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Development of a methodology for analyzing the effectiveness of the regional higher education

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Abstract:

In this study, the organization of university space in the system of regional space in methodology of analysis and evaluation of the effectiveness of the Volga Federal District At the moment, issues of prospects and opportunities for the transition of the Russian economic system into the so-called fairway of the fourth industrial revolution, conventionally called Russia 4.0, are gaining momentum to a greater extent. This type of economic development of mankind, based on which there is an almost complete absolutization of the process of cooperation of human, biological and digital technologies. Suffice it to note that according to the estimates of a number of leading experts and expert agencies, it is expected that by the end of 2035 the number of robotic and automated jobs will reach about 95%, about half of the jobs that exist today will be unclaimed.

Key words: higher education, development, industry 4.0, the methodology
JEL Classification Codes: A29, I23, L8.

Introduction :

1. INDRODUCATION

It should be noted that the Russian economy has significant potential not only in terms of synchronizing, relative to global trends, the process of entering the fourth industrial revolution, actively absorbing the transition to a new type of economic system, but also signs of an advanced transition to a new type of economic structure [1]. At the same time, despite the active role of the state program "National Technological Initiative", the most important factor justifying or, conversely, refuting the theses about the possibilities of the transition of the Russian economy to a new reality is the degree of readiness of economic entities for such transformations and changes, as well as the level of institutional infrastructure, providing this process. Undoubtedly, this measure of readiness in a natural evolutionary way, coupled with measures of state influence, will reach its apogee, and the Russian economy will integrate into global trends that provide for the change of a new technological order. The only question is when this will happen, what key factors will contribute to this and how high-quality will such a transformation be? The answer to these questions is very non-trivial and requires its own complex and systematic solution and analysis [2]. One of the key factors in the process of effective development of the national economy and its regions is traditionally the level and quality of higher school development. A particularly relevant issue in the context of this problem is the analysis of the quality of the structure and functional organization of the higher education system, this is due to a number of reasons [3].

2. MATERIEL ET METHODES

The most significant ones are determined by the need to form an adapted system of training qualified personnel in accordance with the current and future needs for labor resources in the national and regional markets. It should be noted that in the conditions of the administrative-command economy, especially in the era of its industrialism, this issue was given very significant and close attention, which somewhat decreased during the transformation of institutional reforms of the 90s. It is enough to pay attention to the fact that the state policy of the USSR clearly defined compliance with the emerging needs in the labor market. In accordance with them, as a result of efforts to link and adapt the higher education system to the personnel needs of the economy (and partly to the development needs), three main types of universities have taken shape [4]:

1) Universities, creation according to the territorial-production principle. Their functions consisted in cord support of specific sectors of the regional socio-economic system. Such higher educational institutions included universities oriented by regional labor markets (pedagogical, agricultural, engineering, and others).

2) Branch universities focused on providing personnel to the competitive sector of the economy and on a national scale (specialized universities focused on training, for example, in such areas as aviation engineering, engineering, geology, etc.),

3) Classical universities that trained personnel for science and other universities, primarily in fundamental disciplines, as well as personnel for local managerial elites (economic, historical, legal, education).

Unfortunately, it can be stated that despite significant shifts in the effective development of the higher education system in recent years, its functional content still requires institutional reforms and transformations. This is due to many aspects, the most significant of which are characterized by structural distortions in the current system of training highly qualified personnel and its compliance with the demand in the labor market [5]. At the same time, it should be stated that this discrepancy arises both in the conditions of the current development of the national economy and in the conditions of the prospective needs of employers, taking into account the transforming system of reproductive processes aimed at the global restructuring of the mechanisms of economic development in the future, including within the framework of the concept of the fourth industrial revolution. Thus, taking into account the above, at the current moment in the Russian economy there is an urgent issue of synchronizing the process of the personnel training system and the emerging demand for labor, which is being adjusted in accordance with global trends. Solving this issue is a very difficult task and requires a comprehensive, systematic approach. The discrepancy between the labor market and the system of training highly qualified personnel is evidenced by data revealing the dynamics of the growth of graduates in the humanities and the nature of the demand for labor in Russia (Figure 1.1).Despite the fact that the share of students studying in the fields of Economics and Management and Humanities is steadily decreasing, its level is still significant and does not correspond to the strategic objectives of the Russian economy focused on technological breakthrough. An indirect confirmation of the imbalance of development institutions is the observed. Thus, taking into account the above, at the current moment in the Russian economy there is an urgent issue of synchronizing the process of the personnel training system and the emerging demand for labor, which is being adjusted in accordance with global trends.

