

# Evaluation of the return of investments in transport route development

*Ulyana I. Malakhova*<sup>1,\*</sup>, and *Victoriya A. Vinichenko*<sup>1</sup>

<sup>1</sup> Siberian State University of Water Transport, 33, Shchetinkin Str., Novosibirsk, Russia

**Abstract.** The network of Russian railways provides the movement of goods and passengers both within the country and in the context of international transport, through which goods from different countries go in transit. In Russia the railway lines are double-track and fully electrified on the main directions of the East-West transport corridor. The modernization of the branches from the Trans-Siberian railway to the state border with China and Mongolia continues. The paper describes the business model of the project, the corresponding calculations for managerial decisions on the launch of a direct train route Novosibirsk – Urumqi and return. During the study, the monitoring of existing routes of passenger traffic was carried out: the capacity of railway routes, frequency, duration and capacity of alternative crossings. The result of the study is a developed model for launching a project of a direct connection between Novosibirsk and Urumqi and return. The paper describes the stations that are of particular importance for the route – the place of customs inspection, rearrangement of wheel sets of cars due to the different wheel gauge of neighboring countries. The result of the study is a multifunctional model of a transport route that allows analyzing the economic parameters of any route of a railway communication. According to the model, it is possible to analyze various parameters of the revenue side of the project, calculate the amount of investments and indicators for the assessment of the effectiveness of real investments.

**Keywords:** Transport, logistics, investment efficiency, management solution

## 1 Introduction

Nowadays the promotion of competitiveness of a business is inextricably connected with the maximization of the benefits of its owners, in particular, by the search for ways to expand the business [4]. The development of Russia today makes it necessary to establish and strengthen ties between domestic companies and Asian regions. Today the projects are being implemented in the world that has been united under the general name “One Zone – One Road” (Concept of the pan-Eurasian transport system “New Silk Road”). This determines the spatial structure of economic development – the increase in the turnover of transit cargo and flow of tourists. These indicators determine the relevance of the development of additional direct routes connecting Russia with Asian countries, in particular, with China. Thus, the relevance of the research topic is reasoned by the intensification of the movement of tourists and goods in this direction, reflected by the lack of capacity of railway routes, as well as the presented characteristics of the frequency, duration and capacity of alternative crossings.

In order to establish links in this direction, it is advisable to use railway service: the necessary infrastructure has been created. The network of Russian railways ensures the movement of goods and passengers

both within the country and in the context of international transport, through which goods from different countries go in transit. The paper proposes the launch of a direct train Novosibirsk – Urumqi (and return), its economic justification. It is important to note that Novosibirsk and Urumqi are the largest transit points in their region, which are provided with a developed transport infrastructure.

## 2 Problem Statement

In Russia the railway lines are double-track and fully electrified on the main directions of the East-West transport corridor. The modernization of the branches from the Trans-Siberian railway to the state border with China and Mongolia continues. It becomes difficult to determine an investment-attractive route for the new transport infrastructure for a number of reasons; the key ones are urban sprawl and possible environmental consequences [2].

Since the creation of additional direct routes involves passing through the border territories of Russia and China, the railway network of the Republic of Kazakhstan will be an integral part of the train movement. The current state of the railway infrastructure in the areas of international transit is characterized by the lack of sufficient reserves of crossing capacity. In the

\* Corresponding author: [malakhova997@gmail.com](mailto:malakhova997@gmail.com)

future, the development of directions for unified network normative indicators and systems for automatic control of train traffic is planned [3].

Nowadays the initiative is put forward to create a direct passenger train on the route from Novosibirsk to the north-west of China with the inclusion of postal and baggage cars in the scheme. The city of Urumqi was chosen to launch the project (it is the largest transit point of the Lanxin Railway in PRC). The implementation of the project became possible as a part of the creation of the concept of a new pan-Eurasian transport system "New Silk Road".

### 3 Research Questions

The research subject is determined by the object and subject of the study.

