

Spatial Organization and Modernization of Vocational Education: On the Way to Digitalization

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ABSTRACT

The article considers the process of modernizing the region's vocational education system and its digital development in relation to the spatial organization of the regional educational environment. The vocational education system acts as a key area of "growth pole" in the national economy for the breakthrough innovation and technological development scenario planned in state regulatory and legislative documents. Such a scenario requires an effective spatial organization of the regional vocational education system. For innovative development in Russia, there are necessary resources (accumulated human capital), concentrated in the regions of the country and requiring effective mobilization and organization.

In order to assess the trends in the digital development of the vocational education system (using the example of the subjects of the Russian Federation, which are the part of the Ural macro-region), an analysis of statistical indicators was carried out on the basis of the use of a comprehensive approach, which allowed to obtain an index of digitization of the system. The positive dynamics of the index can describe the process of digitization of the vocational education system in the region.

Keywords: *regional system of vocational education, spatial organization, differentiation of regional development, digital educational space*

1. INTRODUCTION

For the breakthrough scientific and technological development of Russia, a key area of the national economy is the vocational education system, which serves as the basis for the creation of innovations, the economy of intelligence in the face of tough global competition. Russia needs to make breakthrough scientific and technological development in the near future, so it is necessary to mobilize resources for the process of modernization, effective spatial organization of the vocational education system and create new qualitative conditions for innovative development of society and economy, outlined in state documents [33; 34; 35; 36; 38; 40]. The system of vocational education in the new economic conditions should be ready to form the competencies demanded by the modern economy and the labor market, which manifests its contribution to the development of the region's labor potential and economy, the generation of innovation and the creation of an economy of intelligence. This will allow Russia to enter the top five economies in the world.

Effective development of the national economy requires the modernization of the vocational education system, the structure of which includes higher education (HE), secondary vocational education (SVE) and postgraduate (postgraduate studies, doctoral studies, adjuncturetc.), according to the Federal Law "On Education in the Russian Federation" from 29.12.2012 № 273-FL (edit.

from 03.08.2018 г.). Modernization also includes a process of digitalization, the globality of which leads to the need for its organization and regulation. It should be noted that at present there are barriers to the digitalization of the educational space and the national economy in Russia. The author's analysis of some of the problems of digital development was carried out in one of the published scientific papers [20].

In the studies, scientists note the positive changes in the information and communication space of education, but the remaining problems require an immediate solution to meet the tasks set by the state to digitize the educational space and economy. According to scientists the spatial approach in modern science is insufficiently researched, debatable, has relevance, significance.

The purpose of the article is to justify the direction of development of the spatial organization of the vocational education system, the process of its modernization in accordance with the program of digitalization of the national economy based on the experience of research of domestic and foreign scientists.

2. RESEARCH METHODS

The main method of researching the spatial organization of the vocational education system, trends in the process of its digitalization, is a comprehensive theoretical approach. This approach includes the theory of spatial development, which is a relatively new direction in domestic research of

the regional economy, the position of humanistic theory, from which its main directions - socioeconomics and the theory of human capital, including those that are not sufficiently researched in both domestic and foreign scientific works.

The comprehensive approach is universal and allows us to compare the results with the main marks and indicators that characterize the condition of the study object, in addition, this approach allows to take into account the impact of key indicators and make their timely adjustment in the future.

3. RESEARCH'S RESULTS

The issues of spatial organization of the vocational education system, its contribution to the region's economy, and the modernization process are relevant in scientific research, as the effectiveness of the organization and the state of the system depend on the opportunities for generating and implementing innovations in the regions that together make up the national economic system.

Different methods of assessing and analyzing the development of the potential of the educational system of regions, their spatial organization are proposed by the researchers, but nevertheless, they are noted insufficiency. Next, a review of some of the existing studies of the innovation and educational potential of the regions is provided.

