Innovative Transformations of Higher Education in the Age of the Digital Economy

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Abstract

In the process of development of the digital economy, caused by the quick implementation of AI, blockchain, big data, etc., all large companies selected the strategy of digital transformation of business. That's why young generation has to conform to the requirements set to specialists of the future, based on the knowledge of digital technologies and the skill to use them in their professional activities. These circumstances influence the transformation of higher education with the emphasis on implementing the innovative educational models, which are oriented at training of specialists that have digital culture and digital competencies. The purpose of this work is to consider the modern international models of digital competencies, which are the basis for the formation of an innovative model of higher education in the age of the digital economy. We offer a model of organizational transformation of the educational process, built on the competence-based approach. The specifics of this model consist in the integration of well-known competencies according to federal state educational standards and digital ones. We show an example of the updated model of professional competencies in the sphere of procurement and logistics, which is developed according to the requirement of one of the leading Russian companies. Based on this model of professional competencies, we develop a competence-based model of implementing an educational program by the example of the master's program "economics and logistics management in the fuel and energy complex." We show the integration of the basic digital culture and skills of work with digital technologies in the professional activities in each educational level.

Keywords

Digital economy • Digital culture • Model of digital literacy • Digital competencies • Higher education • Digital education • Universal digital competencies • Professional digital competencies

JEL Code

I25 • I21 • J24

1 Introduction

At the modern stage of the global digital transformation, which was caused by the Fourth industrial revolution, reconsideration of human capital takes place; it integrates not just a set of knowledge, skills, and abilities for satisfying certain needs in society but also digital culture and literacy for applying digital technologies and means of the digital environment in the professional and consumer activities.

One must agree with (Ergasheva, 2020) that digitalization will influence all spheres, including economic, production, and educational.

At present, new requirements to formation of human capital are set in large companies and could be found in the modern images of employees, which must possess digital skills.

Based on analytical studies of international consulting companies and Sberbank's corporate university (Katkalo et al., 2018), digital literacy is knowledge and skills that are necessary for providing security and increasing effectiveness of the implementation of digital technologies and Internet. According to them, digital competencies is human's ability to work with the data in the digital form, use digital technologies in all business processes, control processes based on information that has a digital track, and implement digital technologies in all forms of activities.

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E. G. Popkova (ed.), *Business 4.0 as a Subject of the Digital Economy*,
Advances in Science, Technology & Innovation, https://doi.org/10.1007/978-3-030-90324-4_11

Hence, digital competencies are the basis for the formation of digital literacy.

We're confident that to accelerate the process of increasing the effectiveness of production and business processes in companies, there's a need not only for digital technologies of a new generation but also for human capital, which is able to create and use these technologies in the professional activities. This requires the organizational transformation of the traditional system of higher education, based on implementation of new educational programs that take into account the model of digital literacy in the context of life-long learning. Such innovative model of higher education can ensure training of a future specialist, which will conform to the strategy of development of the business of a company that is based on digital transformation.

To substantiate transformation of the system of higher education for the purpose of formation of digital literacy of a future specialist, it is necessary to use the existing international models of digital competencies, developed by the leading international companies in the sphere of consulting. Short characteristics of the modern models of digital competencies are given in Table 1.

A widely known European model of digital competencies has been developed in two variants—for citizens and for the educational system. The model that is oriented for citizens includes five subject spheres and twenty-one companies that are necessary for the society. These include information literacy, communications in the digital environment, formation of digital content, and security. The block of information literacy contains competencies that are based on the skill to use information, its search in the digital environment, the skill to analyze and process information and evaluate it for determination of correctness and reliability of the sources of data.

It should be noted that development of the skill to use large volume of different information, knowledge of the rules of behavior in the digital environment, and their application for information exchange between the participants of the economic system are digital communication.

The large block of digital competencies is devoted to protection of personal data and provision of confidentiality of information in the digital environment for the purpose of preventing fraud schemes with private finances, property, and assets. The last block of digital competencies is connected to the skill to use modern digital technologies to create new knowledge and innovations to solve problem situations.

