

Socio-economic potential of the territory as a factor in the development of organic agriculture

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Abstract. This paper presents the results of studies on the examination of rural areas in the regions of the Siberian Federal District (SFD) regarding the organization and expansion of organic agricultural production. For the socio-economic characterization and compilation of the rating potential of the SFD subjects, demographic, infrastructure, and territorial groups of factors were identified. The main competitive advantages of production and implementation of organic products were identified for each region. The rating compiled by the authors identifies the Novosibirsk region as the most promising for the development of various forms of organic agriculture. Krasnoyarsk, Irkutsk, and Tomsk regions also have high potential. The Republic of Altai and the Omsk region can be considered as regions of medium prospects due to limitations imposed by the weak development of some of the factors considered. The Republics of Tuva and Khakassia, as well as Altai and Kemerovo regions, are limitedly suitable for the development of the organic sector. A clear definition of the priorities of agricultural producers, the choice of a suitable strategy, and the presence of state support at all stages of the organization of organic production will be a necessary condition for the successful development of the sector.

1 Introduction

Organic agriculture represents the most environmentally friendly production system, expanding worldwide as the demand for “organic products” increases [1]. The popularity of adapting and implementing organic agricultural production models is also due to ecological issues, primarily related to the sustainability of agroecosystems [1,2], biodiversity conservation [2,3], and improving the quality of life of the population [4]. The organic sector in the global economy shows stable growth [5-7], making this area attractive for development in our country [8-10]. However, investors are always interested in where their activities can bring the most significant result while minimizing risks, and the state is whether it is advisable to support the development of organic agriculture in a particular territory. The regions of the Siberian Federal District (SFD) have significant potential in both production

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and the sale of products categorized as organic production [11-13], which makes it especially relevant to search for the most economically favorable territory for organizing and expanding the production of “ecological” products.

The aim of the study was to obtain a consolidated assessment of the socio-economic potential of the subjects of the Siberian Federal District in the field of organization and expansion of organic production, based on a combination of demographic, infrastructure, and territorial features of the regions under consideration. This work is a summary of the two-year work of the team of authors who considered the factors and features of the development of organic agriculture in the regions of the Siberian Federal District [11,14,15].

2 Materials and methods

The initial material for the study was data from the Federal State Statistics Service of Russia and other open sources (Rosstat, Regions of Russia: Basic Characteristics of Russian Federation Subjects: Statistical Compilation (2021); GIS, Online Directory of Organizations 2GIS (<https://2gis.ru>); Rosstat, Database of Indicators of Municipal Formations (<https://rosstat.gov.ru/storage/mediabank/Munst.htm>); Rosstat, Statistical Information on the Socio-Economic Development of Rural Territories of the Russian Federation (<https://rosstat.gov.ru/storage/mediabank/sel-terr.html>); Ministry of Education of the Russian Federation, Official Website of the Ministry of Education of the Russian Federation (https://edu.gov.ru/activity/statistics/general_edu); Rosstat, Population of the Russian Federation by Municipal Formations (Statistical Bulletin) (<https://rosstat.gov.ru/compendium/document/13282>); Report on the state and use of agricultural land in the Russian Federation in 2021 (Moscow: FGBNU Rosinformagrotech, 2022), as well as reports and scientific papers [11-19] describing the demographic, economic, and social situation of the rural population, as well as the level of infrastructure development and competitive advantages of rural areas of the Siberian Federal District regions.

For the rating, the following groups of factors were identified: demographic (population size and age structure of the rural population, employment level, migration balance), infrastructure (engineering, social, and transport infrastructure of the region's rural areas), territorial (presence of attraction points and factors increasing attractiveness, assessment of the size of the solvent demand for organic products from the population).

The initial data were grouped, as described below, into blocks, each of which was analyzed by a group of experts. Using morphological analysis and advanced forecasting methods [20-23], the current state, dynamics, and importance for the development of organic agricultural production of each indicator were assessed independently of each other on a scale from 1 to 5, where 1 means the best rating among the regions considered, and 5 – the worst.

The ratings obtained in this way were combined, and based on them, each of the SFD regions was assigned a rating score from 1 to 10, reflecting the prospects for the development of organic agricultural production in its territory.

The methodological basis of the mathematical analysis is the principal component method and cluster analysis by the k-means method.

