ADVANTAGES AND PROSPECTS OF CREATING REGIONAL HIGH-TECH AGRARIAN CLUSTERS

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Abstract:
One of the breakthrough directions for the development of the agro-industrial complex of Russia in the near future should be its transformation into a high-tech agro-cluster and the preparation of its participants for effective interaction in the digital economy. The authors determined the role of agro-industrial clusters in the development of the agrarian sector of the Russian economy and the impact of the digital economy on these processes through the introduction of breakthrough technologies. Clustering was carried out, based on an emergent approach to identifying and grouping indicators of the ratio of the resource potential and the agrarian development index of municipal districts that are of primary importance in identifying agro-zones of intensive development in the economic space of the region. A grouping of participants in the agro-industrial complex has been proposed with the separation of economic entities with a high and partial level of readiness, as well as those capable of self-adaptation to the conditions of the digital economy.
Keywords: *agrarian clusters, agrarian sector, clustering, digital economy.*

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INTRODUCTION:

Digitalization plays a key role in enhancing the competitiveness of the modern economy and in stimulating Russia's economic growth, since it launches modernization of traditional industries, creates new industries, which in turn becomes the basis for economic growth of regional ecosystems. The application of digital technologies is observed in modern banking, transport, agriculture, health care, education and many other areas.

The introduction of new digital technologies increases labor productivity, reduces business costs, increases the availability of information, reduces barriers to entry into new markets, and has a multiplicative effect on the development of industries and the economy as a whole. Regarding the scale of influence, we can cite the McKinsey forecast, according to which the economic effect of the digitization of the Russian economy by 2025 could increase GDP by trillions of rubles.

To assess the potential of digitalization of industries in Russia, on behalf of the government subcommittee on the digital economy, a Council on Digital Transformation of the Economy was formed. Among the latest proposals of the Council are such new directions as Digital Health and Digital Transport and Logistics. In the work of new directions - from e-commerce to digital agriculture and industry.

Today we can note the positive dynamics of the use of digital technologies in the agrarian sector of Russia, however, there are a number of problems, among them limited access to knowledge and technologies, a high proportion of vacant agricultural land, and existing restrictions in the development of agricultural informatization infrastructure, and the prevalence consumption of cheap and low-quality food and more.

Krasnodar Region, where the rural population makes up 47% of the population of the Region, is one of the largest producers of agricultural products in Russia. However, today this sector of the Russian economy is experiencing significant difficulties associated with reduced profitability of agricultural production, reduced output of certain types of products and low technological level using land resources, difficulties in obtaining credit funds, weak competitiveness of products, etc. [1-8].

All of the above necessitates the transformation of the agro-industrial complex of the Krasnodar Territory into a high-tech agro-cluster and the preparation of its participants for effective interaction in the digital economy.

MATERIAL AND METHODS:

The clustering carried out is based on an emergent approach to identifying and grouping indicators of the ratio of the resource potential and the agrarian development index of municipal districts that are of primary importance in identifying agro-zones of intensive development in the economic space of the region.

The cluster analysis procedure was performed using the k-means method, the goal of which is to divide m observations (from the space R^n) into k clusters, with each observation belonging to the cluster whose center (centroid) is the closest.

The Euclidean distance is used as a measure of proximity:

$$p(x,y) = \|x - y\| = \sqrt{\sum_{p=1}^{n}(x_p - y_p)^2}, (1)$$

where x, yϵR^n.

The k-means method divides m observations into k groups (or clusters) (k ≤ m) $S = \{S_1, S_2, ..., S_k\}$, in order to minimize the total quadratic deviation of cluster points from the centroids of these clusters [5]:

$$\min[\sum_{i=1}^{k}\sum_{x^{(j)}\epsilon si}\|x^{(j)} - \mu i\|^2], (2)$$

where $x^{(j)}\epsilon R^n$, $\mu_i\epsilon R^n$.
μ_i - cluster centroid S_i .[9]

The Ward method (Ward'method) was used as a method for hierarchically combining the units of the studied population (37 municipalities) into clusters, based on the minimum variances within the clusters.

The classification of objects (municipal formations) into groups — clusters was carried out by the Ward method according to the principle of minimum intracluster dispersion.

RESULTS AND DISCUSSION:

The object selected municipalities of the Krasnodar Territory, and as the subject - the value of the key indicators of the agro-industrial complex: gross agricultural output, the number of people employed in agriculture, the area of agricultural land, and also calculated the index of agrarian development of the territory.