According to the results of analysis of international models of digital competencies, the presented models are

Table 1 Short characteristics of the modern models of digital competencies

Model of digital competencies	Short characteristics
Model of digital competencies for citizens	Envisages training in five subject spheres and contains twenty-one digital competencies that are necessary for the society. The subject spheres are as follows: information literacy, communications and cooperation, creation of digital content, security, and solution of the problem
EU Digital Competence Framework for Educators	Envisages the formation of digital skills in three key directions: (1) using digital technologies in teaching and learning; (2) receiving skills for digital transformation of society; (3) skill of analysis and forecasting on the basis of data
Target model of competencies 2025, developed by Boston Consulting Group	Includes not only technical skills in the sphere of ICT but also cognitive and socio-behavioral competencies, aimed at provision of comfortable life, effective communication, and self-development of a human in the digital environment. Cognitive skills include self-development, organizational, managerial skills, achievement of results, solving nonstandard tasks, and adaptability Socio-behavioral skills include communication, interpersonal skills, and inter-cultural interaction
The New Foundational Skills of the Digital Economy, USA	The model includes three blocks: block of digital competencies, block of business capabilities, and managerial skills. The first block includes skills on development of software, programming, work with large arrays of data, and skills of data analysis. The second block includes the skills of project management and creation of digital design. The third block includes the skills of analytical, systemic, and critical thinking

Source Katkalo et al. (2018)

based on formation of the basic digital skills, which are connected to the use of digital devices and online service. They also include specialized professional skills and so-called cognitive and socio-behavioral skills, including solving complex professional tasks in the digital environment with behavior of human in the digital environment.

Systematizing the modern requirements of corporations to the formation of digital competencies of future specialists, we offer a model of innovative transformation of higher education based on the integration of universal, professional, and digital competencies.

2 Materials and Methods

The innovative educational result should be a competence-based model of the system of higher education, which includes educational programs for development of universal, professional, and digital competencies. According to Popkova and Gulzat (2020), such trend of development of higher education is stimulated by the global digitalization of society, quick growth of scientific and technological progress, and implementation of digital technologies in the production and financial and economic system of corporations and companies.

This article is based on numerous published works on the problem posed, in particular, on the work of Malinetskiy and Ivanov (2020).

In the digital economy, the current competencies of a future specialist must be formed through implementing the individual career trajectories into the educational process. In our previous scientific works (Leybert & Khalikova, (2019)), we offered a model of transformation of educational programs in the system of higher education, based on the integration in the three-level system of competencies, including universal, general professional and professional, and digital skills. Its short description is presented in Table 2.

According to the data of Table 1, all levels of competencies of educational programs have to reflect digital competencies of trainees. At the level where universal competencies form, a trainee must be ready for self-realization and self-development and possess digital culture and communications in the digital environment. At the second educational level, trainees learn digital competencies at the user level and learn to apply them in professional activities. At the third educational level, trainees receive special professional digital skills, which will allow them to be ready to perform professional tasks in the conditions of digitalization and to perform work functions of the corresponding qualification level, established by the companies' demands and professional standards for the corresponding type of profession.

The results of the scientific research in the sphere of innovative transformation of higher education should be the formation of new approaches to transformation of higher education in the conditions of the digital economy, formation of a trajectory of digital culture's development, and professional digital competencies with trainees.

The innovative model of higher education's digital transformation consists of two stages.

The first stage is formation of the basic competencies within the expansion of knowledge and skills that are obtained in the process of the main educational program. As was mentioned in Leybert & Khalikova (2019), the key competencies are determined based on analytical interconnection of specialist's activities in the conditions of business's digitalization: the specialist's motives, goal, and actions and how this will influence the specialist's self-development.

At the second stage, managerial competencies are formed in the conditions of the digital economy. The technology of learning envisages the integration of a classical system of education and digital education through implementation of online lectures for each discipline. Lectures are unified in educational models. Each discipline consists of educational

Table 2 Characteristics of the three-level system of competencies of an innovative model of higher education in the conditions of the digital economy

Educational level of competencies	Short characteristics
I—Universal competencies	Studying the foundations of digital culture, models of storing and processing of data, and computer programming and modeling
II—General educational competencies	Studying digital culture in professional activities, information technologies in various forms of professional activities, applied AI, models of data processing and analysis, and strategies of digital business
III—Professional competencies	Studying analysis of non-structured data (big data) in the digital economy, designing information systems in the digital economy, storing data based on blockchain and cloud technologies, development of data bases and data banks in information systems, protection of information and digital signature, security in the digital environment, methodology of using automatized corporate systems based on ERP, etc

Source compiled by the authors

modules. To get into the educational process, it is necessary to develop and perform tasks with the use of information technologies and software products, as well as packages of applied programs with a graphic interface.

3 Results

As an example of transformation of a higher education model in the conditions of the digital economy, let use present an updated model of professional competencies in the sphere of procurement and supply (Fig. 1), which has been created for a Russian oil company. The model has two blocks of competencies—functional and strategic. Digital competencies belong to the second group and include digital literacy and management of innovations and technologies' development.

Based on the model of professional competencies, we have created a competence-based model of implementing the educational program of master's program "economics and management of logistics in the fuel and energy complex" (Fig. 2), which reflects the requirements of mastering of competencies from state educational standards FGOS 3+ + and from the potential customer of future specialists in the sphere of procurement activities and logistics. At all competence levels, there are disciplines that allow mastering digital competencies, which conforms to the realia of the digital economy.