Four clusters were chosen to divide the data. The following methods were also used in the work: computational and graphical, abstract-logical, analysis, synthesis, forecasting. Diagrams of socio-economic indicators are built in the Draw.IO software package (app.diagrams.net).

The computational part is performed using the R programming language for statistical data processing and graphics in the integrated R-Studio development environment.

3 Results and discussion

The territories of the SFD are differentiated by natural-climatic, demographic, transport, infrastructure, economic, and institutional conditions. On one hand, this complicates the development of organic agriculture in the region, but on the other, it provides opportunities for diversifying the organic sector and specializing individual territories [13,14,19]. Common advantages of the SFD in organic production include the following factors.

Firstly, there's the presence of continental transport corridors. These include the Trans-Siberian Railway, federal and regional highways such as “Irtysk”, “Siberia”, “Chuysky Trakt”, and others, as well as the Northern Sea Route. The region's major rivers, Ob and Yenisei, can also be considered part of the district's transport infrastructure. These transport arteries allow for the export of organic agricultural products produced in the SFD regions to more solvent regions of the European part of Russia, as well as to China and, through the ports of the Far East, to global markets, primarily Southeast Asia. Thus, organic product manufacturers can initially target external markets, which have much greater solvency than the internal regional market. Secondly, the district has significant areas suitable for certification for organic production. First and foremost, the possibility of bringing unused agricultural lands into circulation should be considered. The largest land reserves in percentage terms are held by the Republics of Tuva and Khakassia, as well as the Irkutsk region, and in absolute terms by the Krasnoyarsk Territory and the Novosibirsk Region. Thirdly, major scientific and educational centers are located in the SFD, which can undertake both the training of qualified personnel and the scientific support and accompaniment of organic agriculture at all its stages. One cannot overlook the general problems of the SFD regions, the main one being the negative dynamics of the rural population.

For a more detailed analysis of the territories, it is necessary to consider the SFD regions separately. Based on previously conducted work, the results of which are presented by the authors [11,15], a list of the main socio-economic factors was compiled, capable of characterizing the potential of the territories of the Siberian Federal District in the field of organizing and expanding organic agricultural production.

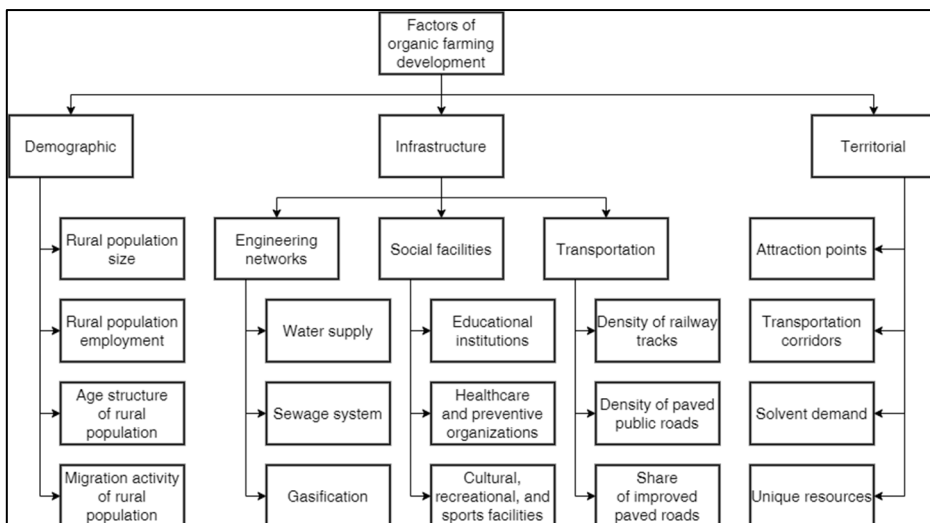


Fig. 1. System of indicators for deriving a rating assessment of the potential of the subjects of the Siberian Federal District in the field of organizing and expanding organic agricultural production.

The absolute value of the factor shows the current conditions for the emergence and development of organic agricultural production in the region, and the dynamics reflect the prospects for forming the organic sector in the future. Table 1 below provides final ratings for the most important indicators, from the authors' point of view, as well as final rating scores for each of the district's regions.

Table 1. Consolidated rating of the subjects of the Siberian Federal District by the potential for organizing and expanding the production of organic agricultural products.