Solving this issue is a very difficult task and requires a comprehensive, systematic approach [6]. The discrepancy between the labor market and the system of training highly qualified personnel is evidenced by data revealing the dynamics of the growth of graduates in the humanities and the nature of the demand for labor in Russia (Figure 2.1).Despite the fact that the share of students studying in the fields of Economics and Management and Humanities is steadily decreasing, its level is still significant and does not correspond to the strategic objectives of the Russian economy focused on technological breakthrough. An indirect confirmation of the imbalance of development institutions is the observed dynamics of the growth of unemployed with higher education against the background of a significant level of the share of graduates in the humanities.

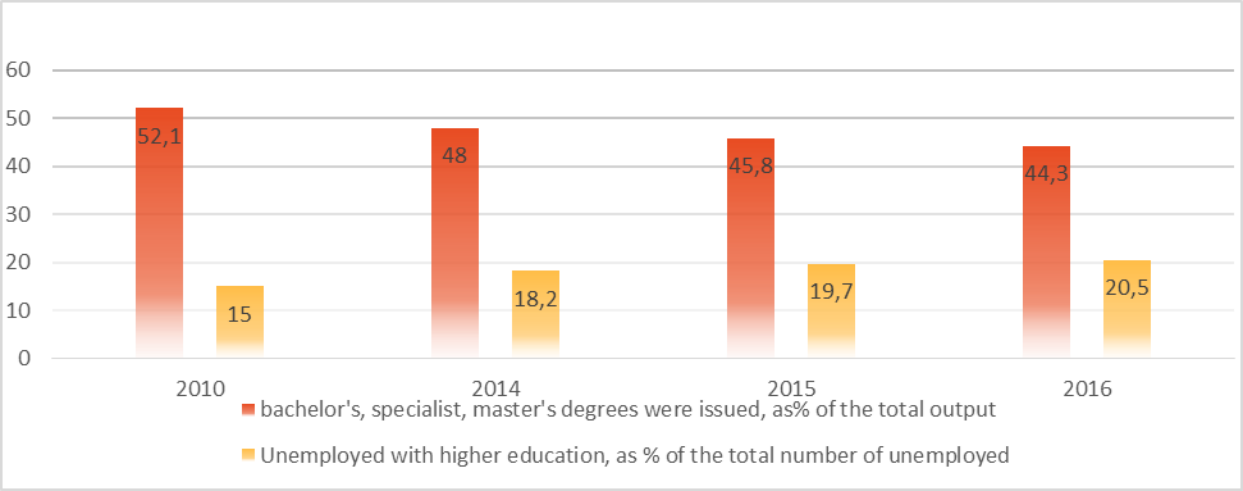

Figure 2.1 - Dynamics of university graduates and the share of unemployed in the labor market with higher education (prepared by the authors on the basis of Rosstat data)

As one of the methodological approaches contributing to the solution of the raised question about the compliance of the higher education system with the generated needs in the labor market, a toolkit can be used to determine the shares of universities grouped in accordance with the above classification in their total number in the higher education system. At the same time , an important aspect of solving the task is to conduct such an analysis in the regional context [7].This will allow not only to identify the degree of strategic competitiveness from regional systems, from the point of view of the correspondence of the "settings" of the university education system to the real sector

of the economy, but also to understand the prospects for their socio-economic development in the system of emerging trends in higher education - the main source of human capital generation, generating the basis for technological Breakthroughs in the economy. In accordance with the indicated approach, as well as guided by the grouping of universities relevant to the industrial economy of the USSR, the work carried out the systematization of the university space of the Volga Federal District in the context of its individual regions. All higher educational institutions of the Volga Federal District were subjected to a systematic analysis that allows them to reveal their belonging to one or another group characterized by mono- and versatility in the field of training highly qualified specialists in the field of training highly qualified specialists .At the same time, an approach was chosen as the main tool for the implementation of this stage of the study, according to which the values of the concentration coefficient of the training areas used (the Herfindahl-Hirschman index) were calculated[8].

