Strategic Support for Modelling Transport Infrastructure Projects

E. V. Bolgova, S. A. Bolgov, and E. V. Lisyukova

Abstract The digital transformation of the economy requires transport to combine the interests of investors, state administrations and sectoral development actors in order to create a reliable transport infrastructure, which can be provided by a strategic support factor. The inclusion of this factor in the model of transport infrastructure projects has enabled to develop a method for harmonizing project objectives with the targets of sectoral, territorial and digital strategies worked out on the basis of the authors' research used the factor analysis and risk analysis of transport infrastructure, the method to coordinate projects and strategies. According to the authors, the proposed method ensures the coordination of projects with related strategies at the macro-, meso- and micro-levels, shapes a shared vision of project results, implementation scenarios and the role of all stakeholders in the project, as well as the economic development of the Russian subject, horizons for achieving a project's goals and performance indicators. The outlook for the proposed harmonization method is linked to improvements in the modelling of energy infrastructure projects, communications infrastructure and digital communications.

Keywords Digital strategy · Infrastructure · Project · Sectoral · Territorial

1 Introduction

Transport infrastructure projects are related to the economic functions of transport in the development of territories in the context of the digital transformation of the economy. The lack of developed transport infrastructure, its low level of digitization creates a limiting effect, hinders the expansion of markets, the profit from trade, technological advances, spatial agglomeration and the commercialization of a new

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knowledge. The density of transport network, the implementation of large-scale projects ensure high rates of economic growth, lower trade costs and economies of scale, the accumulation of intellectual capacity and employment growth, which shall be the centre for transport planning and development [1, 2]. The scale, however, increases the sensitivity of projects to risks, reduces the sustainability of the implementation phase [3]. Project statistics show that about 25% of projects fail; another 20% perform better than expected; the remaining 55% achieve less than expected [4]. In such circumstances, the success of a project is achieved by conditions that, when considered in the feasibility study, prevent inefficiencies and failures. These conditions include the market environment, which includes competition, affordability, user needs, state of the transport network, suppliers' capabilities, cost–benefit ratios; operational characteristics, related to the quality of project management and the digital design of the project, the site, the growth of traffic; and the institutional framework, including strategic project support, a factor which scientists agree includes variables influencing the choice of how the project is to be implemented as a strategic design that brings together the needs of different stakeholders in an effort to develop a sustainable transport infrastructure [5, 6]. Based on the variables in the strategic support factor, operators develop alternatives to involving different levels of management and specialists in the project, and take management decisions based on the interests of all stakeholders [7]. The influence of this factor leads to the creation of a transport infrastructure project model that incorporates competing modes of transport within the locality, harmonizes the interests and needs of all interested and involved parties, forms a project team with experience in conducting feasibility studies, organizing business operations with an acceptable risk level.

2 Methodology

The modelling of transport infrastructure projects, with the inclusion of a strategic support factor in the outline of the model, aims to prevent the failure or poor results of large-scale projects. The risks of unsatisfactory results are caused by contradictions arising from both the differentiated demands of stakeholders (different expectations of costs, benefits, timing, uncertainty, risks) as well as differences in the use of digital technologies in the project feasibility study and implementation phases. To overcome these contradictions, it is possible to use modelling practices that harmonize project objectives with the targets of sectoral, territorial and digital strategies. The use of this method leads to the formation of a common vision of the project results, which eliminates the ripple effect of the shortcomings of the initial design phase on the operational phase, ensures the sustainability of transport projects, and reduces the project sensitivity to risks. The harmonization of project objectives with sectoral, territorial and digital strategies, applied in the modelling of transport infrastructure projects, makes it possible to achieve several levels of project efficiency. The effectiveness of the project for an investor is achieved by the sustainability and achievability of commercial results, the sectoral efficiency—by the coordination of the interests of

Table 1 Strategic planning documents of the Russian Federation used to harmonize transport infrastructure design objectives with the targets of sectoral, territorial and digital strategies

Sectoral strategies	Territorial strategies	Digital strategies
Transport Strategy of the Russian Federation until 2030 [8]	The spatial development strategy of the Russian Federation [9]	The strategy of digital transformation of the economy of the Russian Federation until 2030 [10]
		Digital transformation strategy for Russian railways [3]

Source Authors

competing transport industries and transport and logistics enterprises, the territorial efficiency—by a sustainable balance of the transport network in the region's economy and the processes of its digital transformation. Sectoral, territorial and digital levels of harmonization presuppose the systematization of strategic planning documents and development targets defined in their content. For transport infrastructure projects of the Russian Federation, the package of strategic documents includes current strategies and plans presented in Table 1.