The method of integrated assessment of the educational and scientific potential of the region was proposed by Solovey O.V. [37,p.62] A comprehensive "three-step evaluation system" based on a combination of matrix methods and indicative and mutual diagnosis of the potential of the region's educational system was proposed by Shvakova O.N. [42, p.10] The importance of the method proposed by the author lies in the possibility of a one-time assessment of the educational system from the point of view of the resource, process and result. The comparative rating of the "generalized indicator of the use of the innovation potential of the region" is provided by Maskaykin E.P. and Artzer T.V. [29, p.48] Their methodology bears similarities with Shvakova O.N.'s methodology in applying a general indicator in the rating of assessing the potential of innovative development of regions. The authors emphasize the importance of the proposed methods in the possibility of a realistic assessment of the innovative development of the territories. Golushko T.K. proposed a method of diagnosing the qualitative and quantitative characteristics of educational potential, setting priorities "measures to improve it... in the course of building an innovative economy and education"[18,p.43].

The problems of assessing the quality of education are explored by Fomitskaya G.N. and justifies the need to implement such "both on the part of the educational system itself, and on the part of society and the state," where she writes that external assessment determines "new forms of public life" and consumers have access to reliable information about the "results of the educational system"

[41, c. 8]. The complexity of this assessment lies in taking into account its multifacetedness, which requires a holistic interdisciplinary approach.

In the area of quality assessment problems, Zahir Y.S. notes a large gap in the quality assessment methods of the municipal level educational system, where this level is important, fundamental, because in the vocational education system it is the first and its functioning affects the state and quality of the vocational education system at the regional and national level. [24]. It should be noted that the author's assessment has a special place in the regulatory documents, for example, adopted since 2000 by the National Doctrine of Education, in the Russian Education Assessment System (REAS), in the federal targeted programs for the development of education (for subjects and in the state), since 2005. The adopted regulations are aimed at organizing and regulating the functioning of educational organizations.

Zakharova I.V. offers a method of assessing the social impact of an educational institution in the region based on a correlation analysis of "the attitudes, goals and values of educational service manufacturers and their consumers" [23, c. 211]. The author shows the increased importance of the social influence of education, which was identified in the formation of it as a social institution. This complex institution is embedded in the regional socio-economic system, which has come to the fore in the sphere of increment of human capital and socio-economic development.

As a result of the study of the contribution of regional higher education systems, the National Research University «Higher School of Economics» published a report outlining the results of a comprehensive assessment that integrates the traditional approach ("economic-based" approach), a skill-based approach, and the contribution of universities presented from the perspective of the facilitator of innovation in the region [32, p. 6, 9-10].

Analyzing the socio-economic development of the region, Lischina G.N. highlights the factors of influence, among which the state of the vocational education system (higher and secondary) is considered as one of the most important in the field of providing the region's economy with the necessary personnel. It is the educational space of the region, its state and organization that provides the personnel needs of the "social, economic, sociocultural spheres of the region" [28, p. 19]. The author attaches importance in the spatial organization of the vocational education system to its main property - integrability, another important feature of the system is manifested in interaction with the regional labor market, for which it is necessary to establish a "social partnership" [27].

Goldstein H. and Drucker J. write about the traditional functions of the educational system (educational, research) in the process of social development have changed,. [6]. The development of scientific and technological progress, the introduction of new technologies in education leads to the performance of universities not previously characteristic of their entrepreneurial function, where the commercialization of innovation involves the establishment of network interactions between educational

organizations, business and government (state, regional). The performance of new functions leads to a change in the role of vocational education in the formation of knowledge and territorial development. Similar territorial interactions between the sphere of education, economic structures and the state of Itzkowitz G. and Leidesdorf L. (12, 3) are called the triple helix model, where all the subjects of relations in the innovation system are equal.