#### 3.1 The object of research in this paper is the route Novosibirsk – Urumqi (and the way back).

Novosibirsk and Urumqi are the largest transit points in their region, which are provided with a developed transport infrastructure. This infrastructure includes the international airports Tolmachevo (Novosibirsk) and Divopu (Urumqi), large railway stations providing passenger and cargo traffic: Trans-Siberian Railway – Novosibirsk-Glavny, Lanxin Railway – Urumqi-Yuzhnaya. Automobile transportation is represented by an extensive network of roads. Novosibirsk has the following highways.

- Federal highways R-254 "Irtysh" (Chelyabinsk – Novosibirsk), R-255 "Siberia" (Novosibirsk – Irkutsk) and R-256 "Chuisky tract" (access to the Central Asian countries, Mongolia, China).

- Regional highways with access to the Northern latitudinal highway (Tomsk), North-East Kazakhstan, South Kuzbass.

In order to determine the key parameters for the organization of the route, it is necessary to monitor all types of alternatives for various types of transport: air travel, rail and bus crossings and mixed (road and rail) crossing [1].

In the market of passenger transportation services, direct flights are offered by one airline – S7 Airlines. The description of the route from Tolmachevo airport to Divopu airport: route number S7 5739, flight frequency is twice a week (every Wednesday and Sunday), flight time is 2 hours 35 minutes, the number of seats for passengers is 78. Including transfer, total travel time on average is 5 hours 15 minutes (to Tolmachevo airport (40 minutes), check-in (1 hour 30 minutes), time for baggage claim (30 minutes). Minimum price as of 12.01.2020 is 8606 rubles.

During the study, the monitoring of existing routes of passenger transportation by railway service was carried out. According to the website of the Russian Railways,

there are six alternatives that are included in the train routes:

- 301N Novosibirsk – Karagandy;
- 054Ts Astana-Nurly Zhol – Urumqi;
- 013H Almaty 2 – Urumqi.

Passengers are transferred along the route at such stations as Akadyr, Sayak, Zharyk, Karagandy Pass., Karagandy Sort., Sary-Ozek. All transfer points are located on the territory of the Republic of Kazakhstan.

#### 3.2 The subject of the research is the logistics and financial characteristics of Novosibirsk – Urumqi route (and the way back)

Mixed travel is determined by rail and road transport. The route starts at Novosibirsk-Glavny. In Almaty at the Sairan railway station, a transfer to a vehicle – a bus is carried out. Transport to Urumqi runs daily from Monday to Saturday. The total travel time is 3 days 1 hour 29 minutes, including the waiting time for a bus in Almaty of 23 hours 19 minutes. The cost of a train ticket varies from 3803 to 5384 rubles (depending on the class of service), transfer by bus in conversion from tenge to rubles at the rate of the Central Bank of the Russian Federation is 2744 rubles. The minimum fare is 6547 rubles. Prices are as of January 12, 2020.

A bus journey with a transfer to railway transport can be considered as an alternative to transfer in mixed traffic from Novosibirsk to Urumqi. The route starts at the Novosibirsk bus station. In Karaganda, there is a transfer to a train to the station Urumqi – Yuzhnaya. The total travel time along this route is 2 days 11 hours 24 minutes, taking into account the transfer time (1 hour 29 minutes). The total cost of transportation is 6190 rubles. Prices are as of January 12, 2020. It is necessary to note that the monitoring of this route revealed that there are no vacant places for sale by railway service for the next three months. This indicates that it is not possible to use the services of the above mentioned carriers.

The bus route from Novosibirsk to Urumqi is presented with transfers in cities such as Nur-Sultan (Saparzhai bus station) and Almaty (Sairan bus station). The total travel time is 2 days 4 hours 20 minutes. The total cost of the fare from Novosibirsk to Urumqi is 6563 rubles. The cost is indicated as of January 12, 2020.

Thus, monitoring of existing routes in the direction of Novosibirsk – Urumqi and the way back identified five possible options for moving passengers from Novosibirsk to Urumqi. They are: air flight (S7 company), six railway routes with transfers, a bus route (including Avtoservice – Novosibirsk bus station and two carriers of the Republic of Kazakhstan), mixed routes: railway and bus passages.