Figure 2 shows disciplines of the educational program that combine the blocks of competencies by the demand of a potential customer—company—according to the requirement of the federal educational standard.

Thus, universal competencies and strategic competencies are covered by discipline "basic digital culture"; general educational competencies are covered by discipline "information technologies"; professional competencies and strategic and operational competencies are covered by discipline "predictive analytics of logistics and supply chains." It should be noted that as per the requirement of employers, the model of professional competencies includes functional competencies that stimulate the skills of performing functional work duties of a future specialist. Each functional block is highlighted by different color, which is also repeated in the competence-based model of implementation of the

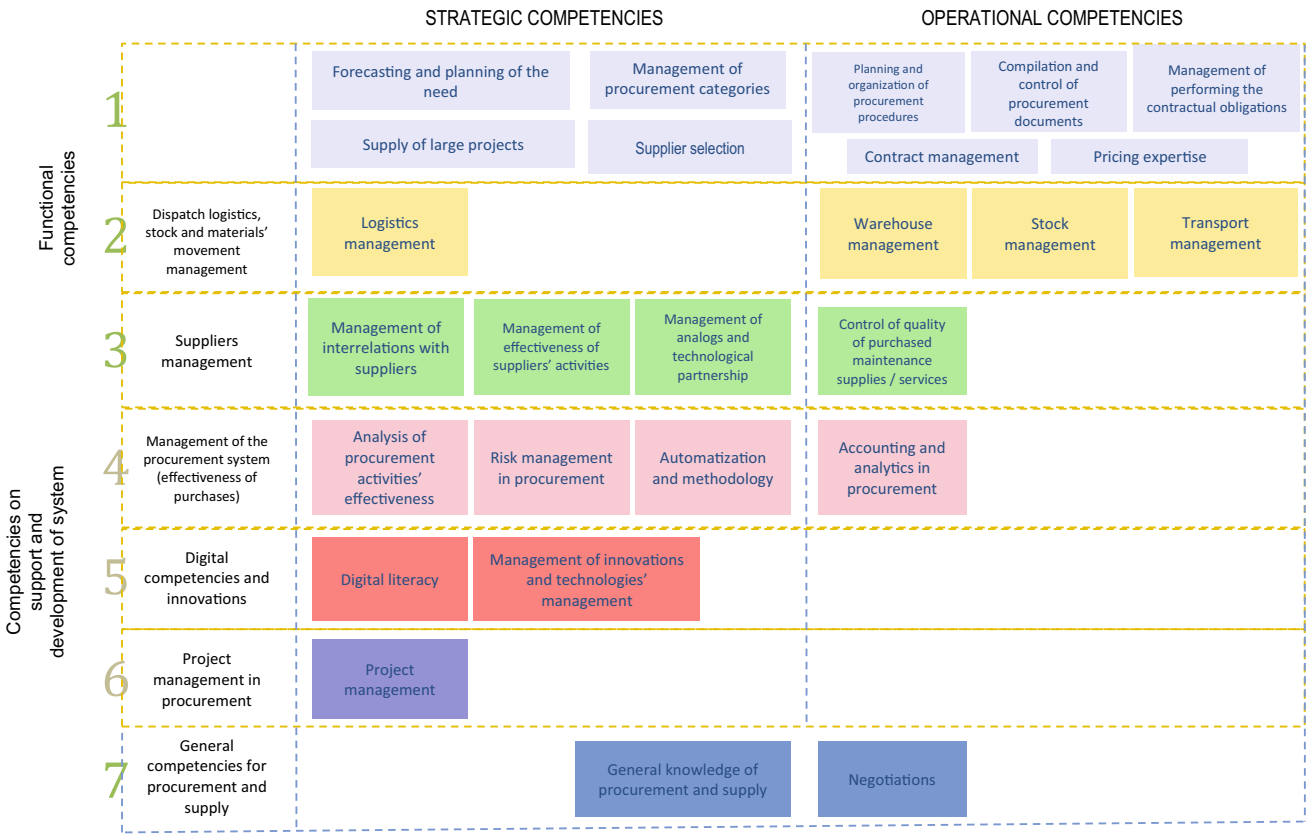

Fig. 1 Model of professional competencies in the sphere of procurement and logistics in 2020. *Source* compiled by the authors

