Relationship of production and population in Siberian and Mongolian cities

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Abstract. The purpose of this study is to identify the spatio-temporal relationship between the population and production of the urbanized territories of the Siberian-Mongolian region. Cross-cutting methods - statistical, cartographic, comparative-geographical are used at all stages of the study. The units of measurement taken are the following: in Russia - urban districts and municipal districts, in Mongolia - the capital city and aimags. The main results consist in identifying the main urbanized areas that have formed in places of maximum population concentration: around the capital city of Ulaanbaatar in Mongolia, and in southeastern Siberia around the regional centers of Irkutsk, Ulan-Ude and Chita. Competitive advantages and opportunities of cities and regions are assessed. The increasing role of the main economic centers objectively leads to the growth of the corresponding agglomerations and damages the functioning of other urban settlements. Based on the analysis of the economic complex of the studied territory, the branches of industrial specialization are distinguished, the typologies of municipalities of the region are carried out according to the prevalence of the main activity in the industry. The determining factors of the social and economic development of cities are the effects of the economic and geographical location and the accumulated socio-economic potential of the territory in relation to adjacent spaces.

1 Introduction

The scientific basis of the work was formed by the publications concerning in research to determine the economic specialization of territories and the main trends in the change in the territorial organization of industry. The analysis of the territorial organization of the economy was carried out using economic and statistical methods, among which the comparative method of studying economic and geographical phenomena, their concretization and generalization is of great importance. The work performed to determine the economic specialization and territorial structure of the economy and population of the Baikal region plays an important role [1-3]. For Siberia, “the leading tendencies of changes that have...
In general, the system of urban settlement in the Transsib zone is well developed in comparison with other Siberian territories. It also has a relatively high density of the network of urban settlements, the main centers of population concentration, modern production facilities and innovative industries, has a powerful scientific and educational complex, performs transit and logistics functions of transport, from regional centers the management of the corresponding regions is carried out [5].

V. B. Sochava Institute of Geography SB RAS has repeatedly published materials of comprehensive geographic studies of the natural, resource, economic, demographic, and ecological characteristics of the territory adjacent to the Transsib, taking into account the prospects of the Baikal-Mongolian Transport Corridor [5, 6, 7].

2 Objects, data and methods

The model study area was represented by the transboundary Baikal-Mongolian transport corridor connecting the main cities of Southeastern Siberia and Central Mongolia through the cross sections of the Trans-Siberian and Trans-Mongolian railways. The Russian part of the study area is a sublatitudinally oriented strip adjacent to the Trans-Siberian Railway (we call it the transport corridor or the Transsib zone). It includes the cities and districts of three constituent entities of the Russian Federation (Irkutsk Oblast, the Republic of Buryatia and the Zabaykalsky Krai), crossed directly by the railway from Tayshet to Chita (1683 km). The distance between the main cities by rail is 456 km (Irkutsk-Ulan-Ude) and 557 km (Ulan-Ude-Chita). The transboundary and Mongolian part of the study area is a submeridionally oriented strip branching south from the Transsib to Ulan-Ude and extending 657 km to Ulaanbaatar, which includes cities and districts of the southern part of the Republic of Buryatia and cities and aimags of the northern and central parts of Mongolia.

To maintain the continuity of research, the authors relied on previous scientific publications concerning the population and industrial specialization of the territories under consideration [1–3, 7–9]. The informational basis of the work was formed by statistical materials of the Federal State Statistics Service (url: https://rosstat.gov.ru/), the National Statistical Service of Mongolia (url: https://www.1212.mn), official data of local authorities. The main bodies of statistical information are taken from the Rosstat reference books: "Regions of Russia. Basic socio-economic indicators of cities" (2020), "The size and migration of the population of the Russian Federation" (2020), "The population of the Russian Federation by municipalities" (2020). The observation units taken for the study are urban districts and municipal districts of Russia, as well as the capital city and aimags of Mongolia.