Figure 1 illustrates the level of similarity of municipalities in the degree of effectiveness of agricultural development. Accordingly, research objects (areas of the Krasnodar Territory) are shown on the Y axis, and the distance between them in arbitrary units (k) is shown on the X axis.
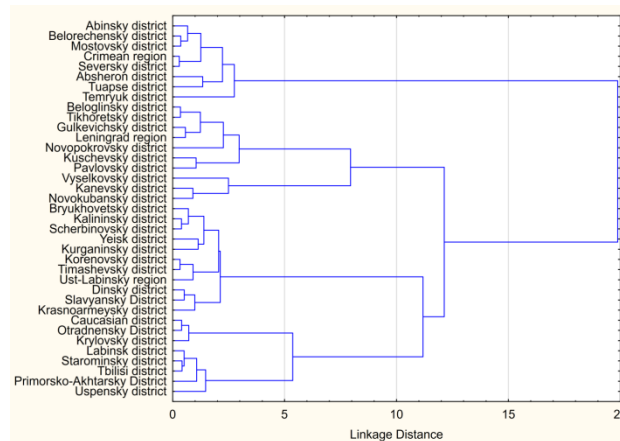
Figure 1: Clustering of municipalities of the Krasnodar Territory by the degree of efficiency of agricultural development.

The subregional territories with the lowest indices in agriculture should include the municipal districts in the first cluster: Bryukhovetsky district, Dinskoy district, Yeisk district, Kalininsky district, Korenovsky district, Krasnoarmeysky district, Kurganinsky district, Labinsky district, Slavyansky district, Starominsky district, Tbilisi district, Timashevsky district, Ust-Labinsky district, Shcherbinovsky district.

For the resulting second cluster, which included municipalities with a resort-tourist and industrial orientation (Absheron district, Mosty district, Temryuk district, Tuapse district) and areas specializing in agriculture and processing of agricultural raw materials (Abinsky district, Belorechensky district, Krymsky district, Primorsko-Akhtarsky district, Seversky district, Uspensky district).

It should be noted that Tuapinsky has high scores in terms of the development of construction, investment activity, the financial condition of economic entities, the development of the consumer market, and the accumulated economic potential. With regard to social development indicators, a low proportion of the population with incomes below the subsistence minimum, low unemployment, and a high level of purchasing power should be noted. However, the development of social infrastructure has a low score, in particular the provision of housing.

According to the results of the clusterization, agro-zones of intensive development in the economic space of the Krasnodar Territory (cluster 3) include municipal districts specializing in agriculture and the processing of agricultural raw materials - Kanevskaya and Novokubansky districts, as well as the

Vyselkovsky district, which specializes in addition to agriculture and industry. These areas effectively use existing agricultural potential.

The fourth cluster included: Beloglinsky District, Gulkevichsky District, Kavkazsky District, Krylovsky District, Kushchevsky District, Leningradsky District, Novopokrovsky District, Otradnensky District, Pavlovsky District, Tikhoretsky District. This cluster has an agricultural focus.

The basis of all interactions of subjects of the agro-industrial complex are information and communication relationships. They cover all spheres of activity, speaking in the form of informational interactions between agricultural organizations, producers of means of production for agriculture, enterprises processing and marketing agricultural raw materials and food in order to provide them with relevant information that plays an important role in management decisions and contributes to the innovative development of the agro-industrial complex and etc. [10-15].

Information and communication interactions of subjects of the agro-industrial complex should be formed in a single information space of the agro-industrial cluster, and the effectiveness of introducing digital technologies depends on the willingness of its participants to work in a digital economy, which can be attributed to the group:
- with a high level of readiness (cluster 3);
- with a partial level of readiness (cluster 4);
- adaptable (1 and 2 clusters).
The group in a high level of readiness includes economic entities of the agrarian and industrial complex of municipal formations, possessing

advanced technologies and using them in the production process.

The group with a partial level of readiness includes stably working and profitable enterprises of agricultural services, food and processing industries, retail chains, poultry farms, etc.

The third group can be classified as medium and large agricultural enterprises; having material, financial and

labor resources to use modern information technologies.

CONCLUSION:

The presented study demonstrates the prospects for creating regional high-tech agro-clusters in the Krasnodar Territory [16-19]. Taking into account the results obtained, it is advisable to create and implement a digital agrarian territorial platform. In Figure 2, we present the planned result of creation.

Figure 2: Results of the creation of regional high-tech agro-clusters on the example of Krasnodar Region

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