

Resource Provision in a Digitizing Economy: Problems and Perspectives

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Abstract. This article studies the provision of human resources within a digitizing economy—a contemporary issue in Russian politics. Currently, enterprises are struggling to compete due to human resource shortages. The authors present a solution based on effective interaction between business, government and education. Without this integration, it is impossible to make the transition to an information society. A significant shortage of human resources cannot be filled by Universities with limited state support; graduates are not specialists and university knowledge quickly loses its relevance. Therefore, businesses need to help train future experts by leveraging their superior commercial structures. This article analyzes the Russian labor market, foreign experience of cooperation between education and business, highlights the main institutional forms of cooperation and proposes a triad interaction model to facilitate the transition into the digital economy. The resulting triad model synthesizes and integrates best practice from the most advanced, entrepreneurial university programs in the world.

1. Introduction

Digitization represents a new dimension of development in the world economy. Currently, information technology has captured all spheres of society and it is impossible to imagine modern life without it. In other words, the traditional society (primarily agricultural) and the industrial one are replaced by post-industrialism, wherein the acquisition and processing of information is a key component of the sustainable development of the economy and national competitive advantage.

"Boston Consulting Group predicts the volume of the global digital economy -16 trillion.doll. United States in 2035. Today, the share of the digital economy in Europe's GDP is more than 5 %, in the US more than 6%." [26] "The share of the digital economy in the GDP of developed countries from 2010 to 2016 increased from 4.3% to 5.5%, and in the GDP of developing countries – from 3.6% to 4.9%. In g-20 countries, this figure rose over five years from 4.1% to 5.3%. The UK leads the world with its share of the digital economy, representing 12,4% of its GDP» [28].

Russia cannot ignore international development trends and needs to participate in the global march towards digital economy. In this regard, "the Government of the Russian Federation has developed and in July 2017 approved the program of development of the digital economy until 2024, which defines five basic areas: regulation, personnel and education, the formation of research competencies and technical reserves, information infrastructure and information security.»[17] It is worth noting that "according to Boston Consulting Group, the consistent digitalization of the main sectors of the Russian economy will create added value by 5-7 trillion by 2021. RUB. per year, which is comparable to the total revenues of the Russian budget from the oil and gas sector (7.4 trillion. RUB in 2014) » [26]. But

it is important to understand that the implementation of the digital economy requires, first of all, human resources. It is not just about the able-bodied population, it is about highly qualified personnel with modern knowledge, skills, competencies, and the ability to think innovatively. According to Schwab K. [32], the transition to the digital economy will entail a social crisis caused by the aggravated unemployment. This phenomenon will not only slow down the pace of the transition, but also lead to negative consequences for the population and economy of the country. "Currently, Russia lags behind the leading countries of digitalization by 5-8 years. If the current growth rate of Russia's digital economy remains at the same level, by 2020, due to the high rate of global change and innovation, this gap will expand to 15-20 years. » [29].

2. Literature review

Many Russian scientists study the issues of security and human resource development, for example, scholars such as V. Baidenko [4] Filippov V. M [11] Zhuravleva T. B [43] Lomakina, T. Yu. [20] they study the problems of professional education development. The solutions to issues related to the quality of human resources are reflected in the works of E. V. Belkin. [5] Blokhina T. K. [6], Zhuka S. S. [42] Katulsky E. D. [18] ,Maslova Yu. A. [22] The problems of human capital management in the context of digitalization of the economy were touched upon in the works: V. V. Glukhov [38] Dyatlov, S. A. [8]. Shmelkova L. V. [33] The works of Vasilchuk Yu A. [39]., Lopukhin, V. Yu. [21]., Ryazanov V. T. [30]. and other scientists studied the transformation of social labor and the role of human resources. Modern aspects of cluster integration of economic entities were considered in the works: Halasova S. S. [15], Danchenko A. S [34]. Novoselova N. N. [7] and other. Etkowits H. [9] Artemov, D. I [1] Starikov V. S. [35] and others considered in their works the role of higher education institutions in their transformation and scientific and industrial integration into entrepreneurial activity.

3. Methods

The research Methodology is based on a combination of systemic, evolutionary and institutional approaches using private General scientific methods of functional-structural, subject-object, factor, comparative, statistical analysis and forecasting. The information and empirical base of the research is represented by the normative legal acts of the Russian Federation and subjects of the Russian Federation, statistical data and information materials of the Federal state statistics service, the Ministry of economic development of the Russian Federation, the Ministry of education and science of the Russian Federation, the Organization for economic cooperation and development, the National center for monitoring the innovation infrastructure of scientific and technical activities and regional innovation systems, as well as Internet resources containing analytical information and data, characterizing the state and problems of innovation ecosystem development in Russia.