Research has a strong interest in the role of universities in the production of knowledge for regional development, as evidenced by the research of Harrison J., Turok I., where the presence of universities, their geography and development are the most important [7, p. 979]. In the field of the geography of educational institutions are studies of Hermansson K., Scandurra R., Graziano M., who studied the regions of the EU. The authors found an average growth of 30% in the higher education sector during the period 2002-2012. The authors identify the ongoing process of concentration of higher education institutions in the regions and the factors that contribute to it: on the one hand, public policy, in connection with the public financing of their activities, on the other hand, the preference of students to study in economically developed regions. The economic impact of higher education on regional development is obvious and benefits those regions where their concentration is taking place. In addition, the concentration and development of vocational education depends on the level already achieved, where the past has a significant impact on the future of development. For the lagging regions, there is still an opportunity to improve the level of economic development in the region. [8].

Charlie Karlsson and W. Zhang write that the region with higher education institutions has much more opportunities for the accumulation of human capital, and hence socio-economic development. The authors conducted a comparative analysis aimed at identifying differences between the two regions (one of which has a higher education institution) to improve human capital on the basis of a dynamic model that identifies this relationship.

Garcia-Alvarez-Coque H.-M., Mas-Verdu F. and Roig-Tierno N. write about the positive impact of the vocational education system on regional development, which revealed a link between the presence of high-ranking universities and the competitiveness of the region [4]. The authors concluded that the best way to achieve the efficiency of the region's economy is a combination of a private (regional) research system, a network of inter-firm cooperation and a high level of human capital.

There is a series of scientific works by the author's team, which determine a significant contribution to the region's

economy from the development of higher education institutions. Hermansson, K., Lisenkova, K., Lecca, P., Swales, J. K., and McGregor, P. G. determine the contribution of higher education institutions to the local economy, determined by hiring staff and buying goods and services for their activities [10].

It should be said about the priorities that determine the direction of meaningful modernization of the professional education system. The system should not only meet the demands of the labor market, but also stay ahead of them, which involves the introduction and use of innovative ideas, revolutionary solutions and technologies, which requires its ability to form "the population of competences necessary for the breakthrough scenario to be realized" [16, c. 689].

Spatial planning issues are relevant in the research of domestic and foreign scientists. For example, Gawroński K., Assche van K., Hernik J. in spatial planning and management define potential for universities in the field of cooperation in the field of knowledge and experience sharing. Analyzing the principles of spatial planning in Poland and the United States, the authors justified the need to manage and socialize this process, decentralize government and create local governments [5].

The spatial organization of social infrastructure in the region, while creating "networks of multifunctional institutions that integrate different types of economic activity" [(26, p.11) explores Kozlova M. A. She explored the "center-periphery model" that identifies centrifugal and centrifugal trends; symmetry and asymmetry based on the calculation of composite indices and the compilation of rating spree of regions with varying degrees of urbanization and forms of organization of research objects. Comprehensive assessment of the spatial organization of economic activity in the region, based on the calculation of the integrated index, proposed by Suvorova A.V., allows to identify the dynamics of the level of creativity of the environment and assess the effectiveness of the innovative component of the region's economy [39, p.12].

The author investigated the spatial organization of the regional vocational education system on the example of the Ural macro-region, where a comprehensive index presented in Table 1 is calculated. This index is obtained as an average arithmetic of the three pre-received indices: the index of the nature of the placement of elements of the vocational education system; the index of contribution to the economy (formation of labor potential) of the region; digital development index for 2014-2017.