The objectives of this study are to interconnect the study of production and population in the cities of Southeastern Siberia and Mongolia within the spatial framework of the Baikal-Mongolian transport corridor. The distribution of the population, the network of settlements, the features of the socio-demographic state and changes in the population on the territory of the Baikal-Mongolian transport corridor were investigated. Based on the analysis of industrial specialization, a territorial grouping of the considered municipalities, urban districts and aimags was carried out according to the volume of products shipped.

3 Results and discussion
- the peculiarities of a sparsely populated region, which, due to its supercontinentality and remoteness from most economic agents, cannot count on intensive economic ties with the world.
- the existing system of settlement, in which opportunities for productive employment of the population are available in a few urban areas, and their changes cause migratory movements of the population.
- ethno-national characteristics of reproduction and migration of the population of Russia and Mongolia, which are at different stages of the demographic transition.
- geopolitical factors of interaction with neighboring regions and countries that consider the ties between southern Siberia and Mongolia in terms of the formation of the China-Mongolia-Russia economic corridor.

The population of the territory is uneven, and the contrast in the population increases. The narrow strip, which is made up by the regions of the Russian part of the transport corridor, has a population density of 11.2 people/km², which is 4 times higher than the average population density of the Baikal region (2.8 people/km²). The ratio of the population density in the Mongolian part of the transport corridor to the population density of Mongolia is more than sevenfold - 14.8 to 2.0 people/km². If the area of the Russian part of the transport corridor is 16.7%, then the population size is 65.9% of the corresponding indicators of the Siberian regions. In Mongolia, the differences are even more contrasting: 7.9% of the territory and 55.8% of the country's population located in the Trans-Mongolian transport corridor (table 1).

Table 1. Population in the transport corridor and in the regions in 2015–2020.

<table>
<thead>
<tr>
<th>Region</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total (thou of people)</td>
<td>Including transport corridor thou of people</td>
</tr>
<tr>
<td>IRKUTSK OBLAST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REPUBLIC OF BURYATIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZABAYKALSKY KRAI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THE BAIKAL REGION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MONGOLIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THE BAIKAL REGION AND MONGOLIA, TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

districts, less than 1 person per square kilometer – in three districts, and in Ulaanbaatar there is no rural population.

The displacement into the largest cities - regional centers - and their suburban areas leads to depopulation of the entire vast regional periphery [10] and the Trans-Siberian semi-periphery, which consists of the rest of the highways. Small urban areas of intensive development are distinguished, other territories actually remain outside the modern development. The configuration of the inhabited areas looks like a broken chain along the Trans-Siberian and Trans-Mongolian highways.

Fig. 1. The density of the rural population and the population size of urban settlements in 2020.
The urban population completely dominates, even for Buryatia, where 4 municipal districts are headed by rural settlements, the level of urbanization is close to the national average (72.8%) (table 2). The largest number of cities (15) and urban-type settlements (20) are located in the Irkutsk Oblast, along more than 800 km section of the railroad, where 157.4 thousand km² are in the territory of the mainline areas. However, the average distance between urban settlements in the Irkutsk section is greater than the average distance for the Transsib.

The core cities of the Trans-Siberian urbanized space—the centers of the subjects of the federation (Irkutsk, Ulan-Ude, Chita)—have a decisive influence on the development of the Siberian regions. In Mongolia, in socio-demographic terms, Ulaanbaatar dominates[11]. The Mongolian capital exceeds the total population of all three regional centers of Southeastern Siberia. The four cities together account for 62% of the transport corridor population. The socio-economic potential of the main cities of Southeastern Siberia and Mongolia is influenced by a powerful transport and geographical factor of development. There is an intensified polarization of the center-periphery development in the economic and social aspects. In fact, the entire periphery is a migration donor for the “capital cities”. There is a

Table 2. Urban settlements in the Baikal-Mongolian transport corridor in 2020.