Problems: provision of the Russian labor market with highly qualified specialists during the transition to, and formation of, the digital economy.

4. Discussion

4.1. Analysis of human resources in Russia

In our study, we define human resources as "a set of different qualities of people (first of all, intellectual abilities, knowledge and skills, as well as education, physical and psychological health, etc.) that determine their ability to work to create tangible and intangible benefits» [19].

Currently, Russia does not have the necessary personnel to transform the economy. Despite its leading position in the international rankings (Table. One) [25]

Table 1. Share of the population aged 25-64 with higher and secondary vocational education, in % 2016.

Countries	Interest
Canada	57
Russia	56
Israel	50
Japan	50
Britain	46
USA	46
Australia	44
Finland	43
Estonia	39
OECD average	37
Spain	36
France	35
Latvia	35
Greece	31
Poland	30
Germany	28
Czechia	23
Turkey	19
Italy	18
Mexico	17
Brazil	15
Brazil	9

Source: Education at a Glance, 2017, OECD

The situation in the country is different, first of all, such inflated data are caused by the method of calculation of this indicator, namely: "Russian higher education is classified by the OECD according to the international classification as ISCED5A, and secondary vocational – as ISCED5B. It is the prevalence of secondary vocational education that makes Russia one of the leaders in a kind of ranking of OECD countries» [5].

According to A. R. Bessudnov, D. Yu. Kurakin, V. M. Malik, the most correct data are the 2010 census data, which state that only 27% of the population aged 25 to 64 years received higher education.

At present, the issue of filling out the naturally retired older workers in many professional qualification groups does not occur, which in the future may lead to a threat to the leading sectors of the economy. Moreover, the problem of employment of the population has worsened due to the development of techniques and technologies, this is due to a rapidly changing environment, as a consequence of the increased requirements to the content of the experience, skills, abilities, knowledge, competencies, intellectual capital of the worker. "For example, in an innovative economy, everyone should strive to release their own innovative potential, when innovation activity is transformed from a one-time act into a constantly reproducible process. » [14] In view of the lack of necessary skills of the majority of the able-bodied population of our country, this process is difficult to implement, for the economy there is a threat of increasing unemployment and increasing problems associated with employment. For example, the Agency for strategic initiatives, together with the SKOLKOVO business school, has compiled a list of specialties that will not be in demand in the labor market in the foreseeable future, such professions include: notary, librarian, copywriter, tester, system administrator, Bank operator, analyst, Secretary, logistics, driver, dispatcher and journalist. This list corresponds to the survey conducted by the recruitment company Hays [40].

According to the study of the Federal service of state statistics "On the number and needs of organizations in workers by occupational groups as of October 31, 2016 (based on the results of a sample survey of organizations) » [10]. The Russian Federation needs 637 612 people, of which 27 052 leaders (4.24%) and 173 984 specialists of higher qualification (27,29 %). Table 2 shows the absolute need for workers by region.

Table 2. The Absolute need for an employee by region.

Area	Number of persons
Health	58475
Education	30866
Science and technology	39665
Information and communication technologies	9447
Business and administration	18152
Law, Humanities, culture	17379

Source: Federal state statistics service "On the number and needs of organizations in workers by occupational groups as of October 31, 2016 (based on the results of a sample survey of organizations)"

Based on the above table the most popular workers are in areas like health, science and technology and education. Analyzing the relative need for workers presented in table 3, the most popular areas are: health, information and communication technologies, law, humanitarian fields and culture.

Table 3. Proportion of the need for workers in the total number of jobs, in percentage.

Area	Number of persons
Health	7,9
Education	1,1
Science and technology	2,2
Information and communication technologies	3,2
Business and administration	1,8
Law, Humanities, culture	2,4

Source: Federal state statistics service "On the number and needs of organizations in workers by occupational groups as of October 31, 2016 (based on the results of a sample survey of organizations)"