The Transport Strategy of the Russian Federation until 2030 defines the main direction of the development of the transport infrastructure as a factor ensuring the socio-economic development of the country and its regions by means of speeding up trade, while spatial development is a means of creating new agglomerations and developing existing ones [8]. Until 2030, it is planned to increase the competitiveness of the transport complex, to expand the range of competitive transport services with a logistical component and to improve their quality on the basis of advanced transport and logistics technologies. The spatial development strategy for of the Russian Federation points to transport infrastructure as a factor in the development of the economy of the Russian regions and macro regions, the seriousness of which is determined by the prevailing trends and problems of the country's spatial development (concentration of economic growth and increasing population pressure in a limited number of centers, migration mobility, interregional socio-economic and spatial disparities) [9]. The strategies for the digital transformation of the Russian economy, the digitization of the transport industries and the digital development of Russian subjects are aimed at a set of transformations that create conditions for increasing the availability of goods and services, using modern digital technologies [3, 10].

3 Results

3.1 The Harmonization of Project Objectives and Targets of Sectoral, Territorial, Digital Strategies

The content and implementation mechanisms of the harmonization method are explained by the authors of various applied studies. Mazboudi and the co-authors propose mechanisms for harmonizing corporate strategies of different countries in the context of internationalized business [11]. Kutty and the co-authors, researching models of smart cities, have come to the conclusion that the disadvantage of these models is the low harmonization of the goal of territories' sustainable development with the development strategies of smart cities. Based on a systematic approach, a new conceptual model has been established to transform the city into a sustainable smart city [12]. Troisi and the co-authors develop a meta-management mechanism that harmonizes the development of territorial ecosystems and competitive sustainable development of a community [13]. Lisin, Strielkowski, Chernova, Fomina have been exploring the harmonization of energy security (as a goal of public administration) and market economy realities. The solution of balancing the interests of territorial authorities and territorial generating companies in the formation of energy security development strategy was proposed [14]. In the task of harmonizing the project objectives and multi-level targets of the involved strategies, the scientific papers presented form the theoretical basis for identifying three levels of harmonization (Table 2).

The harmonization of the objectives of transport infrastructure projects and sectoral, territorial and digital strategies at the macro, meso and micro levels creates a meaningful balance of project activities in the Russian subjects. Such a balance is achieved by detailing project objectives and matching them to the targets of the involved strategies (Table 3).

It is clear that the objectives of transport infrastructure projects, harmonized with the objectives of the involved strategies, ensure:

- at the macro-level: the factor functions of transport in the spatial and economic development of the Russian subjects and the Russian country as a whole;
- at the meso-level: the competitive development of the transport and logistics complex of the Russian subjects, and the breakthrough (digital transformation) development of the technologies for the provision of services by enterprises in transport industries;
- at the micro-level: commercial efficiency, low risk sensitivity, high sustainability of investment projects, realized to modernize transport network, create transport and logistics centers, develop high-tech transport business, digital platforms and service technologies.

3.2 Developing a Strategic Vision for Project Results

The harmonization of project objectives and targets of the involved strategies results in a shared—strategic—vision of project results among all stakeholders. In essence,

Table 2 Levels of harmonizing the project objectives and targets of the involved strategies

Levels	Strategies			Projects
	Sectoral	Territorial	Digital	
Macro-	Transport infrastructure as a factor of: • the socio-economic development of the country by means of accelerated trade; • the spatial development of the country by means of the formation of new agglomerations and the improvement of existing agglomerations	Transport infrastructure as a factor of: • the social and economic development of the Russian Federation by means of breakthrough technologies; • the development of the economy of the Russian regions and macro-regions by means of spatial development; • the competitiveness of the economies of the Russian Federation; • clustering of the regional economy	Digital transformation as a factor of: • the social and economic development of the country by means of creating an ecosystem of the digital economy of the Russian Federation; -the development of high-tech businesses, overcoming constraints	• Integrated development plans; • National projects (NPs); • Federal Projects (FPs)
Meso-	• the development of transport corridors; • increasing the level of economic connectivity of the territory of the Russian Federation through the expansion and modernization of railway, aviation, road, sea and river infrastructure	• the development of the transport services segment (freight and passenger transport); • the development of logistics services segment (warehousing, complex cargo service)	• improving competitiveness in the global transport market	• a regional component of federal projects; • public–private partnership projects; • investment (infrastructure) projects of the Russian Federation

(continued)

Table 2 (continued)

Levels	Strategies			Projects
	Sectoral	Territorial	Digital	
Micro-	• integration of Russian railways into the global market; • advanced organization of road transport; • integration of road infrastructure (roads, feeder roads, road «interchanges») into logistics chains of goods and passenger transport	• at least 85% of the network in the largest urban agglomerations meets regulatory requirements	• digital platforms and technologies; • innovation, breakthrough technologies, changing the corporate culture of transport companies, increasing efficiency and creating new business processes, developing the spectrum of transport and logistics services	• investment projects