<table>
<thead>
<tr>
<th>Units of settlement</th>
<th>Irkutsk Oblast</th>
<th>Republic of Buryatia</th>
<th>Zabaykalsky Krai</th>
<th>Mongolia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban districts</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Towns within districts</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Urban-type settlements</td>
<td>20</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

On both sides of the Russian-Mongolian border, most of the territories are migration donors. The migration redistribution of the population in the Mongolian part of the transport corridor is a one-way traffic in favor of the capital Ulaanbaatar. In the Russian part of the transport corridor, migration is in favor of regional centers and their suburban areas.

Urbanization processes in Siberia and Mongolia developed asynchronously. Siberia was characterized by accelerated urbanization in the 1930s-1960s, while in Mongolia this process was slower. In general, Mongolia is experiencing rapid demographic growth, which has acquired a migration acceleration in the capital Ulaanbaatar, where population growth was 169% in the period 1990–2020. Siberian cities are growing slowly due to the exhaustion of the demographic component of urbanization. In the post-Soviet period (1990–2020), population growth was 7%, 8%, and 23% in the cities of Irkutsk, Chita, and Ulan-Ude, respectively. Demographic processes at the beginning of the XXI century are characterized by a low birth rate, the reasons for which are the dominance of the modern model of a small family, a decrease in the absolute number of reproductive contingents of women, postponement or refusal to have children due to socio-economic instability. The regions of Southeastern Siberia as a whole have a narrowed reproduction of the population, while only Republic of Buryatia stands out against a general backdrop, which has a high share of the titular ethnic group in the population.
for the regions of Siberia, but also for the aimags of Mongolia, where the territories along the Trans-Mongolian railway line dominate.

Within the considered strip in 2019, industrial products were shipped for 2,160.9 billion rubles, which amounted to 53.3% (slightly more than half) of the total industrial production. Of course, the contribution of the regions under consideration is ambiguous, the leader is the municipality of the Republic of Buryatia (73.3%), followed by the municipalities of Irkutsk Oblast and Zabaykalsky Krai (41.1% and 37.2%, respectively) (table 3).

Table 3. The volume of products shipped in the transport corridor area and in the region in 2015–2019.

<table>
<thead>
<tr>
<th>Region</th>
<th>2015</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total,</td>
<td>Including the transport</td>
</tr>
<tr>
<td></td>
<td>billion</td>
<td>corridor</td>
</tr>
<tr>
<td></td>
<td>rubles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>share in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the region, %</td>
</tr>
<tr>
<td>Republic of Buryatia</td>
<td>131.2</td>
<td>118.2</td>
</tr>
<tr>
<td>Irkutsk Oblast</td>
<td>898.5</td>
<td>317.5</td>
</tr>
<tr>
<td>Zabaykalsky Krai</td>
<td>107.4</td>
<td>78.5</td>
</tr>
<tr>
<td>Mongolia</td>
<td>334.6</td>
<td>308.4</td>
</tr>
<tr>
<td>Baikalsky Region</td>
<td>1137.1</td>
<td>514.2</td>
</tr>
<tr>
<td>Mongolia, total</td>
<td>1471.7</td>
<td>822.6</td>
</tr>
</tbody>
</table>


2015 to 2019 there is an increase in the share of the transport corridor in Irkutsk Oblast (by 5.3 percentage points), while the share of the transport corridor territories in the Zabaykalsky Krai (by 41.3 percentage points), Mongolia (by 17.5 percentage points) and the Republic of Buryatia (by 16.8 percentage points).

Such a change in the contribution to the volume of shipped products of the territories under consideration is associated with a change in the structure of the economy of the regions. In 2015–2019 there is a decrease in the share of manufacturing in the gross regional product (GRP). In the Irkutsk Oblast, the leading positions belong to the mining industry (31.5%), in the Zabaykalsky Krai, transport (18.4%) and the mining industry (15.0%), in the Republic of Buryatia, transport (10.8%) and manufacturing (9.9%) [7]. There is an increase in the mining and service industries, the activities of which are located mainly outside the territory under consideration, these are the northern regions of oil and gold mining, as well as other types of mining.