Table 1 Comprehensive index of spatial organization of the regional vocational education system of the subjects of the Ural macro-region [21, p. 138]

| Subjects | 2014 | 2015 | 2016 | 2017 |
|------------------------|------|------|------|------|
| Bashkortostan Republic | 0,39 | 0,42 | 0,64 | 0,75 |
| Udmurt Republic | 0,09 | 0,12 | 0,18 | 0,22 |
| Perm region | 0,27 | 0,33 | 0,21 | 0,44 |
| Orenburg Region | 0,16 | 0,18 | 0,38 | 0,35 |
| Kurgan region | 0,00 | 0,00 | 0,00 | 0,00 |
| Sverdlovsk Region | 0,70 | 0,80 | 1,00 | 1,00 |
| Chelyabinsk region | 0,56 | 0,47 | 0,60 | 0,53 |

Calculated by: "Regions of Russia: Socio-Economic Indicators" 2008, 2013, 2017, 2018; Russian Ministry of Science and Higher Education. URL: <http://vo.guraduate.edu.ru/registry#/?year=2015&slice=6>

Thus, the results of the above methods and assessment of the spatial organization of the vocational education system in Russia reveal the ongoing process of concentration of educational institutions (most of the higher education) in cities of large and largest. In municipalities and rural areas,

vocational education institutions are being dispersed. The calculated proportion of elements of this system is evidenced by this (table 2). The proportion of vocational education institutions in urban areas is rightly referred to as the urbanization index.

Table 2 The share of elements of the regional vocational education system in the cities of the subjects of the Ural macro-region, % [21, c. 296]

| Subjects | 2013 | 2014 | 2015 | 2016 |
|------------------------|-------|-------|-------|-------|
| Bashkortostan Republic | 44,36 | 46,59 | 62,14 | 61,54 |
| Udmurt Republic | 84,00 | 66,67 | 69,63 | 69,32 |
| Perm region | 62,16 | 66,91 | 67,15 | 69,34 |
| Orenburg Region | 81,61 | 78,72 | 84,15 | 73,96 |
| Kurgan region | 56,41 | 54,76 | 55,81 | 47,73 |
| Sverdlovsk Region | 55,56 | 56,63 | 58,89 | 59,18 |
| Chelyabinsk region | 58,43 | 69,13 | 75,00 | 68,83 |

Calculated by the author by: Monitoring-2017 (archive of materials 2016). URL: <http://indicators.miccedu.ru/monitoring/?m=spo>; Russian Ministry of Science and Higher Education .URL: <https://минобрнауки.рф/министерство/статистика>

Indicators were selected to investigate and assess trends in the digitization of the regional vocational education system: 1) information openness; 2) the use of special software tools in training; 3) implementation of educational programs using remote educational technologies (RET); 4) the implementation of professional educational programs using e-learning (EL). All these index values are presented in the study [21].

Received index values in the period 2013-2017. have generally positive dynamics in the subjects of the Ural macro-region. 100% of the requirements in the field of information openness of educational organizations are fulfilled. In some of the subjects studied (Perm region, Orenburg and Kurgan regions), the observed decline in the index of information openness is due to a decrease in the number of educational organizations of higher and secondary vocational education (Monitoring of the vocational education system) [19], which is influenced by the state-sponsored educational reform (since 2012) [40].

Index values of indicators of the use of personal computers in the activities of professional education organizations of the subjects of the Ural macroregion for the period from 2013-2017 remain stable, no significant growth was observed. The availability and number of computers is a condition for the realization of the information openness of vocational education organizations, and contributes to the improvement of the use of special software, e-learning

(EL) and remote educational technologies (RET) in the educational process, which also characterizes the process of modernization of the educational environment. The index values of PCs are influenced by the number of vocational education organizations reduced by the reform, and there are some problems in the computerization of the region's educational space, among them: the lack of available technical means as a result of their wear, obsolescence, and many SVE organizations (e.g. in Bashkiria, Orenburg and Kurgan regions) are located in rural areas, where innovations are slower than in cities as a result of such factors as a lack of funding, problematic in the allocation of communication lines and high-speed Internet, etc.

The use of special software tools, RET and EL characterizes the process of digitization of the educational space of the region.

It is obvious that the use of RET has certain advantages for users, such as the higher availability of educational programs as a result of the reduction of the distance between the consumer and the educational organization, the lower cost of education, a more convenient way to use educational materials (preserved in the archives), the ability to choose a convenient time for learning materials (classes). A large number of vocational education organizations, especially in large cities, use remote

technologies in the educational process, and the index values of their use are evidenced by this [21].