SFD subjects	x ¹	x ²	x ³	x ⁴	x ⁵	x ⁶	x ⁷	x ⁸	Total
Republic of Altai	4	1	2	2	5	5	4	1	5
Republic of Tuva	4	1	1	1	5	5	5	3	8
Republic of Khakassia	4	3	2	3	5	2	4	3	10
Altai region	1	4	5	3	3	2	4	1	7
Krasnoyarsk region	2	2	3	4	3	4	2	1	4
Irkutsk region	2	1	2	4	3	3	2	1	2
Kemerovo region	3	4	4	5	4	1	3	2	9
Novosibirsk region	2	2	3	3	1	1	1	1	1
Omsk region	2	4	3	4	2	1	2	2	6
Tomsk region	3	2	3	5	1	3	2	2	3

Variable designations: x1 – number and dynamics of the rural population, x2 – employment of the rural population, x3 – age structure of the rural population, x4 – social infrastructure, x5 – engineering infrastructure, x6 – transport infrastructure and transport corridors, x7 – solvent demand, x8 – attraction points and unique resources.

Based on the consolidated rating of the subjects of the Siberian Federal District by the potential for organizing and expanding the production of organic agricultural products, a cluster analysis was performed (Figure 2).

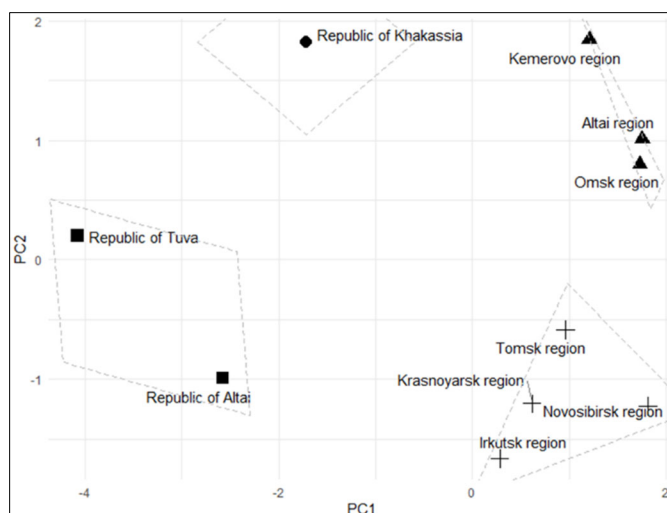


Fig. 2. Graphical visualization of the socio-economic assessment of the subjects of the Siberian Federal District based on the potential for organizing and expanding the production of organic agricultural products.

Figure 2 shows how regions cluster together and visually assess the grouping based on the closest evaluation parameters. Regions in one cluster have similar characteristics based on the variables identified in the analysis. The highest potential is characteristic of Group 1, which includes: Novosibirsk, Irkutsk, and Tomsk regions, as well as the Krasnoyarsk region. The most distant in terms of socio-economic potential assessment is the group that includes the Republics of Tuva, Altai, and Khakassia.

The Republic of Altai is characterized by a low rural population with a high proportion and positive demographic trends. At the same time, the formally well-developed social infrastructure of rural areas is due more to the effect of a low base than to high absolute indicators. Poorly developed engineering infrastructure does not allow for the development of processing and reduces the migration attractiveness of the region. The underdevelopment of the transport sector, combined with low internal purchasing power, hinders the development of organic agriculture, while the high recreational potential can, on the contrary, stimulate it.

The situation in the Republic of Tuva is generally similar, differing even more in the proportion of youth in the rural population and less recreational potential and tourist attractiveness. For both regions, it is recommended to develop livestock based on traditional forms of farming, gathering wild plants, and focusing on tourist demand, followed by scaling and entering external markets.

In the Republic of Khakassia, the transport infrastructure is much better developed, while the demographic situation is less favorable than in the above-mentioned regions. The low arable land area also pushes towards the development of livestock, as well as the transportation of products from neighboring regions. However, processing is complicated by weak engineering infrastructure. Low internal demand, weak tourist potential, and a developed transport network predetermine the export orientation of the region's organic production.

The Altai Territory is characterized by the dominance of small forms of farming, which, combined with low rural wages, pushes towards choosing a labor-intensive path for the development of organic agriculture. However, negative demographic trends clearly indicate that this path cannot be followed for long. Relatively developed infrastructure, combined with high educational and scientific potential, creates prerequisites for transitioning to science-intensive organic production and deep processing of products. The high recreational potential of the region and a developed transport network suggest the possibility of successful work both in the external and internal market.