Depending on the volume of industrial production, all considered territorial entities (municipal districts and urban districts) can be subdivided into 5 main groups. The first group with the highest indices of industrial production (over 100 billion rubles) includes the capital of Mongolia, Ulaanbaatar and the regional center, Irkutsk; it is in these centers that the most complex structure of industrial production is noted. Ulaanbaatar accounts for 58.8% of the volume of shipped products of the entire zone. The industry of the
The capital city is represented by machine-building and metalworking enterprises, woodworking and house-building industries, as well as food industry enterprises. The CHPPs of the capital city generate 85% of the country's electricity (Ulaanbaatar CHPP-1, CHPP-2, CHPP-3, CHPP-4). Irkutsk, the administrative center of Irkutsk Oblast, in terms of the volume of shipped products, is slightly inferior to Ulaanbaatar. Mechanical engineering enterprises (Irkutsk Aviation Plant, Irkutsk Heavy Engineering Plant, Irkutsk Relay Plant, etc.), electric power enterprises (Novo-Irkutsk CHPP and Irkutsk HPP), as well as enterprises of the construction industry and the food industry are also located on its territory.

The second group included three urban districts, one aimag and one municipal district (industrial production from 50 to 100 billion rubles). The industrial production of Chita and Ulan-Ude (the administrative centers of the Zabaykalsky Krai and the Republic of Buryatia, respectively) are distinguished by a wide variety of activities (mechanical engineering, food, building materials industry, electric power industry). A common feature of the Angarsk urban district and the Shelekhovsky district is a clearly expressed specialization in the manufacturing industry. In Angarsk, it is oil refining, which serves as the basis for the development of the chemical industry, and energy, in the Shelekhov town it is non-ferrous metallurgy, which has an export orientation, as well as energy. This group also includes the Orkhon aimag, which specializes in extractive industries. The town-forming enterprise of the aimag is Erdenet (extraction and processing of copper and molybdenum), as well as food and light industry enterprises.

The third group included 12 territorial entities with industrial production volumes ranging from 5 to 50 billion rubles, but this group is very heterogeneous within. It is possible to single out cities that belong to the group of single-industry towns (Sayansk and Usolye-Sibirskoye chemical industry; Cheremkhovo-coal mining), as well as those with the status of territories of advanced social and economic development (TASED). The industrial profile of the Usolsky and Irkutsky districts is the food industry, the Tulunsky one is coal mining, the rest is the timber and woodworking industry. The main industrial production of the Darkhan-Uul aimag (1.5% of the zone) is ferrous metallurgy (a steel plant), the food and building materials industry is developed, Selenge (2.6% of the entire zone) is the food industry.

The fourth group, which is the largest, includes 14 territorial entities, its volume of industrial production ranges from 1 to 5 billion rubles. All territorial entities can be divided into subgroups by specialization: mining (mining of gypsum, salt-Zalarinsky), processing (food industry) and not having a dominant industry (Slyudyansky, Khiloksky, etc.) In the aimag of Tuve, in addition to the food industry, gold is mined.

The fifth group includes territorial entities with the lowest indicators of industrial production—less than 1 billion rubles, the industry dominated by the manufacturing industry (Cheremkhovsky district) or mining, represented by small mining enterprises (coal-Alarsky district). Agricultural production plays the main economic role.

The relationship between population and production is demonstrated by the fact that the main demographic and production potential of the transport corridor is concentrated in four cities (Ulaanbaatar, Irkutsk, Ulan-Ude and Chita): 62% of the population, 73% of production volumes. The rest of the urban districts, except for Angarsk, are of very little importance in terms of demographic and economic indicators. The graphic display of the population and production in 12 urban districts suggests that 4 of them (Zima, Svirsk, Tulun, Petrovsk-Zabaikalsky) are actually not significant centers in the socio-economic space of Southeastern Siberia. Comparison of independent urban districts and the grouping (with the allocation of 5 groups) of territorial entities shows that the main centers only fall into the first or second group. The second group also includes Angarsk, the Orkhon aimag (mainly the city of Erdenet) and the Shelekhovsky district (mainly the town of Shelekhov).
The conjugate mapping of the production potential and the population makes it possible to display the characteristic features of the spatial organization of the economy and the population of the transport corridor (figure 2).

