Transport connectivity of the organic production zone at the regional level

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Abstract. The paper presents an assessment of the development prospects and transport accessibility of organic production zones in the regions of Siberia based on data from state information systems of the Russian Federation and open information systems of commercial digital aggregators. The assessment was carried out with the use of technologies and analytics of the ArcGIS 10.6 program. The Novosibirsk, Omsk, Barnaul, and Tomsk agglomerations have concentrated clusters of investment projects for the processing of agricultural products. The eastern part of the macrozone is characterized by more focal investment activity, the largest of which is the eastern agglomeration of Krasnoyarsk. Investment projects in Kuzbass and the Irkutsk region are dispersed along the main transport routes. The republics of Altai and Tyva and the northern municipalities of the Tomsk and Irkutsk regions remain on the periphery of active transport contacts. Inside the highway part of the region there are areas of low efficiency in the use of transport potential, which makes it possible to increase the investment attractiveness of individual agricultural locations based on a combination of interspecies interaction.

1 Introduction

Currently the study of problems of development of transport infrastructure in relation to the production of organic products in Siberia is considered exclusively from the point of view of the prospects for railway communication, due to the significant remoteness of agricultural production zones from the port system [1]. At the same time, global warming and active government policy for the development of the Northern Sea Route raise the question of the need to study the capabilities of the river and sea fleet to resolve issues of transport connectivity of existing and promising zones of agricultural specialization in Siberia [2-4].

Climate change entails a change in the geography of production of organic raw materials in Siberia [5-7], and changes in the settlement structure indicate new spatial priorities in the field of its processing, which the transport system must also consider [8]. The active participation of Siberian agricultural producers in the federal project “Export of agricultural products” leads to an increase in the load on the road network [9] due to a significant increase

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in export flows in the southern direction (Kazakhstan, Mongolia), which also requires additional emphasis in determining the transport connectivity of the macrozone. However, all these studies, as a rule, concern individual types of transport and do not consider the specifics of transportation of agricultural products [10].

This study aims to fill this gap and use an integrated approach to assess the transport connectivity of the organic production area in Siberia.

2 Materials and methods

The state information systems of the Russian Federation and open information systems of commercial digital aggregators became the information base for geoinformation research and subsequent cartographic presentation of the results. For a vector representation of the geotorial characteristics of Siberia, a connection was made to the ArcGIS 10.6 software package of exchange coverage of the following information systems:

- state information system “Public cadastral map”;
- Earth remote sensing materials from the specialized mapping service Living Atlas from ESRI;
- open geoinformation project of the Asian continent by ESRI;
- open geoinformation project of marine tracks “Marine Traffic” by Exmile Solutions Limited;
- Earth remote sensing materials from Google’s specialized mapping service;
- unified database of investment projects “Investment projects. Digital platform”.

Materials from the database of the organizational structure of checkpoints across the state border of Russia were used to navigate international transport corridors.

Based on the results, maps were compiled for the macroregion in a scale range from 1:10,000,000 to 1:22,000,000, for printing on A4 sheets. When creating maps, artistic design was used using libraries of symbols, color scales, fonts built into the modules of the ArcGIS 10.6 software package.

3 Results and discussion

A transport system that ensures sustainable growth of organic production in Siberia must be linked to existing and promising areas for the production and processing of biological raw materials. The geography of investment activity in Siberia must be taken into account. The system should rely on the system of cargo flows and modes of transport in key mining and processing industries of a non-biological profile (coal, metals, etc.) and consider the biological cycles of production of agricultural raw materials.

The area occupies a deep land position within the country, at a considerable distance from the main international sea routes. River transport is focused on navigable rivers with a limited navigation period, predominantly meridional in orientation, which reduces the possibilities of interregional latitudinal interaction [11].

The advantages of the area are relatively favorable natural and climatic conditions for the production of organic products and high natural resource potential. A developed agro-industrial complex has formed in the region, primarily in the western part, which attracts industry investors here in the medium term.

The region is the main producer in the livestock and crop markets of the Asian part of the country. First of all, the western regions stand out for their grain production: Omsk, Novosibirsk regions, Altai Territory. Favorable natural and climatic conditions and transport accessibility have formed the Siberian grain belt here, and an agricultural production infrastructure with a stable sales market has been formed in the suburbs of the largest cities.
It is no coincidence that the main interests of agricultural investors in the Asian part of the Russian Federation are localized here: processing of crop and livestock products, agro-industrial complexes and centers, non-traditional innovative production solutions. The Novosibirsk, Omsk, Barnaul, and Tomsk agglomerations have concentrated clusters of investment projects for the processing of agricultural products, and the area of the Novosibirsk-Cherepanovo-Barnaul investment projects appears to be a continuous area of concentration of investment decisions in the medium term.