The Omsk region shows slightly worse demographic trends than Novosibirsk. Moreover, it has a much less developed social and engineering infrastructure in rural areas, and the energy intensity of labor is significantly lower. However, the transport system is in good condition. Thus, the region is more likely to focus on exporting agricultural raw materials, choosing a labor-intensive path for the development of the organic sector. It should be noted that Omsk can present, albeit not very large, but stable demand for organic products.

The Kemerovo region is characterized by demographic problems and a relatively underdeveloped infrastructure of rural areas. The region also has an established image of a coal mining center, which does not benefit the market entry of local organic products. Moreover, agriculture is not a priority for the rural economy of Kuzbass, yielding to the extraction of minerals. Among the advantages, one can note the developed transport network, which, however, is also loaded with coal. Based on the above, the development of organic agriculture in the region is possible with significant state support, but in the near future, it is challenging.

The Krasnoyarsk region can be conditionally divided into 2 zones – close to Krasnoyarsk and the West-East transport corridor and the Far North. In the first, it is advisable to develop standard types of organic agriculture based on science-intensive production with a focus on

export, in the second – labor-intensive traditional types of reindeer herding and fishing. The region has sufficient labor resources and satisfactory dynamics. However, the traditionally high level of chemicalization may become a problem when certifying lands for organic agriculture. A relatively developed infrastructure in the first zone allows for the production of finished high-grade products and their delivery to external markets. In terms of internal demand, it makes sense to consider only Krasnoyarsk itself and the nearest industrial centers, as other territories are characterized either by a lack of purchasing power for organic products or by transport inaccessibility.

The Irkutsk region is very similar to the first zone of the Krasnoyarsk Territory, complementing the picture with a more favorable demographic situation and the presence of a tourist attraction in the form of Lake Baikal. A sufficiently developed transport and engineering infrastructure gives the opportunity to develop processing; the taiga is rich in wild plants, and the water system has unique fish species. All this can be offered both to tourists and residents of other regions and countries.

The Tomsk region is rather average in most of the parameters considered. A slightly negative demographic situation with high migration attractiveness, moderately developed infrastructure, scientific and educational potential, natural resources – all these allow the organic sector to choose any development path. Like the Novosibirsk region, it is capable of producing organic fertilizers and plant protection products. A downside is the poorly developed transport infrastructure, which complicates the export of produced goods. In this regard, it is recommended to develop deep processing to increase the specific profit of the producer.

The Novosibirsk region has a high rural population with a slightly negative dynamic. The rural area of the region has a developed transport, engineering, and social infrastructure, which suggests the possibility of developing science-intensive organic production with localized processing and selling not raw materials but high-grade products. The scientific and educational potential of Novosibirsk confirms this idea. Also, the largest city in Siberia can be considered as a center for technological, scientific, financial, consulting, and personnel support for organic production. The recreational potential of the region is not so high and is not fully utilized, but the attractiveness of a large city and its high purchasing power allow orienting part of the products to the intra-regional market. Also, the natural potential, combined with science and production, allows the development and production of not only agricultural products but also organic fertilizers and plant protection products.

4 Conclusion

In conclusion, all regions of the SFD have the potential for the development of organic agriculture, but this potential varies greatly. The rating compiled by the authors highlights the Novosibirsk region as the most promising for the development of various forms of organic agricultural production. The Krasnoyarsk Territory, Irkutsk, and Tomsk regions also have high potential. The Republic of Altai and the Omsk region can rather be attributed to regions of medium prospects due to limitations imposed by the weak development of some of the factors considered. The Republics of Tuva and Khakassia, as well as the Altai Territory and the Kemerovo region, are limitedly suitable for the development of the organic sector, and investors should be very careful in choosing directions of activity and market strategy in these regions. At the same time, for the authorities, the development of organic agriculture can become one of the mechanisms for the development of rural areas and improving the quality of life of the rural population.

A necessary condition for the successful development of the sector is a clear definition of the priorities of the agricultural producer, the choice of a suitable strategy, and the presence of state support at all stages of the enterprise's life. Since the domestic market for organic

products is small, it is recommended for all regions to have an export or tourist orientation of organic production. It is also recommended to develop the processing of organic products and enter markets (especially foreign) with high-value-added goods.

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