A simple linear-nodal structure of economic settlement structures is traced. Linear elements are represented by the Trans-Siberian Railway, which only in one place has a branch to the south to Mongolia. The key elements are represented by large cities, firstly, Ulaanbaatar (with the population of one and a half million people), secondly, Irkutsk-Cheremkhovsky urbanized area (one million people), thirdly, by the regional centers of Ulan-Ude and Chita separately, fourthly, Erdenet, Darkhan and a system of two centers of Zima-Sayansk. Other cities cannot claim the role of support centers in the Baikal-Mongolian transport corridor. Thus, the determining factors of the socio-economic development of cities are the effects of the economic-geographical location and the accumulated socio-economic and demographic potential in relation to adjacent spaces.

Fig. 2. Industrial production against the backdrop of population density.


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4 Conclusions

The study made it possible to clarify the existing and obtain new geographical knowledge about the economic and settlement features of the development of the strip adjacent to the Baikal-Mongolian transport corridor. The main results are formulated as follows.

In the field of population-the population of the territory, settlement, population dynamics and the results of demographic and migration processes have been analyzed and evaluated. It has been established that, in contrast to depopulating peripheral territories, the population in the transport corridor zone is growing. The population density here exceeds the average density by several times, the migration redistribution of the population is directed strictly in favor of the Mongolian capital city of Ulaanbaatar and Siberian regional centers-Irkutsk, Ulan-Ude, Chita and their suburban areas. Irkutsk is at the stage of suburbanization: the periphery of the agglomeration is growing faster than the main city. Urbanization over-concentration is expressed in Ulan-Ude and Ulaanbaatar, which account for 45% of the population of Buryatia and Mongolia, respectively. Chita (33% of the population of the Zabaykalsky Krai) does not have such pronounced features of urbanization. The main promising direction in the development of the settlement system will be the continuation of the contraction of the demographic potential to the few centers and zones of their influence in the conditions of depopulation not only of the regional periphery, but also of most of the transport corridor influential zone.

In the field of production, a high level of industrial development of the transport corridor zone was revealed, where more than half (53.3%) of the total volume of shipped products is produced. Such branches of specialization as electric power, oil refining and chemical, mechanical engineering, non-ferrous metallurgy, forestry and woodworking play the leading role in the economy. Industrial centers of various sizes (5 groups) and specializations have been identified, including two largest and five large ones. Recently, the economic specialization of the region has changed significantly. In Irkutsk Oblast and the Zabaykalsky Krai, there is a shift towards resource and raw materials specialization (growth in the mining sector of the economy), which is confirmed by an increase in investments in the extractive industries. As a result, there are territorial shifts in industry to less developed, peripheral areas, and new mining centers are being formed.

In the sphere of interconnection between population and production, the main demographic and production potential of the transport corridor is concentrated in four cities (Ulaanbaatar, Irkutsk, Ulan-Ude and Chita): 62% of the population, 73% of production volumes. The formed human potential of the territory, adapted to life and activity in the Siberian ultra-continental climatic conditions, should be used to change the raw material orientation of the existing regional economy. Using the capabilities of the Trans-Siberian and Trans-Mongolian highways for the functioning of the international transport corridor is a means of solving not only the transport and logistics problems of the Eurasian economic space, but also allows the development of cities (and, more broadly, agglomerations) as the backbone centers of the territory.

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References


5. Transsib Zone as the Eurasian Economic Corridor 2016 Ed L. M. Korytny (Irkutsk, Publishing House V B Sochava Institute of Geography SB RAS)


