Formation of logistics facilities in transport corridors

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Abstract. Modern processes taking place in the global economy testify to the increasing role and importance of international transport infrastructure. The geo-economics situation of the country, the attraction of transit freight flows, the rational organization of the passage of foreign trade cargo largely depends on the degree of integration of the national transport and logistics market in the international market. Among the priorities of its work until 2030, Russian Railways notes the development of the Trans-Siberian Railway as a transit transport artery. It is assumed that its development is able to transfer the Asia-Europe transit flow and back from sea to rail. Switching transit freight flows from sea to rail is also one of the tasks and the revival of the transport route between East and West, announced by China as a large-scale transformation of the entire trade and economic model of Eurasia. This concept of a new pan-Eurasian (and in the long term intercontinental) transport system is based on a historical example of the ancient Great Silk Road, which has been in operation since the 2nd century. BC and was one of the most important trade routes in antiquity and in the middle Ages.

1. Introduction

The Strategy for the Development of Railway Transport of the Russian Federation until 2030 [1] notes the priority development of the terminal-warehouse infrastructure that corresponds to the realities of the transport and logistics market.

The “New Silk Road”, the idea of which was put forward in China in September 2013, is the generalized name for the complex of strategies of the “Economic Belt of the Silk Road” (SREB) and the “Sea Silk Road of the 21st Century”. The first project is aimed at Eurasia, and Russia is joining it. Its purpose is to connect the Middle Kingdom with Europe through the countries of Central Asia and Russia. The second project is focused on the development of cooperation with countries of Western, South and Southeast Asia, as well as East Africa and Europe [2].

In today’s world, China occupies important, if not leading, positions in its region in various industrial sectors, and therefore the question of the possibilities of delivering a very large amount of Chinese products, including ways and means of delivering goods from China to Europe and back, has now become very serious [3].
The route includes a transcontinental railway - the Trans-Siberian Railway, which passes through Russia and the second Eurasian continental bridge passing through Kazakhstan. At least 1% of $600 billion of goods are deliver from Asia to Europe annually by land transport [4].

China intends to invest in the project more than $40 billion from a special fund. The Asian Bank has already allocated $50 billion. The funds will be direct to the construction of railways, ports and other facilities, to the development of relations between the countries participating in the project. Resource Wantchinatimes estimated the total investment of China at 22 trillion dollars. According to forecasts, within the framework of the Silk Road, $21 trillion is expect in goods turnover per year, which may increase the share of China in world GDP to 50%.

The priority projects for China are infrastructure projects, which allow not only to ensure the unhindered delivery of Chinese export goods to other regions of Eurasia and load the country's production capacities, but to increase the economic interdependence of the countries participating in the project. Today, almost 94% of containerized cargo from China to Europe is deliver by sea, and only about 6% falls on land transportation. Despite this, in order to diversify supplies, China intends to develop land routes, and the Central Asian region has a special role in this process [5].

China first proposed to Russia to use the infrastructure of the economic corridor for trade purposes. Russia, apparently, will gain access to ports on the New Silk Road and take part in the transit of goods. Of course, in this way the PRC solves one of the important tasks - to give impetus to the development and inclusion of the western territories in the international economy.

Shortest transport routes pass through Russian territory, connecting Europe with the states of Central Asia and the Asia-Pacific region - the world's largest economic centers, the exchange of goods between which is steadily expanding.

Today, each of 520–530 million tons of Russian foreign trade cargo can potentially be forward. However, Russia is only in 31st place in the export of transport services (export of transport services in our country is only about $3 billion). Therefore, the advantages for the Russian economy are obvious when “connecting” the domestic transport and logistics infrastructure to the “New Silk Road” project [6].

Thus, participation in the New Silk Road project is certainly beneficial for Russia. She has traditionally been part of it. The New Silk Road project will contribute to an increase in trade and the development of Russia's own land and sea transport network. The prospect of cooperation with China is obvious, but without expanding the associated infrastructure, it is impossible to talk about additional volumes of commodity flows [7].

2. Study methodology
The development of transport and logistics infrastructure is the focus of the work of such authors as Kudlac S., Kurenkov P., Kurbatova A., Majercak J., Mesko P., Panak M., Pokrovskaya O., Safronova A., Sciomachen A.