Only air transport has a direct route among the alternatives described above, but it does not provide the possibility of transporting a large amount of cargo. Motor transport does not have a direct non-stop

connection and also does not provide transportation of sufficient cargo by passengers. In the future of the development of the route, only railway communication can provide both direct travel for passengers and transportation of goods in specialized cars.

Thus, the analysis of key parameters, namely the time of transportation, cost, frequency of flights, determined the insufficient capacity of the route on the market. It is advisable to develop an investment project to launch a direct route from Novosibirsk to Urumqi and back with the inclusion of postal and baggage cars.

## 4 Purpose of the Study

The purpose of this research is to substantiate the feasibility of the organization of a transport route in the direction of Novosibirsk – Urumqi (and the way back) by railway service.

## 5 Research Methods

During the course of the research we carried out:

1. The description of the logistics business model of railway transportation;

2. The description of the key parameters of the organization of the Novosibirsk – Urumqi railway transport route (and the way back) – the route, key stations, the composition of the train, especially the passage of border zones;

3. The monitoring of existing alternatives in the described route: the analysis of prices and transportation times, frequency of routes;

4. The evaluation of performance indicators and risk analysis of the transport route between Novosibirsk and Urumqi (and the way back).

The basis of the study was determined by the interpretation of scientific, methodological and educational literature, regulatory documents. In the analytical part of the paper, the results of monitoring alternative routes and those described by the author are substantiated by the prospects for the development of the route, describing problem areas that require analysis. The research result is the definition of the economic feasibility of the logistics project.

## 6 Findings

Railway transportation is a fundamental component of the economic development of both an individual transport company and the country as a whole. Nowadays the management of the transportation process in railway transport determines the factors that affect the composition of costs and they are represented by the volume of traffic, route range, technical equipment of railways, train composition, train load, average daily mileage etc. In the study, the costs are grouped by tariff components: the carriage part, the infrastructure

component (including station one), locomotive part. Thus, the prime cost of railway transportation determines the composition of costs as a separate block in the formation of transport routes. These conclusions were drawn based on the result of a study of aspects of the business model of railway transportation and the composition of costs [5].

**The justification of the design part:** the feasibility of the organization of the Novosibirsk – Urumqi route (and the way back), monitoring of existing alternatives, description of the key parameters of the organization of transport route. According to the research results, the cooperation between Russia and China in transport and logistics sector can be considered mutually beneficial. Novosibirsk is a connecting link between the West and the East: there is an active process of the inclusion of the regions of Western Siberia in global logistics supply chains. Moreover it is one of the largest transport and logistics hubs. Urumqi, in its turn, provides promising volumes of transportation of both cargo and passengers.

The analysis of alternative ways of transportation Novosibirsk – Urumqi determined five possible options for transportation of passengers:

- 1) air travel (company S7);
- 2) six railway routes with transfers (KTZh);
- 3) bus route (including “Autoservice” – Novosibirsk bus station and two carriers of the Republic of
- 4) mixed routes: rail and bus passages.

At the same time, only railway service can provide a direct transfer to passengers and heavy cargo transportation. The analysis of logistics characteristics (transportation time, cost, frequency of flights) confirmed the demand for the Novosibirsk – Urumqi railway route (and the way back).

**Key parameters for the organization of a direct train Novosibirsk – Urumqi (and the way back).** It is planned to lay the route through the already existing infrastructure facilities of the Russian Federation, the Republic of Kazakhstan and the People's Republic of China. There are 38 railway stations along the route of the passenger train. The length is 1930 km. The estimated composition of the train is 14 cars (4 SV, 4 compartments, 5 postal-baggage and a restaurant car). Thus, the total number of seats for passengers will be 216: compartment carriage – 144 seats, SV carriage – 72 seats. The volume of the transported cargo per one postal and baggage car is 100 cubic meters; the weight varies from 20 to 26 tons. It is necessary to note that the described option is basic. In the future, in accordance with the demand, the composition of the train will be regulated and thereby the economic component of the project will change.