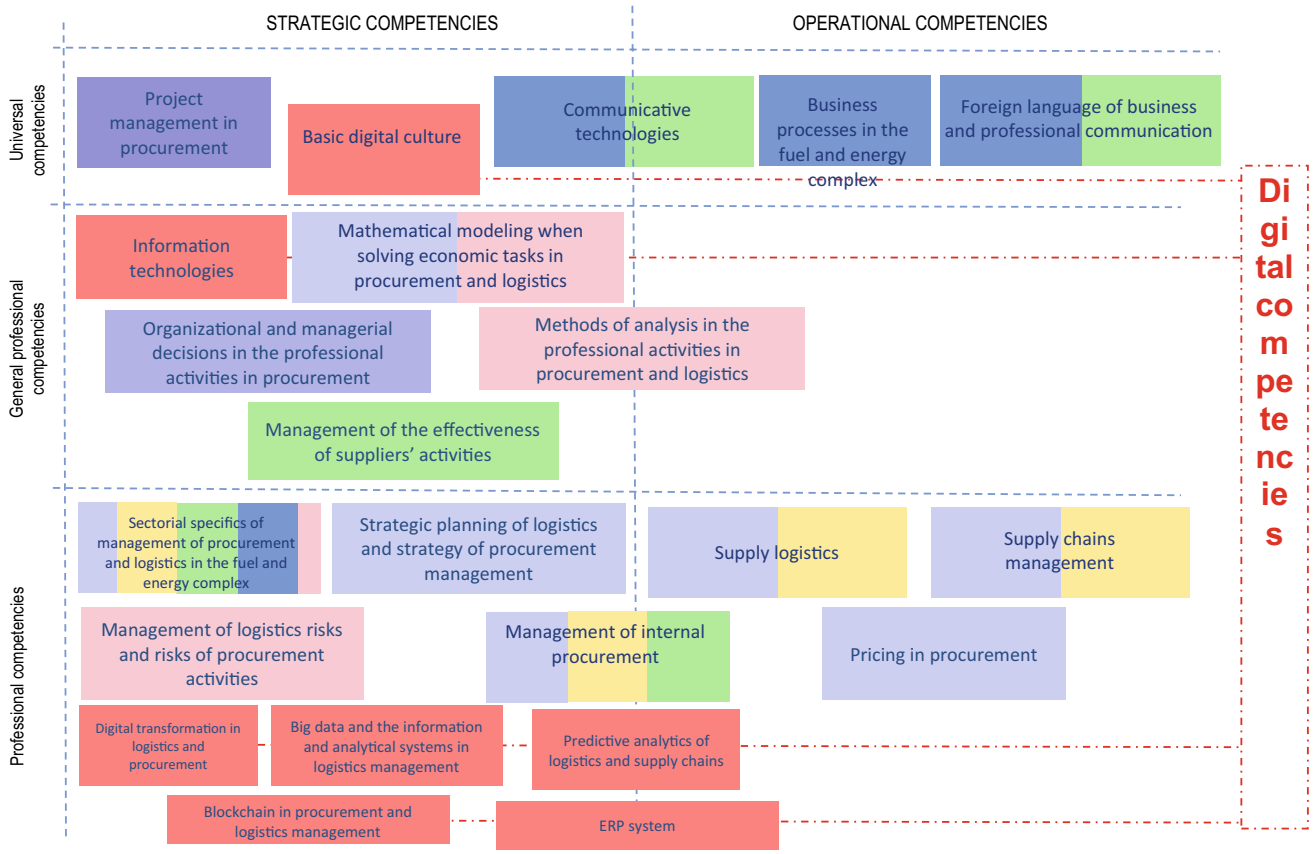

Fig. 2 Competence-based model of implementing the educational program of master's program "economics and logistics management in the fuel and energy complex" in the conditions of the digital economy. *Source* compiled by the authors

educational program. There are disciplines that cover several functional competencies in a specialist's professional sphere.

4 Discussion

In the age of quick digitalization, the system of higher education undergoes serious changes in favor of self-education and remote education with the use of digital technologies, which could eventually influence the quality of education in a negative way (Malinetskiy, 2020). There are positive and negative aspects of total digitalization of education.

Some of the leading scholars see positive aspects of the transformation of higher education in the conditions of public digitalization. Thus, a group of scholars (Vanchukhina et al., 2019b) offered a new form of obtaining higher technical education with the simultaneous receipt of managerial and digital competencies. A part of educational burden will be set onto the system of remote education with the use of digital technologies. Another group of scholars (Sekerin et al., 2018) pays special attention to such forms as on-job training and job-related training, including teaching digital literacy.

As is noted in the works (Goldfarb & Tucker, 2019) and (Vanchukhina et al., 2019a), development of the digital economy is inevitable, and development of hi-tech production systems requires skilled personnel—that's why it is necessary to transform the system of higher education with orientation at receipt of digital competencies.

5 Conclusion

Thus, the offered competence-based model of transformation of higher education in the conditions of the digital economy is aimed at training of specialists that have basic skills in the digital economy and professional digital competencies and could make quick decisions in the conditions of uncertainty, based on big data and predictive analytics and created innovations in the digital environment.

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