The Trans-Siberian transport corridor and development of urban agglomerations

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Abstract. When discussing the geographical features in the formation of the framework of the economy, population distribution and nature management of Russia (Siberia) and Mongolia in conditions of the landlocked location and an enhancement in Eurasian integration processes, it is necessary to capitalize primarily on the national priorities of Russia (and on the interests of its eastern regions), with due regard for the interests of neighboring countries. The territories adjacent to the Trans-Siberian Railway (Transsib) have favorable opportunities for implementation of major transport projects and for general economic growth. The competitive advantages and possibilities of the cities and agglomerations will look different if they are regarded not as separate entities but as forming part of a common Trans-Siberian economic space. An enhancement in the role of the transport hubs, such as Tyumen, Omsk, Novosibirsk, Krasnoyarsk, Irkutsk, Ulan-Ude, objectively leads to the growth of the respective agglomerations and is detrimental to the functioning of the other urban settlements along Transsib which are associated with the railroad. The Trans-Siberian transport corridor should become the belt of economic development of the adjacent landlocked territories and work for integration of the vast Eurasian space thereby unleashing the potential of the urban agglomerations of Siberia.

1. Introduction

The territories adjacent to Transsib line in the main belt of settlement of Russia and have the most favorable opportunities in Siberia for implementation of big transport projects, including for the construction of a fast railroad, as well as for a further general economic growth. Such opportunities include the relatively comfortable natural and climatic conditions and the most planate topography (except for the area adjacent to Lake Baikal); a relatively high degree of development and settlement; a comparatively well-developed agriculture permitting to ensure food security; an advantageous transport-geographical location along the country’s main latitudinal polyroute (the existence of the Moscow motor road, the trunk oil pipeline, the fiber-optic communication line, etc. running parallel to the railroad); large reserves of highly effective natural resources; powerful bases of construction industry with the manufactory of varied building materials; high-voltage power lines with excess electric energy of the Angara-Yenisei hydroelectric power stations; and numerous urban settlements including those which form large agglomerations (Novosibirsk, Krasnoyarsk and Irkutsk), etc. [1-3].
However, while the territories of the Trans-Siberian transport corridor show an increase in population size, the “non-Trans-Siberian) territories show a depopulation. In addition to the attractiveness of the territories along the Trans-Siberian railroad relative to the other Siberian periphery, the cities and their suburban zones have a high attraction. The territories with a significant inflow of population are characterized by a high proportion of able-bodied people, which is illustrated by the example of the suburban districts of the regional centers: Emelyanovskii and Berezovskii (near Krasnoyarsk), Irkutskii (near Irkutsk), Novosibirskii (near Novosibirsk), and Ivolgininskii (near Ulan-Ude). The socio-economic potential of the major cities in southern Siberia is influenced by a powerful transport-geographical development factor. There is taking place an enhanced polarization of the “center-periphery” development in the economic and social contexts. The entire periphery is in fact the migration donor for the Siberian “capital cities”. While in Soviet times the main changes in the urban system were unidirectional in the form of the growth of cities, the changes during the post-Soviet period have become immeasurably complicated. There is an ongoing enhancement in the processes of socio-economic development on highly urbanized territories formed by major cities. Along Transsib (from Ulan-Ude to Novosibirsk) there are seven large (with the population size larger than 100 thousand) cities which include four regional centers and three industrial cities (Angarsk, Achinsk and Berdsk). There occurs a concentration of the population and most of the highly-paid kinds of activity in major cities of Siberia, for the most part in regional centers [4, 5].

2. Objects, data and methods
V.B. Sochava Institute of Geography SB RAS has carried out a geographical investigation into the natural, resource, economic, socio-demographic, population distribution and ecological conditions and characteristics of the territory adjacent to Transsib, in view of the prospects of creating a high-speed railroad and the Eurasian economic corridor in general. The model segment was represented by a section of Transsib 2300 km long between the cities of Ulan-Ude and Novosibirsk where the railroad crosses from east to west five federal subjects of Russia: the Republic of Buryatia, Irkutsk oblast, Krasnoyarsk krai and Kemerovo and Novosibirsk oblasts. The belt adjacent to Transsib (arbitrarily called the zone of Transsib) was considered, which includes the cities and districts of these five regions traversed directly by the railroad, as well as those located at less than 10 km from it (more than 60 districts and cities) [6].

On the whole, the system of urban settlement in the zone of Transsib is well developed when compared with the other Siberian territories; it has a relatively high density of the network of urban settlements, the main Siberian centers concentrating the population, and modern production facilities and innovation sectors; it performs transit transport functions and management of the Siberian regions. The migration pattern is different in different regions. Particularly large migration losses correspond to the eastern regions. Thus, most regions of Western Siberia were characterized by an inflow of population, whereas Eastern Siberia, on the contrary, showed an outflow of population. Novosibirsk oblast is the main region receiving the population. The mobility of the population of Siberia is generally higher than Russia’s average but it is low in the Main Belt of settlement along Transsib; minimal mobility is characteristic for Irkutsk and Kemerovo oblasts. The migration redistribution of the population in the cities of the Transsib zone occurs strictly in favor of the regional centers, with the million-strong cities of Novosibirsk and Krasnoyarsk always standing out among them [3, 6, 7].