At the same time, in the conditions of precarization of labor, candidates should have not only knowledge, competencies and skills in a particular specialty, but should have competencies and skills in related industries, including the skills of information technology processes. In other words, in modern conditions there is a market of hybrid professions. "The trend of precarization is combined with the possibilities of distant labor, for example, on remote access to the network. This means - the growth of dependence on the digital component. » [37]. Strong communication between science, business, the state and higher education institutions is necessary to adapt to the rapidly changing information environment, forecasting the need for personnel, which allows a timely response to the modern challenges of the economy and to maintain top positions on the world stage. "The mechanisms of interaction between the University and business structures are largely similar to the mechanisms of the market economy: universities meet the offer of graduates, research and organizational work, the corresponding demand generated by the national economy and business structures. Interacting at the institutional level, universities and business structures contribute to the optimization of each other's actions in various areas (economic, industrial, socio-cultural, educational, etc.), thus achieving a synergetic effect» [31]. Currently, universities do not have sufficient resources to train highly qualified personnel for high-tech industries, which are the basis for scientific and technological progress. Moreover, the theoretical material does not correspond to the practical experience, as a result, business structures need to educate university graduates, which is not only costly for organizations, but also a long process. In the Russian Federation, cooperation between universities and organizations takes

place mainly without the involvement of students, it is important to understand that mobility is developed only in the leading universities of the country, and even in these universities, not all students have the opportunity to undergo internships, practices, etc., moreover, the frequency of their conduct is insufficient to form the necessary practical experience, knowledge and competencies.

Let us consider the foreign experience of cooperation between educational institutions and business structures. After analyzing the interaction between universities and business, the most interesting is the experience of such countries as the UK, Finland, USA, Brazil and Germany.

In the United Kingdom, only joint research centers established at universities and private organizations are funded. In other words, private organizations engaged in scientific research activities were left without public funding, this caused R&D to be moved to Universities, which increased the involvement of scientists, teachers and students in projects organized by private business. For example, "the British-Dutch oil and gas company Royal Dutch Shell, through funding for major University Initiatives Imperial College London solves fundamental problems related to the preservation of the environment or renewable energy sources. » [12].

In Finland, the idea of individual business projects is actively developing (mainly benchmarking, collection and analysis of information), for each project a working group of students is formed, headed by a teacher and coordinated by an employee of the company. This practice is most actively carried out by Aalto University. Students are selected based on the needs of the project and the personal qualities, knowledge and skills of students. For students, these projects are interesting for the development of practical skills; they also receive money for the implementation of the project from the business and evaluation from the educational institution. For entrepreneurs, it is about finding potential employees and improving the efficiency of the company through integration with universities.

Many US universities practice capstone projects, these assignments are designed for graduates, projects are focused on solving practical problems in a particular enterprise, and represents a final qualifying work. Another distinctive feature is the involvement of companies to develop curricula, management of educational programs and courses, thus Universities prepare the necessary personnel for the country, and the employer receives a specialist. Also, the system of student grants (especially developed grants from \$50 000 to \$75 000) provides a flow of innovative ideas, which are further implemented in business structures

In Brazil, secondary education takes place in parallel with vocational training programs (contracts 4PC), moreover, at the legislative level, it is regulated that large business should provide up to 15 % of vacancies under these contracts [12]. In Germany, many educational institutions are focused on practical experience, numerous companies enter into targeted contracts for training with higher education institutions. Also, as in the United States, in Germany, some training programs are jointly developed with business structures, usually training are under the leadership of these companies paid practice, which helps the student understand the specifics of the company and assess the realities of working life. In particular, Fachhochschule training programs (3-4 years) require a one-year internship wherein students receive training in a business. Master's programs are deeply integrated into business structures, all graduate qualification works of master's degrees are presented in the form of projects that need to be implemented in business structures, in other words, projects need to be tested at the enterprise to be successful. Many universities have organized centers for interaction with business structures, organizations support the innovative activities of students and act as customers for the development of new technologies and innovations. Due to the practical orientation of training, small businesses actively seek student consulting services.

4.2. The development of the relationships of the triad under the influence of digitalization

Relations between higher education institutions and business in Russia are developing, but so far cooperation is spotty and is currently at an early stage. Basically, the leading institutes in the top 20 best universities of the country are involved. Universities and large enterprises will cooperate to review the organizational practices of enterprises, provide training courses, targeted training programs

and guest lectures with leading practitioners, educational research and production clusters, technology parks, business incubators and more. Examples of such cooperation are: "Vnesheconombank and MUST MISIS have created a competence Center for new materials and breakthrough technologies with a focus on blockchain, convergent and quantum technologies» [24] this competence center was established in 2017 and has no analogues, it is planned that the main consumers will be state bodies and corporations. Also, 17 Russian universities are partners of Gazprom, the main task of this cooperation is the training of future personnel [13].