HHI = S12+ S12…+ sn2…….... {1}

S1…, Sn – distribution of the given contingent of students by branches of science and their total volume.

This index characterizes the level of specialization of a higher educational institution in the areas of training defined in accordance with the traditional classification:

-mathematical and natural sciences-engineering, technology and technical sciences-healthcare and medical sciences-agriculture and agricultural sciences-social sciences-education and pedagogical sciences-humanities-art and culture

In order to simplify the methodological tools used in the classification of universities, their distribution provides for two typologies - higher education institutions belonging to the group of classical universities, providing a multidisciplinary approach to the implementation of training areas in accordance with the above branches of sciences. The second conditional group includes universities specializing in a multidisciplinary field of activity. In accordance with the classification of higher educational institutions of the USSR, these are educational institutions, these are educational institutions belonging to the category of industry or specializing in staffing specific sectors of the regional socio-economic system.

The logic of the distribution of higher education institutions into conditional groups (multi-profile (classic in accordance with the gradation of universities in the

USSR) and multi-profile) is formed on the basis of a comparison of the current value of the HHI coefficient of the university (HH $_{university}$) to the average value for the district

(HHI $_{county}$) – the general range of values of the analyzed sample {formulas……1.2 ,1.3}

HHI $_{university}$ > HHI $_{county}$. multidisciplinary $_{University}$…… {1.2}

HHI $_{university}$ < HHI county. Multidisciplinary $_{University}$ …… {1.3}

In a concentrated form, the procedure for distributing universities into two conditional groups is shown in Figure 2.2