3. Results and discussion

3.1. The development of the urban agglomerations
The development of the agglomerations of Siberia as the major transport-logistic hubs is impossible without the development of the infrastructure of railroad transport, both for the purposes of ensuring transportation in zone of active economic development and for the purposes of ensuring passenger traffic.
Among the urban agglomerations of Siberia, the major agglomerations, the list of which is topped by million-strong cities, are all located on the Trans-Siberian Railroad. And the central cities of the “Trans-Siberian” agglomerations are the cities having the functions of regional centers (table 1).

In view of the fact that a unified official technique of determining the composition of urban agglomerations is lacking, we proceeded from the principle that the agglomeration is a cluster of closely interrelated settlements. The composition of agglomerations was defined as a cluster of interrelated settlements including the main city (central city), other cities, suburban areas and district centers from neighboring territories which are closely interrelated with the central city of the agglomeration. The population of each of the major urban agglomerations on Transsib (the Novosibirsk, Omsk, Krasnoyarsk and Irkutsk agglomerations) exceeds one million, the population of the Tyumen agglomeration approaches one million, and the population of the Ulan-Ude agglomeration approaches half a million.

Table 1. Composition and population of major urban agglomerations located on Transsib.

| Urban agglomeration (UA) | Urban districts | Municipal districts; district centers | Population, thou | Growth in 2000–2020, in % |
|--------------------------|----------------|---------------------------------------|-----------------|----------------------------|
| Tyumen UA                | Tyumen\(^b\)  | Tyumenskii district                   | 596.6           | 934.6                      | 156.7                      |
| Omsk UA                  | Omsk\(^b\)    | Omskii district; District centers: Lyubinski, Maryanovka, Kormilovka, Tavrichesko, Azovo | 1299.5          | 1288.3                     | 99.1                       |
| Novosibirsk UA           | Novosibirsk\(^b\), Berdsk, Iskitim, Ob, work settl. Kol’tsovo | Novosibirskii district; district centers: Kolyvan’, Kochenevo, Moshkovo | 1797.5          | 1954.5                     | 108.7                      |
| Krasnoyarsk UA           | Krasnoyarsk\(^b\), Zheleznogorsk, Divnogorsk, Sosnovoborsk | Berezovskii and Emelyanovskii districts | 1113.3          | 1346.3                     | 120.9                      |
| Irkutsk UA               | Irkutsk\(^b\), Angarsk, Usolye-Sibirskoe | Irkutskii and Shelekhovskii districts | 1061.6          | 1141.0                     | 107.5                      |
| Ulan-Ude UA              | Ulan-Ude\(^b\) | Ivolginskii district                  | 395.7           | 498.2                      | 125.9                      |

\(^a\) Authors’ calculations based on data official website of the Federal State Statistics Service (RF) 2020 https://www.gks.ru.
\(^b\) Center cities are marked in bold.

The role of a major city in the Trans-Siberian urban agglomerations is quite unequal; it is very clearly pronounced in Tyumen, Omsk and Ulan-Ude, and in the three cities: Novosibirsk, Krasnoyarsk and Irkutsk, with the central city predominating; the role of the periphery is very important (figure 1). And it is only in the Irkutsk agglomeration that the role of the periphery is quite comparable in the population size with the central city. In the Novosibirsk and Omsk agglomerations, the population size of the periphery is gradually decreasing.
An important characteristic is the significance of the agglomeration in oblast system itself. A city, such as Novosibirsk, is a giant against the background of the agrarian periphery and is quite self-sufficient; the central functions of Novosibirsk are significant, but they extend to Siberia as a whole rather than the oblast. The situation in Irkutsk is different: this city lives as the center of the oblast with a large number of industrial points for which it always performed the organizational functions. Krasnoyarsk occupies an intermediate position: Krasnoyarsk krai also has many industrial centers but Krasnoyarsk itself stands out among them.

The competitive advantages and possibilities of the cities will look different if they are regarded not as separate points but as forming part of agglomerations lying in a common Trans-Siberian economic space. This is particularly relevant for Irkutsk whose agglomeration includes the cities of Angarsk, Usolye-Sibirskoe and Shelekhov, the total population of which is slightly smaller than the population of the central city; here, the cities of the agglomeration and the space between them add the potential of several important railroad stations as well as free territories for the establishment of a large ware storage center [7-9].

Nowadays, the Ulan-Ude agglomeration is a potential agglomeration, because it corresponds to one or to several criteria of identification. In the future, it can form part of the firmly established agglomerations. Ulan-Ude is a major railroad junction (the main route of the Trans-Siberian railroad, and the initial point of the southern line of the East-Siberian Railroad to Naushki and further to Mongolia and China). The suburban zone of Ulan-Ude is formed by the territory of rural areas. There is reason to call it an agglomeration in view of the intense and varied ties between settlements and, primarily, a very high intensity of circular (commuting) migration of the population.