The most common forms of interaction in the Russian institutional environment are technoparks, business incubators and clusters. Business incubators or "...technology centers, start-up centers of new companies, technology centers and start-up companies, innovation centers and start-up companies, science parks, technology parks, Commerce and trade parks» [41] they act as "... a tool for business development and promotion, providing assistance to entrepreneurs at an early stage of their activities by providing consulting and legal services, the main purpose of which is to create conditions for the accelerated development of small innovative companies, which, in turn, create new jobs and values, strengthen the economy and revitalize society." The main difference between business incubators is their focus on the economic entity, the result of this form of support is a firm that is adapted to the market environment and is able to respond in a timely manner and meet modern economic realities. To date, 91 incubators have been created and operate on the basis of the University, which is 35 % of the total [2].

The original domestic technology parks created in the 1990's were based at universities and also served as business incubators supporting SMEs. The research staff at such parks created enterprise data. Technoparks were formed at state scientific centers, and then rolled out at the regional level. The main task of the Technopark is to unite enterprises with a similar orientation and help them to "get on their feet" for independent functioning, only after achieving this goal does the enterprise leave the Technopark. It is important to distinguish a business incubator from a Technopark, in modern realities a business incubator can function as an independent association or act as the core of a Technopark. But business incubators do not have territories, do not support already functioning enterprises (support is provided only to those enterprises that are at the initial stage of development), the policy of updating customers is strictly observed, and support is provided for both high-tech and small businesses. "According to the geographic information system "Industrial parks. Technoparks. Clusters" Ministry of industry and trade of Russia, in 2018 Russia had 65 industrial Technoparks, with another 16 being created» [23].

«The educational cluster is a local spatial concentration of effective associated universities, research institutes, research centers, related industries and institutions specializing in the creation and dissemination of innovative technologies and related functional infrastructures. » [16].

It is worth noting that the power of scientific and educational potential is concentrated in the educational cluster, innovative ideas are generated, and its activities are aimed at their implementation. In other words, the clusters accumulate opportunities for the implementation of social creative potentials. Also, the main condition for the functioning of this type of cluster is the integration of employees of higher education institutions. Educational clusters help communicate the main trends in the development of science, which is important for the intellectual formation of employees. "The priority in the implementation of scientific and educational cluster initiatives is a critical mass of highly qualified human resources» [36]. Also of great interest at present is the applied bachelor's degree, which is the prototype of the European business school, the main advantage of such training is the close cooperation of business structures and educational institutions, from the first year of study the student is integrated into the enterprise and after four years of training the company receives a formed specialist. In Russia, 37 universities and 65 colleges from 47 subjects of the Russian Federation took part as an experiment beginning in 2009.

In the context of digitalization, there is a transformation of all sectors of the economy, including the mechanisms of cooperation between business structures, education and the state. Educational organizations are actively implementing information technology in their activities, thereby simplifying

many processes. For example, RUDN-University uses a telecommunication educational and information system that hosts educational materials for students, and this university has introduced electronic document management, which saves time and financial costs.

Digitalization completely changes the nature and type of taught disciplines, today no one will be surprised by the use of presentations and video, audio materials in the classroom. Moreover, academic education transcends educational institutions, now it is not necessary to be in the classroom to improve skills and develop competencies. For example, Academic Earth was launched in 2009, this site is a repository of video lectures on the Humanities, socio-economic, social, technical, natural sciences from the world's leading professors. Another striking example is the course project created by Stanford professors, which contains more than 2000 courses in 160 specializations from different educational institutions, users can even receive a certificate. Even mobile phone users can access this site. Therefore, students can get the necessary materials from anywhere in the world.

Digitalization erases the factor of territorial discrimination between the institutional environment. The authors see real interaction and cooperation between distant higher education institutions and business structures via telecommunications. Students can get practical skills in other regions of Russia, on the job, at university. Perhaps there are opponents of this approach, but the reality is large portions of university students work during their studies. This is due to a number of reasons: material circumstances, the desire to be independent, awareness of their position in the labor market and more. Under the latter, we understand the students' awareness of the need to obtain practical skills and experience for future demand in the labor market. Since most organizations consider the necessary criterion for employment-experience. Therefore, the integration of education and business will allow students to develop the required skills through training, which will allow them to accumulate the necessary practical experience and form professional competencies.

Using the triad model, business structures benefit from getting a specialist at the end of training. Thanks to digitalization, interaction with educational institutions is simplified, there is an opportunity to hold meetings and interviews online. Business participation in the development of curricula, provision of internships, as well as practical training, round tables, conferences with the invitation of industry specialists contributes to the development of human capital and the formation of highly qualified experts.