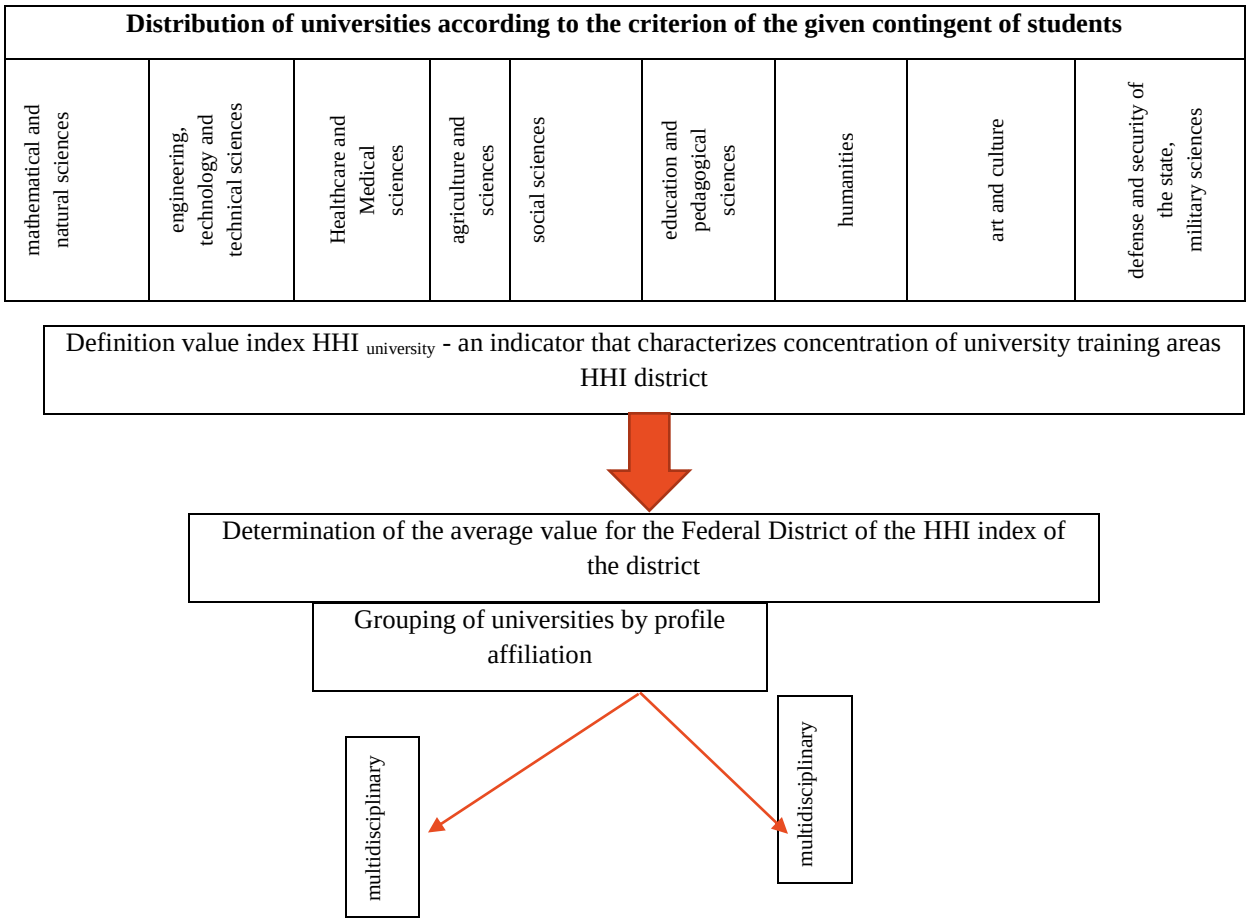

Figure 2.2 Procedure for the distribution of universities into two conditional groups in accordance with the orientation to a mono- and multidisciplinary approach to the implementation of educational programs

3. RESULATATS ET DISCUSSION

The results of the assessments carried out in the context of the regions of the Volga Federal District are presented in Figure 3.1.

Figure 3.1 - The ratio of multidisciplinary universities to multidisciplinary in the regions of the Volga Federal District (in descending order of the proportion of multi-profile universities), developed by the authors

According to the assessments received, there is a significant imbalance between mono-multidisciplinary higher education institutions in the higher education system of modern Russia. On average, the share of multidisciplinary universities in the district is about 23% of the total number of educational institutions [9]. It is important to note that in the industrial economy of the USSR during its

heyday (the 70s of the twentieth century) The share of this category of universities accounted for, on average, more than 93% in the country (Figure 3.1). This dissonance clearly demonstrates the imbalance of the system of training highly qualified personnel, its relative inefficiency and inconsistency with the needs of the labor market.

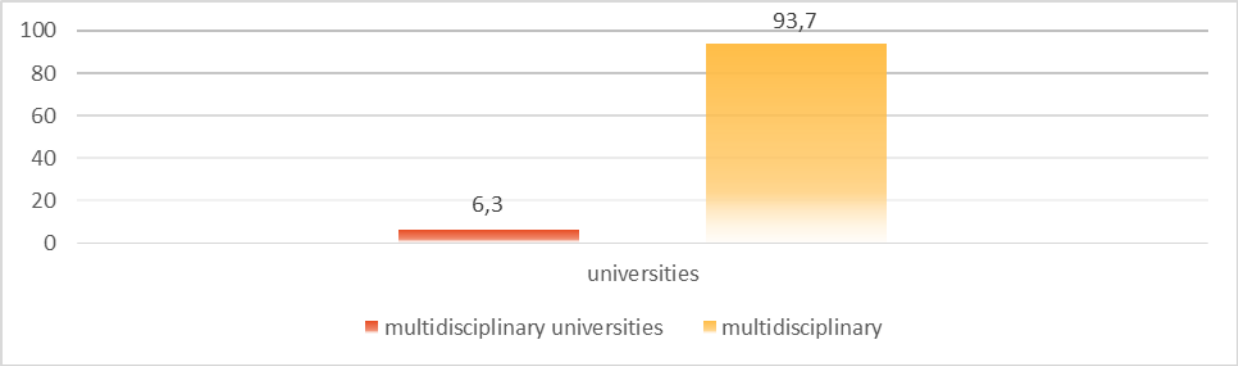

Figure 3.2 - Network of universities of the USSR, 1970 (developed on the basis of data)

Undoubtedly, it would be wrong to assert that a multidisciplinary approach to the organization of the higher education system a priori determines the inefficient way of development of regional/national economic systems, especially in the context of the globalization of the economic space, which provides for the need to implement a multi-competence approach to the provision of educational services. However, it should be borne in mind that the excessive orientation of the university to a differentiated approach to the organization of the implementation of educational programs does not contribute to the concentration of efforts of the higher academic institution within its main educational profile and, moreover, does not meet the current needs of the economy, which place an increased demand for qualified personnel with competencies in the field of natural science. At the same time, it should be borne in mind that the current state of affairs is only a reflection of the labor market situation due to negative trends in the national economy.