The formation of logistics facilities in the transport corridors of the Russian Federation is a prerequisite for the implementation of the New Silk Road project.

For this reason, the purpose of the study is to determine the prospects for the implementation of the New Silk Road project in the conditions of the Ural region of the Russian Federation.

In the research process, the following research methods used: synthesis method, document analysis method, calculation and analytical methods, comparison method, statistical and quantitative methods.

The study carried out in the following stages:

1. To identify prospects for the implementation of the project "New Silk Road" in the Urals region.
2. Identify barriers to the development of the "European" Silk Road railway routes from China to Europe.
3. Explore the logistics infrastructure of the Ural region.
4. To propose a decision-making algorithm for the effective formation of the terminal network as a set of the logistics center of the Ural region.

The research hypothesis is that for the effective implementation of the New Silk Road megaproject, it is necessary to create logistics centers in the Ural region of the Russian Federation.

3. Assessment and results

Russia’s connection to the route as a whole depends on the degree of development of the domestic railway infrastructure. It was planned that the New Silk Road through Russia will go through the Middle, Southern Urals and northern regional territories, where the construction of the Northern latitudinal railway is underway. The possibility of extending the highway through the Midnight - Obskaya line to Kazakhstan and China is being considered. It is also possible to integrate the Northern Urals into the “route” by sea or by land, having fulfilled the conditions for the modernization of the railway network [8].

For example, the Chelyabinsk region strives to become one of the largest logistics hubs on the New Silk Road, with such competitive advantages as the intersection of key railways and highways. The starting point of the new Russia-Kazakhstan-China transport corridor is the multimodal transport and logistics complex Yuzhnouralsky TLC. As part of the project, the region’s government is actively working to ensure that TLC “becomes a key entry point into the Russian Federation by rail.” The issue of creating a special economic zone of an industrial-production type around a TLC with an area of 133.4 hectares is being studied. Foreign goods imported into the territory of this zone will be placed and used without payment of import customs duties and taxes, as well as without the application of non-tariff regulation measures. The investment potential of TLC is of great interest to Chinese companies [9].

Sverdlovsk Region also plans to become an active participant in the New Silk Road megaproject. China is showing growing interest in the region’s railway infrastructure. About 80 percent of all goods (for a number of items and up to 100 percent) are imported into Russia through the western regions. Sverdlovsk Region claims to be part of this traffic.

At present, transit transport corridors that are part of the Silk Road economic zone pass through the territory of the Ural region.

There are four options for the railway route to Europe through Kazakhstan:

1. the northern branch of the Trans-Asian Railway;
2. the central path TAHM;
3. Chongqing-Duisburg corridor,
4. The Trans-Caspian International Transport Route, which so far is more a planned project than a real one.

The northern direction of TAZHM runs along the Lianyungang-Dostyk-Astana-Petropavlovsk-Yekaterinburg-Moscow-Brest-Hamburg route, and the central corridor crosses the Kazakh-Russian border in the western regions of the Republic of Kazakhstan, following the Lianyungang-Dostyk-Astana-Ozinki-Moscow-Brest-Hamburg route. On average, a container train travels on the TAJM over a distance of 9.5–11.5 thousand km in 11-14 days.

The Chongqing - Duisburg route goes from the eastern regions of China, through Kazakhstan (partially coincides with the central route TAHM), the southwestern part of Russia and goes to the countries of Western and Central Europe through Belarus and Poland. The first test train on this corridor departed in March 2011, and since June of that year, transportation has been carried out on a regular basis. The train runs from southeast China to Germany in 16-17 days. The average shipping cost of one container is from eight to 9 thousand dollars. According to the logistics companies of Kazakhstan, in 2014, 91 container trains were launched along the Chongqing - Duisburg route.
TMTM passes from China through the territory of Kazakhstan, Azerbaijan and Georgia with the subsequent access to the countries of Europe through Turkey or Ukraine. The route involves transshipment of cargo through the Caspian and Black Seas and crossing the customs borders of five states, which significantly increases the duration and cost of transportation. At least for ferry crossings, including freight of a ship, loading and unloading, rental of warehouses while waiting for the ferry, at least 3-4 thousand dollars will be spend. For one container, and the total train travel time, according to expert estimates, is 14-17 days.