**Financial characteristics of the transport route.** The forecast of the revenue of the project determined the prices of passenger transportation services as: compartment car – 7,136 rubles, SV car – 11,390 rubles. Thus, the returns from ticket sales to passengers and returns from a restaurant car will amount to 4,619.03 thousand rubles per one flight. The returns from the

transportation of freight units in postal-baggage will amount to 4,307.28 thousand rubles per one flight. Thus, the total revenues for the provision of services for the transportation of passengers and luggage will amount to 8,926.31 thousand rubles per one flight. Forecasting the annual income, the planned train load (80 %) and its planned frequency (four runs per month) were established in the work. Thus, the income will amount to 342,770.33 thousand rubles in a year.

In order to forecast the expenses of the project, they were grouped by tariff components. The cost of the carriage component will amount to 1,353.78 thousand rubles per one flight. The cost of the infrastructure component will be 2,837.55 thousand rubles per a flight. The cost of the locomotive component will be 1,069.79 thousand rubles per a flight. The extra expenses in the project were set at 3,000 thousand rubles per a month. Thus, the forecast costs for a direct train Novosibirsk – Urumqi (and the way back) will be 288,533.75 thousand rubles in a year.

For the assessment of the efficiency, the project implementation period was set (25 years – the service life of the cars). At the same time, the first target year is represented by nine months and the design load (85 %). Thus, according to these calculations, we found:

- net present value of 153,773 thousand rubles;
- internal rate of return of the project 37 %;
- profitability index of 2.73 rubles/rubles;
- payback period of 37 months;
- discounted payback period of 49 months.

The above mentioned indicators characterize the project for the creation of the Novosibirsk – Urumqi railway route as an attractive one for investment [6]. The present study substantiates its financial success. To get payback, it is necessary to achieve return of at least 222.09 million rubles per year, which in practice is presented by 32 flights.

During the development of the route, both national and supranational risks were determined, since the route is international. Among the most significant are:

- the rise in the cost of the project;
- underfunding;
- currency risk;
- geopolitical risk.

## 7 Conclusion

During the research, a multifunctional model of the transport route was developed, which allowed analyzing the economic parameters of any route of the railway transportation. According to the model, it is possible to analyze various parameters of the return of the project, calculate the amount of investments and indicators for the assessment of the effectiveness of real investments, thereby providing an economic justification for

management decisions when implementing various transport projects. This model was used when performing the financial part of the project.

## Acknowledgments

This research was performed with the support of the Ministry of Education of Novosibirsk Region within the framework of the state program of Novosibirsk Region “Development of Education, Creation of Conditions for the Socialization of Children and Students in the Novosibirsk Region”. <http://docs.cntd.ru/document/5499965>.

## References

1. R. Berežný, V. Konečný. The Impact of the Quality of Transport Services on Passenger Demand in the Suburban Bus Transport. *Proc. Eng.*, **192**, 40–45 (2017). DOI: <https://doi.org/10.1016/j.proeng.2017.06.007>
2. A. Lukin, V. Yakunin. Eurasian integration and the development of Asiatic Russia. *J. of Euras. Stud.*, **9**, 100–113 (2018). Retrieved from: <https://doi.org/10.1016/j.euras.2018.07.003>
3. S. Tischler. Finding the right way – a new approach for route selection procedures? *Transport. Res. Proc.*, **25**, 2809–2823 (2017). Retrieved from: <https://doi.org/10.1016/j.trpro.2017.05.247>
4. I.C. Schutte, A. Brits. Prioritising transport infrastructure projects: towards a multi-criterion analysis. *South. Afric. Busin. Rev.*, **16(3)**, 97–117 (2012)
5. V.A. Vinichenko, V.P. Nekhoroshkov. *Evaluation of the efficiency of transport services: theory and practice*, Monograph (Publ. House Creat. Econ., Moscow, 2019), 244 p. DOI: 10.18334/9785912923029
6. N.A. Ivanova. The choice of methods for assessing the effectiveness of investment projects. *Actual probl. of econ. and manag.*, **1(17)**, 41–44 (2018)