The economy in the period of the 90s. Further, in the zero years of the two thousandth, the conjuncture began to transform under the pressure of institutional transformations in the economy, however, as current practice demonstrates, the situation in the development of the higher education system remains rather ambiguous and does not contribute to qualitative transformations in the socio-economic environment.

Based on the implemented assessments obtained within the framework of a comprehensive analysis of the regional system of competitiveness of higher education,

in accordance with the previously proposed methodological approach, the main characteristic features of the current state of affairs in the organization of the university space are determined by the example of the Volga Federal District.

In accordance with them, it was found that the highest level of efficiency of the organization of the system of training highly qualified personnel, in terms of the ratio of multidisciplinary, have such regions of the Volga Federal District as the Saratov Region, Orenburg Region, the Republic of Bashkortostan, Nizhny Novgorod Region, the Chuvash Republic and the Republic of Tatarstan. This is due to the, that in the structure of the university space of the regional systems under consideration, the share of multidisciplinary higher education institutions accounts for from 20 to 40%, which is significantly higher than the average for the district.

At the same time , it should be noted that there is a pronounced pattern between the level of organization of the university space of the region and the parameters of its economic growth .It lies in the fact that the regions whose share of multidisciplinary universities is not so significant, the dynamics of economic growth in the last few years exceeds the average for the district .It is also important that these regions demonstrate significantly more stable indicators of the effectiveness of the organization and development of the labor market [10].

An important element of the analysis of the competitiveness of the development of the higher education system in the regions is not only the assessment of the effectiveness of the regional university space, but also the study of additional parameters characterizing

the quality of the system of training of highly qualified personnel formed in the region. These include the quality of admission, as well as the presence of the national status of the university. To assess the quality of

admission, among the studied set of universities, "mass education universities" were singled out. In the Volga Federal District, the share of such universities is 21% of the total. In accordance with this approach, as well as using the estimates obtained regarding the grouping of regional.

№	Region	For students assigned to each type of the total number of students				Cluster membership
		multi - profile	multi - profile	research	Mass education universities	
1	Kirov region	0.70	0.14	0.00	0.16	3
2	Perm Region	0.32	0.14	0.47	0.06	2
3	Bashkortostan	0.50	0.22	0.00	0.28	3
4	Mari El	1.00	0.00	0.00	0.00	4
5	Mordovia	0.78	0.06	0.00	0.16	3
6	Nizhny Novgorod region	0.34	0.29	0.29	0.07	2
7	Orenburg region	0.60	0.38	0.01	0.00	1
8	Penza region	0.88	0.01	0.00	0.11	4
9	Samara region	0.52	0.27	0.15	0.05	1
10	Saratov region	0.41	0.39	0.00	0.21	1
11	Tatarstan	0.35	0.11	0.42	0.12	2
12	Udmurt Republic	0.61	0.15	0.00	0.24	3
13	Ulyanovsk region	0.71	0.13	0.00	0.17	3
14	Chuvashia	0.64	0.15	0.00	0.20	3

Table 3.3- Cluster analysis of the effectiveness of the development of the higher education system in the regions of the Volga Federal District (calculated by the authors on the basis of monitoring data on the effectiveness of educational institutions of higher education in 2017)

According to the results of the comprehensive analysis [11], it is necessary to state that four types of regional university space have been formed in the Volga Federal District (Figure 3.2)

Type 1: The university space of the region is characterized by a high proportion of multidisciplinary universities, the quality of admission of which is at a high level, as well as the regions of this group are characterized by a low level of higher education

institutions with the status of a national university and included in the project Top 5-100. The regions of this cluster include: Orenburg, Samara and Saratov regions.

Type 2: The regions of this group are characterized by a moderate level of universities with the status of "multidisciplinary", a high level of the number of higher education institutions with the status of a national university and included in the top 5-100 project. Reception quality is at a low level. The Type 2 regions include the Top 5-100 project. Reception quality is at a low level. Type 2 regions include: Perm Krai, Nizhny Novgorod Region and the Republic of Tatarstan.

Type 3: Regions with an increased level of multidisciplinary universities that do not have the status of "national" and are not included in the Top 5-100 project. The reception quality is at a low level in relation to the regions of other clusters. Type 3 regions include: Krasovskaya Oblast, Republic of Bashkortostan, Udmurt Republic, Ulyanovsk Oblast and the Republic of Chuvashia.