The eastern part of the macrozone is characterized by more focal investment activity, dedicated to the implementation of individual projects. The greatest attractiveness is typical for the largest eastern agglomeration of Krasnoyarsk, but only in terms of processing livestock products, mainly meat processing. The republics of the region are predominantly represented by livestock farming, which is associated with national characteristics; therefore, investment priorities are also localized near the republican centers for processing livestock products. Investment projects of Kuzbass and the Irkutsk region are dispersed along the main transport routes, which is due to the polycentric structure of the Kuzbass agglomeration and the confinement of the western centers of the Irkutsk region to the Trans-Siberian Railway.

The combination of investment projects based on the existing agricultural natural resource potential and transport accessibility is widely represented in the west of the region (Fig. 1). Interaction between producers and processors of agricultural products has been achieved at the modern technological level. When implementing existing investment decisions, it is predicted that the level of product processing will deepen; and the accompanying competitive qualities of products will be strengthened. In the Eastern Siberian regions, the combination of investment projects is complicated by transport disunity, limited domestic sales market, and the focal nature of agricultural areas. Combinations of investment projects in the Krasnoyarsk-Abakan direction to form their own interregional raw material base for processing facilities for crop production (mainly grain production) are promising.

Fig. 1. Transport accessibility of organic production in Siberia.
4 Conclusion

Thus, the basis of the transport interaction of the macroregion is the concentration of economic activity along the Trans-Siberian Railway. The republics of Altai and Tyva and the northern municipalities of the Tomsk and Irkutsk regions remain on the periphery of active transport contacts. Inside the main part of the region there are areas of low efficiency in the use of transport potential, which allows, based on a combination of interspecific interaction, to increase the investment attractiveness of individual locations: the interaction of river, road and railway types. Also promising is the development of foreign trade through the existing border checkpoints in the region to the PRC and the Republic of Kazakhstan. In the future, it is possible to connect to the Chongqing-Xinjiang-Uyghur Autonomous Region-Europe highway of the New Silk Road.

To develop zones for the production of organic products in Siberia, the following directions of state regulation are proposed to ensure transport connectivity of the macroregion:

1. The use of the river network must be arranged. Irtysh in the Omsk region for the transportation of agricultural products from planned investment projects in the agglomeration of Omsk and the central regions of the region. At the same time, the capabilities of this highway are promising for ensuring northern delivery for the autonomous districts of the Tyumen region, including the possibility of a new sea export route through the Northern Sea Route (from the port of Omsk to the village of Chernoluchy - Bolsherechye rural settlement - Tara - Tevriz rural settlement - Ust-Ishim village - the village of Zagvazdino with the junction of the lower reaches of the Osha River: the village of Brazhniko - the village of Bolshiye Turaly - the village of Semenovka), as well as the southern export direction (to eastern Kazakhstan and northwestern China) up the Irtysh through the river checkpoint "Cherlak" (seasonal cargo-passenger two-way point in the village of Olkhovka, Cherlak district, from 2038 km).

2. Unpaved roads must be paved:
   - in the Novosibirsk region – settlement Baskovo - village Kopkul - Kupino - village. Housewarming, with the involvement of the Kupino railway station as an intermediate point to the Karasuk railway checkpoint and the Pavlovka automobile checkpoint of the Novosibirsk branch of the FKGU Rosgranstroy;
   - in the Omsk region on the line New Kashkul - Tara (village Kabyrdak - village Kutyryl - village Taskatly - village Strokino - village Novologino - village Bolshiye Turaly), which, along with the involvement of the lower reaches of the river in shipping. Oshi intensifies the transportation of agricultural products in the latitudinal direction;

3. In the Altai Territory, it is necessary to develop a regional network of intercepting grain terminals in places where grain production is concentrated; to form additional regional cargo-forming hubs in the western export direction; to intensify the southern direction of export flows as a priority, due to the equidistance from the western and eastern borders of the country.

4. In the Krasnoyarsk Territory, a second regional interregional cargo-forming hub for the eastern export direction should be formed considering the existing regional cargo-forming hub; it is necessary to develop interregional road transport cooperation to intensify domestic transportation and the southern direction of export supplies; and to strategize the development of logistics flows of food through river ports focused on the Northern Sea Route.

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References

5. Climate Change and Global Market Integration: Implications for global economic activities, agricultural commodities and food security (Rome, 2018)
10. V.A. Malov, B.V. Melentyev, World of new economics *14*(2), 73-81 (2020)