highlight such the competence as the ability to develop, analyze and implement mathematical models in the subject area (IT-11). Its development can be provided through the study of disciplines such as simulation, econometrics, financial mathematics, macroeconomic planning and forecasting. The examples of the digital society models are shown in [15].

It should be noted that creating mathematical models requires a sufficiently deep knowledge of mathematics, but teaching should be carried out with the use of online

programs that allow to check solutions and facilitate routine calculations.

As for the IT competencies, it is necessary to highlight the skills and IT tools for working with big data, artificial intelligence and programming languages. At the same time, it is necessary to have the core competencies in this area in order to have a common understanding of the aim of neural networks and challenges which these networks address.

Big data analyst (except SQL) should know statistical data analysis tools (IT-12), for example:

- packages SPSS Statistiks;
- programming languages SAS, R, Python which provide data analysis and visualization;
- lightweight package, for example, Gretl.

A popular set of analytics tools is Python + SQL. The example of using them together with the R language is given in [16].

Thus, this competence contains both a mathematical and a programming component and requires considerable development expenditure. It can be applied in the implementation of the end-to-end technology "New production technologies".

**3.5. Critical thinking in a digital environment**

In the modern digital world, it seems that information is an unlimited factor, and computers are all-powerful. However, information and computers can only be used by a person who has learned to make efficient use of them. At the same time, technologies are rapidly developing, that is why the education system should be able to adequately respond to development and trends to educate the specialists of the future [17].

It is important for a successful specialist in the modern economy to form high digital literacy rate, but also logical, critical thinking.

Critical thinking help navigate information, highlight the development directions in the subject area, choose the sources to refer to during training, perceive cause-and-effect connections, generalize and structure information, argue a position and perceive opponents' weaknesses, evaluate job assignments and avoid mistakes connected with inaccuracy or insufficient information.

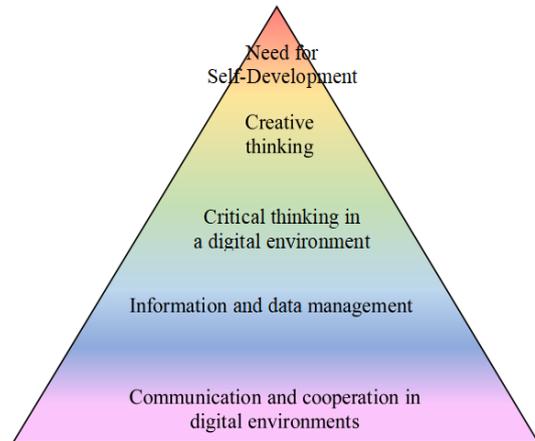
The IT critical thinking competencies:

- the ability to find information from different sources based on the input data (even on little data), and to assess its relevance and reliability with the use of modern technologies (IT-13);
- using analysis and testing tools, for example, created models (IT-14).

**3.6. Hierarchy of the competencies in the digital economy**

Based on our analysis, we will offer the author's view of the hierarchy of the competencies in the digital economy

in terms of their significance for a successful specialist (Figure 2).



**Figure 2** The hierarchy of the competencies in the digital economy in terms of their significance for a successful specialist

The ability to communicate and provide communication is a basic skill that allows to receive and conduct the primary collection of information. The collected information needs proper management, storage and initial sorting. Furthermore, such information can be filtered and critically reinterpreted. False data and connections will be removed from the process or taken into account in it. These three first levels can be considered as the basis for the higher ones. New solutions can be created on the basis of critical thinking and creative approaches and ideas. The top of the proposed hierarchy is the understanding that everything changes rapidly and it requires constant self-development and self-learning in order to keep up with the technologies and the opportunities they provide. There is motivation for learning and self-learning for the whole life. At the same time, the boundaries between the levels of such a pyramid are very blurred and it can be difficult to determine exactly what level knowledge or skill are at.

**4. CONCLUSION**

1. The transition of the economy to the digital era dictates to specialists who want to achieve success the need to form high digital culture and digital literacy rate, a new understanding of information, the development of the skills not only in search, but also in critical data analysis.
2. 14 IT skills are proposed, compared with the competencies of the digital economy. At the same time, it is emphasized that not only IT specialists are in need of them, since IT has become an everyday tool of almost any activity.
3. The hierarchy of the digital economy competencies has been proposed in terms of the order of their formation, which makes it possible to determine the order of teaching the described skills, to identify basic and advanced skills.
4. It is emphasized that the skills demanded by the digital economy become obsolete rapidly, and it is necessary to

develop them for the whole life. The main and most difficult thing is the awareness of such a situation and a requirement for self-development.

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