Type 4: The university space of the regions is characterized by versatility, with a moderate level of quality of the incoming contingent, higher educational institutions of this cluster do not have the status of national and are not included in the Top 5-100 project.

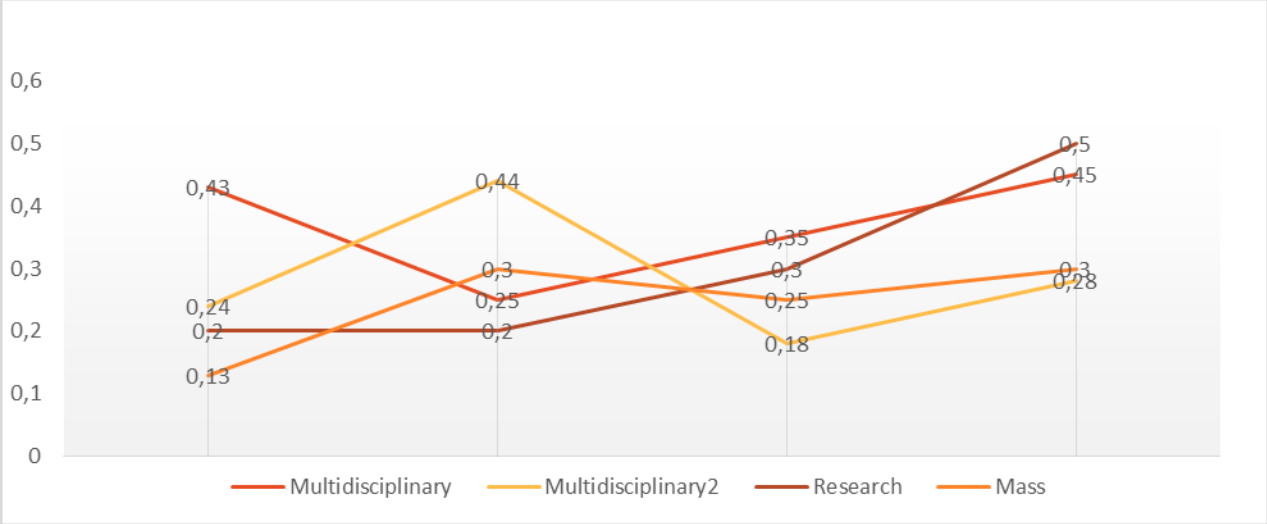

Figure 3.4 - Types of regional university space (cluster profiles)

The regions belonging to groups 1 and 2 are characterized by the greatest potential and competitiveness , since they are characterized by leading indicators in the share of multidisciplinary universities .The regions of Group 2 have an additional competitive advantage, expressed in the presence of a larger number of universities with the status of national and included in the -0project Top 5-100.In addition, it is necessary to state that the universities of the considered group of regions have a high level of quality of admission of the contingent. The regions of cluster 3 and 4 have lower competitive advantages in terms of the effectiveness of the development of the higher education system, since they are characterized by a significantly lower level of efficiency in the context of the problems posed in this study. Today, the problem of developing competition between universities is of particular relevance. One of the main tasks of the state is the formation of a competitive environment that determines the effectiveness of regional higher education systems. In order to assess the level of concentration of higher education institutions in the regions of the Volga Federal District, the Herfindahl-Hirschman indices were calculated {formula 2.1}, but in this case S is the proportion of the reduced contingent in the I-th university from the total number of students in the region. The index value close to 1 indicates the monopolized nature of the educational environment in the region {formula 2.1}, but in this case S is the share of the given contingent in the i–th university of the total number of students in the region. The index value close to 1 testifies to the monopolized nature of the educational environment in the region (one large university). A value close to 0, on the contrary, indicates the presence of high intracranial competition. The calculation results art shown in Figure 3.4. Today, the problem of developing competition between universities is of particular relevance. One of the main tasks of the state is the formation of a competitive environment that determines the effectiveness of regional higher education systems. In order to assess the level of concentration of higher education institutions in the regions of the Volga Federal District, the Herfindahl-Hirschman indices were calculated {Formula 2.1}, but in this case S is the proportion of the reduced contingent in the I-th university from the total number of students in the region. The index value close to 1 indicates the monopolized nature of the educational environment in the region {formula 2.1}, but in this case S is the share of the given contingent in the i–th university of the total number of students in the region.