The main obstacle to the development of the "European" railway routes of the Silk Road remains the low demand for corridors from Chinese manufacturers. Most of the cargo from 2 million-rail container transportation in the China-Europe direction is transport via the Russian Trans-Siberian Railway, and the attracted China-Europe flow through Kazakhstan in 2014, according to Kazlogistic, amounted to about 200 thousand tons, that is, only 10% of the total freight traffic given direction [10].

At present, China supplies products from the machine-building enterprises of the region (Uralmashzavod, UVZ, the Ural Electrochemical Plant, Artinsky Plant and others) and the procurement of Chinese components is ongoing.

Regional authorities plan to create a transport and logistics complex with an area of up to 700 thousand square meters and arrange transshipment of goods ordered on Chinese online sites. For this, it is plan to use the existing infrastructure around Koltsovo Airport. As potential investors are, consider TransContainer and the Yekaterinburg terminal Chkalovsky.

In the summer of 2015, the International Union of Commercial Organizations of China signed a document with the Middle Urals Development Corporation providing for the involvement of Chinese companies in the territory of the Russian-Chinese business park in the Sverdlovsk Region, the construction cost of which estimated at 15-22 billion rubles. The construction of an object with an area of up to 700 thousand square meters is plan near the Koltsovo Airport.

The project of a cross-border e-commerce center may involve such basic enterprises as TransContainer and the Chkalovsky logistics terminal. The project will be in demand “only if it leads to the formation of a new cargo base.

The terminal at the Yekaterinburg-Tovarny station is the largest container railway terminal in the city, capable of handling up to 247.1 thousand TEU (equivalent to a standard 20-foot container) per year. TransContainer also plans to continue the development of this unit, increasing the processing capacity to 280 thousand TEU per year.

It is about using the logistics infrastructure adjacent to the Koltsovo airport. Chkalovsky has ready-made warehouse areas, vacant land plots, as well as a nearby existing customs point and railway entrance.

Two routes are currently being consider: the first - through Kazakhstan with access to Orenburg and Chelyabinsk, the second - from Harbin via Zabaikalsk, Irkutsk and further along the Ekaterinburg - Kazan - Moscow line. In the latter case, part of the route will coincide with the proposed Moscow-Beijing high-speed railway (at the intergovernmental level, only the high-speed rail route to Kazan has been agreed so far, investment volume is 1.07 trillion rubles).

With the cooperation of the region with Harbin, the movement of goods can be organize along the Trans-Siberian Railway, and Koltsovo Airport can be used for transshipment of goods. From Yekaterinburg it is possible to organize an efficient distribution of goods to the north by road, since at distances up to 2000 kilometers it is more profitable than the railway. The possibilities of customs processing of goods in Yekaterinburg are being calculate, instead of taking them to Moscow airports Domodedovo and Vnukovo. At the same time, we need quite large temporary storage warehouses, which have just begun to be, create in the Russian-Chinese business park [11].

Thus, the Sverdlovsk region has all the infrastructural conditions for successful integration into the New Silk Road project.

Creating a terminal and logistics infrastructure is a complex methodological task for a project of any scale - both regional (mesological level) and global megaproject for the formation of transport corridors (macro-logical level) [12,13].
The logistics center is a nodal element of the terminal and logistics infrastructure, which is a set of technologically interconnected technical facilities that provide services for the collection of goods, the formation and dissolution of parties, transshipment to other modes of transport, and delivery of goods to end consumers. When designing an efficiently working terminal and logistics infrastructure, it is necessary to take into account the interests of all participants in the transportation process and many aspects of management: the processing capabilities of logistics centers, their territorial and quantitative location, a functional range of logistics services, etc.

The scheme of logistics centers in ensuring the integration of regional infrastructure in the transport regions of the country is present in Fig. 1 [14].