For the Siberian regions of Russia, the development of the transport system is the most important factor of economic development and increase in attractiveness of the territories for investments and the growth of production, for the life and work of people. The level of development of the logistic infrastructure of the western Siberian cities is higher than in the eastern cities. As far as the geographical location is concerned, however, here the situation is more complicated, because it is...
unique for each city. Thus, the Transbaikalian centers are in a more favorable situation due to their proximity to China and Mongolia with the availability of railroad junctions, whereas not only does Novosibirsk have a more important junction with five railroad directions but also it is characterized by its proximity to Kazakhstan and Middle Asia.

### 3.2. Risks and advantages for the agglomerations of Siberia

Transsib can become an ideal international transport corridor, advantageous for many countries. It is therefore an important task to transform Transsib to a high-speed cargo-and-passenger route which can take over long-distance passenger traffic (which is effective with a dramatic increase in speed and, accordingly, a decrease in traffic time) and international cargo (primarily, container) traffic between West Europe and East Asia.

The advantages of Transsib are obvious: as far as the western border of Russia and its Baltic-Black Sea ports it runs on the territory of a single country, i.e. without crossing the State borders, without a corresponding deceleration and rise in the transportation cost, without the emergence of political risks, etc. By creating the Transsib-based transcontinental high-speed corridor through the use of fundamentally novel technological solutions, it will be possible not only to obtain the potential benefits from the transit location of Russia between West Europe and East Asia but also to economically “bring” Siberia closer to the leading centers of the country and the world [10].

On the other hand, particular mention should be made of the inadequate thoroughness in dealing with the problem and certain risks in the creation of the international transport corridor on the basis of Transsib. Some unclear questions are discussed below.

First, there is no proper international harmonization and coordination as regards the projects and routes of the creation of a global infrastructure of Eurasia, which poses an acute question as to the emergence of a serious competitiveness between Transsib and the Northern Route of the Silk Road. In view of its length, however, the Trans-Siberian corridor will be more competitive than the Northern Route of the Silk Road, for transit cargoes leaving not only Korea and Japan but also the northeastern part of China (for instance, along the Tianjin–Beijing–Ulaanbaatar–Ulan-Ude and Dalian–Harbin–Zabaikalsk–Chita direction). It is unnecessary to contrast Transsib and the Silk Road (there will be enough cargoes for each variant) but to develop an optimal scheme of their interaction in order to maximally decrease transportation costs and to render rational services to cargo traffic on the giant Eurasian space. While Russia, in accordance with its geographical location, controls the transport-economic ties of the northern part of Eurasia, China controls its southern part [10, 11].

Second, there remain some outstanding organizational and economic questions, such as the setting of the through tariff rate and development of the ways to overcome the lack of competitiveness of the transit over land when compared with the sea routes. As a consequence of the obvious techno-economic advantage of the sea transport over the more expense land transport, the transportation cost by a long sea way from East Asia to West Europe remains subjectively much lower than the higher-speed variants over land. To achieve a dramatic increase in traffic capacity and economic competitiveness of Transsib as compared to the sea way requires a radical modernization of the railroad. For implementing such a big capital-intensive megaproject of the transport infrastructure, it is necessary to develop the financial scheme at the level of world standards which would imply setting up the consortium of national and foreign banks, insurance companies, funds, etc.

Third, assessments of non-transport effects of the transcontinental corridors are not adequately addressed, which promote the regional socio-economic growth; the same applies to the measures and mechanisms for stimulating economic activity in the zones of influence of these corridors.

Fourth, in the expansion of external trade cooperation with China, there is not yet any clear strategy in Russia, Mongolia, Kazakhstan and countries of Central Asia aimed to ensure parity conditions of interaction. All of them need the entry to the market with the more diversified and competitive end products in order to avoid becoming mere suppliers of raw materials and sales markets of consumer goods for their powerful eastern neighbor.
Fifth, the creation of the Trans-Siberian corridor also poses critical economic-geographical challenges. Thus, an enhancement in the role played by major transport hubs, such as Tyumen, Novosibirsk, Krasnoyarsk, Irkutsk, Ulan-Ude and others, objectively involves a growth of the respective agglomerations. On the other hand, this would inflict damage to the functioning of the other urban settlements along Transsib which are connected with the railroad (in particular, because of liquidation of small maintenance facilities, a decrease of the number of train stopping points, etc.). The services to the adjacent belt would be severely impaired by the priority for the transit functions performed by the railroad instead of the servicing functions, including the general economic and social functions. It is also unclear what income from the growth of transit traffic will be gained by the Siberian regions themselves.

4. Conclusion
Hence it is not to be supposed that the creation of the international transport corridor on the basis of Transsib is a means of dealing only with sector-specific transport-communication problems and, moreover, a means of organizing transit traffic between West Europe and East Asia. In fact, this corridor is to become the belt of closer economic consolidation and economic development of the adjacent landlocked regions of Russia and to work for economic and political integration of the vast Eurasian space. Undeniably the creation of such a corridor would unleash the potential of urban agglomerations of Siberia by enhancing their organizing role as the support centers of the territory.

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