The state also receives information about the demand for a particular specialty or direction, as well as the need to introduce a new specialty to the labor market, which in the future should reduce the shortage of specialists, which is now acutely felt in some areas. After all, at present, university budgets are tightening, so they are focused on meeting the needs of the population, although the "popular" specialties among citizens are not always consistent with the current needs of the country's labor market.

Based on the above material, as well as the literature studied, the most optimal model of cooperation between business structures, educational institutions and the state in the transition period, according to the authors, is innovative educational clusters (Fig.1). For example, Moscow is currently forming an innovation and production cluster (IPC), which will move away from the industry principle and become the first Russian inter-industry innovation supercluster that will unite IT companies, business incubators, technology parks, academic institutions and educational institutions on a single IT platform. It includes more than 20,000 different objects of innovative infrastructure. In particular, the city has 33 technoparks, one special economic zone "Technopolis "Moscow", 12 433 IT companies, 752 scientific organizations, 47 universities of engineering and technical orientation, 11 business incubators and 6 nanotechnology centers.

It is assumed that the IPC will be able to compete for human capital in the global labor market, thereby making Moscow a viable location for new startups. [27] but it will also create a foundation for the formation and accumulation of new types of human resources.

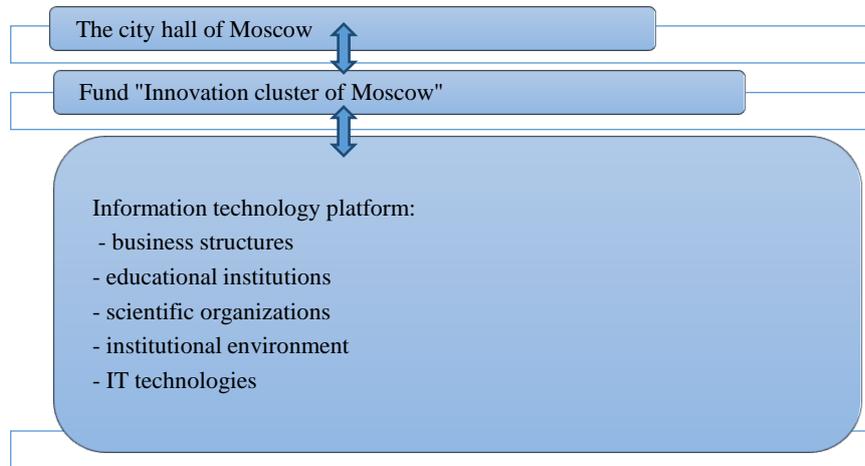


Figure 1. IPC Model.

The use of such technologies like additive, quantum, blockchain, big Data, cloud computing, Internet of things (IoT); industrial Internet of things (IIoT), artificial intelligence (AI), etc. allows the cluster to generate its own innovations, introduce them into production, develop innovative products and commercialize them and accumulate human resources.

The establishment of the PKI aims to:

- develop a cluster management system in accordance with international standards;
- facilitate interaction between clusters of state companies and development institutions;
- support the entry of enterprises into world markets;
- promote domestic technologies;
- promote the modernization of enterprises;
- develop a mechanism to attract world-class investment;
- support fast-growing innovative companies.

Although the PKI documents do not set such a goal as the accumulation of highly qualified human resources, the achievement of this goal is obvious.

According to the authors, the decision on training business structures and higher education should be taken collectively. These solutions should be used to guide the development of curriculum plans and approving dissertation research. It is important that educational institutions take responsibility for the formation of theoretical knowledge, and business structures for the practical part of training. Joint activities will improve the quality of training of graduates (graduates' competencies should be ahead of the existing range of competencies), will strengthen the level of integration between customers of highly specialized employees and their manufacturers. On conjugation the decisions made will be brought to the state level. Beyond this model, it is necessary to develop future personnel in high schools and lyceums otherwise it will be difficult to address the human resource shortage impeding the digitization of the Russian economy.

5. Conclusion

Digitalization creates new conditions for the qualitative transformation of all activities covered by the digital space. The development of new sectors of the economy, the stable development of sectors of the economy, improving the quality of life, maintaining a competitive position on the world stage is determined by how effectively knowledge is used. Knowledge has become the primary resource in modern society, and its bearer is a person. The main requirement for Russia's transition into a digital society is the formation of highly specialized personnel, and hence the transformation of the education system as a whole. To date, the provision of the labor market with highly qualified personnel is a significant problem, according to the authors, only the trinity of science, production and government

agencies will be able to form the necessary personnel reserve for the implementation of a qualitative transition to the digitalization era.

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