The index value close to 1 indicates the monopolized nature of the educational environment in the region (one large university). A value close to 0, on the contrary, indicates the presence of high intraregional competition [12]. The calculation results art shown in Figure 3.5.

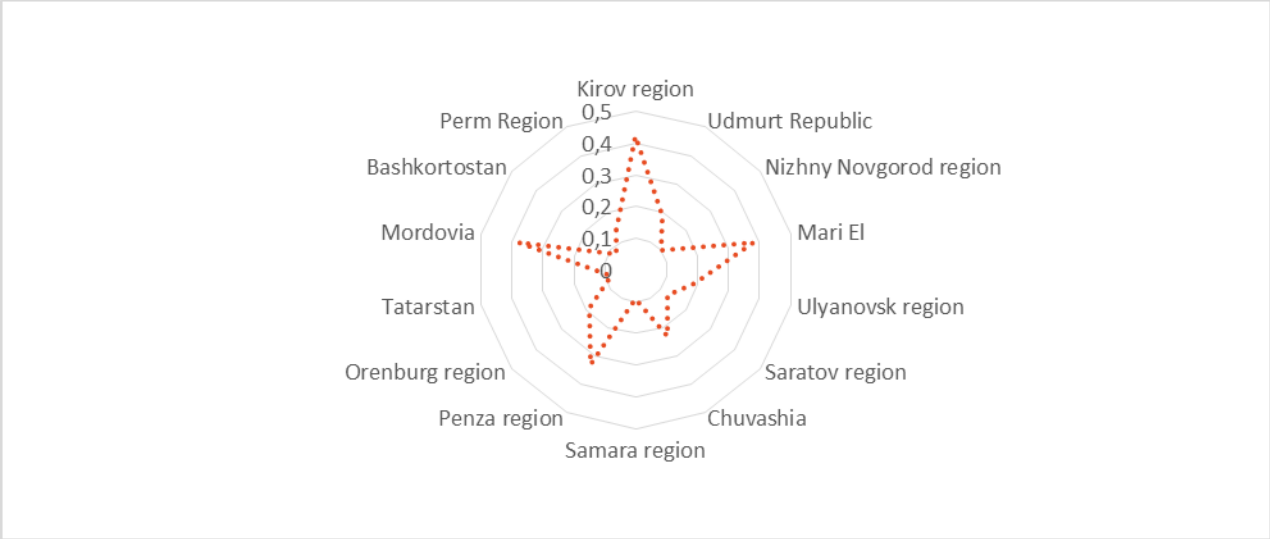

Figure 3.5 Concentration of universities in the regions of the Volga Federal District

The results obtained indicate the heterogeneity of the nature of the concentration of universities in the regions of the Volga Federal District. Regions such as the Kirov Region, Mari El, Mordovia, Penza Region, Udmurt Republic are characterized by a low degree of competition (mainly regions included in clusters 3 and 4 in accordance with previously presented estimates). Low-concentration, or regions with a developed competitive environment, include the Republic of Tatarstan, Bashkortostan, Samara, Saratov, Nizhny Novgorod regions, Perm Krai. The results obtained confirm the assumption that there is a direct correlation between the level of intra-regional competition and the degree of effectiveness of regional higher education systems.

CONCULUSION

In general, it should be stated that at the present stage of development, despite the obvious breakthroughs that have taken place in the last few years, higher education does not fully meet the expected challenges of future transformations in the system of global reproductive processes based, among other things, on the digitalization of the economy, which reflects a new type of organization and development of the labor market, new trends in the formation of labor productivity, new creative opportunities of society. Meanwhile, a new type of school aimed at developing such types of activities and types of labor organization that would contribute to and organically meet the new needs of the labor market in 15-20 years. Unfortunately, it should be stated that the current functional organization of the regional university space cannot fully contribute to solving the most important tasks for the national economy related to the technological needs of the system of training highly qualified personnel, focusing on the use of models of differentiated forms of educational programs based on existing universities. The result of this is that, that the structure of the university space of territorial systems has become dominated by the s called multidisciplinary educational institutions.

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