Index values of the use of special software by professional educational organizations in state statistics (The Ministry of Education and Science of the Russian Federation) began to collect relatively recently (since 2013), and since 2015 they have been added indicators of the use of special software tools in the field of solving organizational, managerial and economic problems. In the subjects of the Ural macro-region, the index values of their application demonstrate positive dynamics in the region as a whole. This dynamic could show greater growth if the number of vocational education organizations in the macro-region decreased as a result of the reform (since 2012).

In the FL of 29.12.2012 "On Education in Russia" in the editorial dated 03.08.2018, Article 16 p. 1, [40] explains the essence of e-education, characterized by the use of information and information technology, technical means, including information and telecommunications networks, transmitting the necessary information through the lines of communication in the implementation of educational programs, the interaction of educational and educational workers.

Due to its novelty, statistical accounting of the use of electronic form of education until 2015 was not conducted, but for the period 2015-2017. index values of the implementation of educational programs with EL in most of the subjects of the Ural macro-region are increasing [21, p. 132].

Educational organizations are committed to introducing e-learning that gives them a competitive advantage, and they are convenient for consumers to use in the areas of professional development, retraining and additional education. In the FL "On Education in Russia" in Article 16 p. 3 speaks of the importance of creating conditions for the development and operation of the information and educational environment, which includes the latest types of information resources and technologies that provide a new format for learning educational programs, regardless of their location [40]

4. DISCUSSION OF RESULTS

The spatial organization of the vocational education system in Russia and its regions is uneven, the differentiation of socio-economic development continues

to grow. This problem affects the efficiency of the spatial organization of the vocational education system, the process of its modernization and digitization, among other things. The uneven distribution of the university network across Russia and its regions is an obstacle to the implementation of an innovative-breakthrough scenario of development, accelerated adoption of digital technologies and socio-economic development in the future [16]. In addition, scientists highlight the problems of underutilization of the existing scientific and educational potential of regions, the process of squeezing the nucleus of effective regions (using their own accumulated scientific and educational potential) against the background of the expansion of the scientific and educational periphery [14].

In addition, Bolgova E.V. concludes that if the modern vocational education system is focused "exclusively on the function of creating and transferring knowledge," in this case it will be a resource underutilized "in relation to spatial progress" [17, c.29], that will only exacerbate the imbalance in the level of territorial development.

There are problems in the process of digitalization the economy in the imperfection of the regulatory and regulatory environment of digital interaction (information and telecommunications technologies in the sphere of economic activity), as stated in the Program "Digital Economy of the Russian Federation" [35]. As the regulatory framework is the primary link in the development of the socio-economic sphere, the Russian government needs to solve the issues of its improvement in the near future.

According to the results of the study, we can say that the beginning of the process of digitalization of vocational education in the regions has been launched: the positive dynamics of the application of new technologies in the educational process (RET, EL, etc.) has been revealed, which requires the development and distribution of technical tools, the latest information resources and technologies, etc.

Computerization is directly related to the process of digitization of the educational environment and this area is not 100% secured. Table 3 provides data on the number of students and personal computers that show the low level of PC security of educational organizations in the subjects of the Ural macro-region.