In the regions where incoming and outgoing cargo flows are formed, logistics centers operate. Carriers of modes of transport are an end-to-end level, which passes as a buffer through all levels, linking them. The terminal network, as the infrastructural basis of transport corridors, (2) as part of the region’s freight forwarding space (3), is comprehensive: it operates at all levels, carrying out freight forwarding and logistics organization of the transit traffic process. Each subsequent level contains elements of the previous one.

![Diagram](image)

**Figure 1.** Scheme of the regional logistics centers in integration with transport corridors [9].

In addition, the Platon system operates in Russia, which ensures the collection of fees for heavy vehicles weighing more than 12 tons for traveling along federal highways (in 2017, trucks paid 1.53 rubles per kilometer).

The money goes to the Federal Road Fund and directed to federal and regional road projects. In particular, in support of regional projects: public-private partnership projects, construction of bridge crossings and projects for the development of our transport corridors in the framework of cooperation between the countries of the Eurasian Union and the SREB [15,16].
Figure 4 shows an enlarged decision-making methodology for the effective formation of a terminal network as a set of regional logistics centers when connecting to the system of national transport corridors.

Financing of the project can be undertaken by operators of the transport market, who, under the conditions of the geographical features of the Urals, are forced to carry out complex transportation by various modes of transport and are interested in their coordinated functioning [17-19].

| Step | Description |
|------|-------------|
| 1.1  | Determination of the terminal network parameters: selection of the number and location of its nodes within region 1 and the type of transport for its servicing with the choice of the type of transport for each transport connection |
| 1.2  | Calculation of transportation costs for the collection of cargo from the territory of region 1 and for the distribution of cargo to the border points of exit from region 1, taking into account the directions and volumes of export |
| 2    | Calculation of total costs for direct transportation of goods from producers in region 1 to consumers in region 2 |
| 3.1  | Calculation of total costs for the transportation of goods through the existing terminal network: from producers of region 1 (collection of goods at the logistics center) through the logistics centers (transportation of goods from the logistics center of region 1 to the logistics center of region 2) to consumers of region 2 (distribution of cargo at the logistics center) from the choice of mode of transport for each transport connection |
| 3.2  | Calculation of construction costs, maintenance of a logistics center |
| 3.3  | Calculation of the total cost of terminal transportation of goods |
| 4    | Determining the economic feasibility of forming a terminal network in region 1 |
|      | Calculation of the terminal network parameters within the region - finding the best terminal network options by number, location of logistics centers, type, combination of modes of transport |
|      | Parallel calculation of indicators of direct transportation and transportation through the designed terminal network with the choice of mode of transport |
|      | Comparison of delivery options, calculation of economic effect |

**Figure 2.** Description of the integrated calculation process.

In figure 2 shows the sequence of calculations when designing the terminal infrastructure when "connecting" logistics centers to national transport and logistics systems.

**4. Conclusions**

The implementation of the New Silk Road project as an unprecedented in scale infrastructure concept will allow:

- significantly speed up and, as a result, reduce the cost of delivery of goods from China to Europe;
- expand economic cooperation on the continent through the construction of transport infrastructure;
- increase the efficiency of the national terminal-warehouse infrastructure with the removal of trade barriers, which will lead to an increase in mutual trade in the region,
• provide conditions for the development of lagging national economic regions due to the multiplier effect in the formation of a powerful transport and logistics infrastructure [20,21].

1. According to expert estimates of Russian Railways, now almost all of the “European” Chinese exports are carried out by sea. If the transport component of the Silk Road Economic Belt project is implemented, half of the export will go through the Russian branch of the future transcontinental railway system - the Trans-Siberian Railway, a unique transport corridor. With an average logistics cost of 10-12% of the value of the cargo, this is able to generate revenues of the Russian Federation from the provision of transport services in the amount of approximately 136.2 billion dollars, or 11.2% of the current GDP annually.

2. The Ural region, as a large industrial center where new products could be created, new added value, can receive a powerful impetus to development. Yekaterinburg, in particular, is not just the nominal border of Europe and Asia, but a dynamic trade and economic center, transport hub, cargo hub, which has all the prerequisites for acting as a key transit hub between the West and the East.

The New Silk Road project should not only build the most convenient and fastest transit routes through the center of Eurasia, but also strengthen the economic development of the inner regions of China and neighboring countries, as well as create new markets for Chinese goods.

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