Table 3 The number of students and the provision of personal computers of professional education organizations of the subjects of the Ural macro-region in 2017

| Subjects | Graduation of specialists of the SVE and HE, thousands of people | Number of PCs in SVE and HE organizations, pieces | |
|------------------------|--|---|----------------------|
| | | Foreducational purposes | with internet access |
| Bashkortostan Republic | 205,3 | 18997 | 22471 |
| Udmurt Republic | 83,2 | 5751 | 8158 |
| Perm region | 124,0 | 10136 | 12397 |
| Orenburg Region | 94,6 | 6554 | 6748 |
| Kurgan region | 37,0 | 3455 | 4144 |
| Sverdlovsk Region | 234,9 | 24645 | 30307 |
| Chelyabinsk region | 177,0 | 15730 | 21045 |

Compiled by the author according to the website Russian Ministry of Science and Higher Education: <https://минобрнауки.рф/министерство/статистика/>

The spatial organization of the system, speed of scientific and technical progress affects the effectiveness of the spatial organization of the vocational education system: the emergence of new forms and learning technologies. Mobile technologies introduced into the educational process contribute to improving the level of education, professional development of students, and it is important to understand the effectiveness and necessity of their use in the educational process, as evidenced by research of Anand, G., Chhajed, D., Hong, S.W., Scagnoli, N. [1]. The vast majority of vocational education organizations in the regions are information-free, thus complying with legal requirements, and their desire to do so ensures their competitiveness [30]. Digitalization is a global focus of modernization in the development of educational systems across the world [2], enabling regions to make better use of their competitive advantages.

5. CONCLUSION

The following conclusions can be drawn from the results of the study of spatial organization and the process of digitization of vocational education in the region. First, the effective spatial integration of vocational education contributes to its contribution to the socio-economic development of the regions [16, c. 689]. Secondly, in the conditions of regionalization, the innovation and educational system is the basis of the development of the territory and is manifested by the inclusion of "internal potentials of self-development of regions in the process of modernization of educational systems" [22, c. 48]. The conclusions of scientists in the study of the experience of foreign countries in the spatial organization of the university system show that "the orientation of higher education on the interests of the regions" gives the necessary opportunities and creates conditions for the qualitative development of individual territories [15, c. 481]. As the quality of education is regulated by regulations, the development of regional quality assessment centers receiving state financial support, including state support, is provided by international and federal programs for assessing the quality of education, training specialists in this field [24, c. 78].

According to the requirements of the FL of 29.12.2012 "On Education in Russia" obtaining vocational education is a regulatory requirement for the level of knowledge, skills and abilities (competence, qualifications) of specialists in the performance of work functions.

In today's environment, the training of competent qualified personnel, vocational education is a prerequisite for the social development of the individual, society, the economy. In the FP of 29.12.2012 "On Education in Russia" obtaining vocational education is a normative requirement for the level of knowledge, skills and abilities (competence, qualifications) in the process of fulfilling a person's work function.

On the basis of a comprehensive assessment, taking into account the localization and media characteristics of the subjects (on the example of the Ural macro-region), the trends of digital development of the vocational education system are investigated. The technique used provided an index of the nature of the placement of elements of the system; The index of contribution to the economy (formation of labor potential) of the region; the index of digital development of the vocational education system in the macro-region space, which allowed to analyze and evaluate the subjects studied in aggregate, as forming a single economic space of the macro-region.

The resulting index of digital development of the researched subjects of the Ural macro-region has a positive value, which allows us to conclude that this process is in its educational space, about the possibility to regulate the concentration of spatial organization of the vocational education system.

Ensuring the information openness of educational organizations Mertzalova T.A. [30] defines as a global trend, a state priority, a regional resource that leads to an improvement in the quality of education to be regulated.

RET, EL are relatively new, modernizing the spatial and organizational system of vocational education, and their quality use requires the creation of environments (dedicated lines of communication, uninterrupted quality communication, appropriate equipment, equipment maintenance specialists, etc.), which are not all professional education organizations, especially in rural areas. С развитием современных технологий, Интернета и других технических средств новые формы обучения все больше будут проникать в жизнь

общества [13]. We can talk about the presence of trends in the digital development of the educational space, including the field of vocational education in the regions. Regulatory and legislative instruments, such as the Russian Digital Economy Program adopted by the Government, are promoting the development of digitalization, the main purpose of which is to create the conditions for the development of a society of knowledge using digital technologies [35].

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