Source Authors

the Strategic Results Framework for a Transport Infrastructure Project is a strategic design aligned to the needs of all stakeholders, with a set of variables comprising: (a) project scenarios; (b) ehe role of the project in the social and economic development of the Russian region (the country as a whole); (b) the horizons for achieving project objectives and indicators of project effectiveness. The project scenarios are based on the socio-economic, institutional and digital context within which the stages of implementation of the technical solutions of the project are to be implemented. Key factors (such as the global market for basic resources, the quality of the institutional environment and the digital ecosystem) combine multiple development conditions, with different combinations creating a range of scenarios within the boundaries of the «optimistic-pessimistic». Starting with the optimistic scenario—«Leadership in the development of transport infrastructure» and ending with the pessimistic one («Struggle for survival»), the specified range can include the scenarios «Scale modernization and expansion of transport infrastructure», «Target scenario (reconstruction, technical re-equipment, digital transformation of transport infrastructure)», «Base scenario (supporting transport infrastructure development)».

The role of the project in the social and economic development of the territories in different scenario conditions will vary within the boundaries of the «Project of Breakthrough Development / Mega Project»—«Project of Integrated Transport Infrastructure Development / Multiproject»—«Local Investment Project / Monoproject». In accordance with the scenario conditions and its role, horizons may be established for achieving the objectives of the transport infrastructure project: (a) identification and creation of conditions for the implementation of the project (pre-investment phase);

Table 3 The specification of project objectives for the transport infrastructure development of the Samara region with the involved strategies on harmonization levels

Harmonization levels		
Macro-	Meso-	Micro-
NP "The Integrated Highway Infrastructure Upgrading and Expansion Plan until 2024"	FP "Europe—Western China"	Bypass construction of the Tolyatti city with a bridge crossing over the Volga River as part of the international transport route "Europe—Western China»
NP "Safe and quality roads"	FP "Road Safety"	Improving the safety of road users (reducing the number of fatalities)
	FP "System-wide Road Development Measures"	Improvement of regulatory policy and application of new technologies in the road sector (construction, renovation, major repairs of regional (inter-municipal) roads); use of new technologies)
	FP "Road Network"	• the improvement of the quality of the road network, including the street network, of urban agglomerations (road network of urban agglomerations, regional and inter-municipal roads in a standard state); • increased share of domestic equipment in total procurement
NP "Digital economy"	FP "Human Resources for the Digital Economy"	• mass training of executive officials in digital competencies and technologies; • training and retraining programmers for civil servants in the areas of digital competence and technology

Source Authors

(b) formation of the project's productive assets (investment phase); (c) provision of transport services (operation phase). The characteristics of each phase are related to differences in project effectiveness indicators and problems in achieving their estimated values. The planned values of Fiscal Efficiency Indicators (NPV of the federal and territorial budget), total investment cost efficiency, equity efficiency, creditor efficiency can be achieved if the project is sustainable, provided by the strategic support factor [15].

4 Discussion

The high sensitivity of large-scale transport infrastructure projects to the risks of failure and inefficiency that arise during the implementation phase of technical solutions implies a new approach to project modelling. In the modelling of transport infrastructure projects, strategic support needs being taken into account alongside the market and operational conditions. In the context of the content and mode of implementation variables, the strategic vision that brings together the needs of all stakeholders aiming to create a fail-safe transport infrastructure, this factor aligns project objectives with the targets of sectoral and territorial strategies. The model of the transport infrastructure project taking into account the strategic support factor can be implemented in the feasibility study of the project, which main directions are presented in Table 4.

As a result of the model, the common vision of the transport infrastructure project will combine strategic, commercial and engineering design. The sustainability and low sensitivity of the project to the risks of failure or inefficiency during the implementation phase will be achieved by balancing the interests, needs of investors, government and stakeholders involved in the sector development strategy.

Table 4 Directions for the development of a transport infrastructure project feasibility study in a strategic support model

Project feasibility study/design (project vision)	Factors	Variables
Institutional/strategic vision	Strategic support of a project	Project implementation scenarios; the role of the project in the social and economic development of the Russian subject (the country as a whole); horizon of project objectives; budgetary efficiency
Market/commercial vision	State of the transport network, market competition, user needs, financial accessibility, supply capacity; cost–benefit ratio	Analysis of the transport market; marketing concept and pricing policy; accommodation (localization); material, labour, financial resources
Operational/engineering vision	Quality of project management and information support, site, project design, traffic growth	Design part project schedule

Source Authors

5 Conclusion

Transport infrastructure projects being large-scale and, therefore, risk-sensitive are fragile at the stage of the implementation of technical solutions, and should be developed taking into account the economic functions of transport in territorial development, what is achieved by including strategic support in the project model. The strategic support factor is defined in the paper on the basis of a shared position of researchers as a set of variables defining a strategic design that brings together the needs of investors, governments and actors, involved in shaping sectoral development strategies in an effort to create a sustainable transport infrastructure. The method of harmonization proposed by the authors for the inclusion of the strategic support factor in the project model is necessary to harmonize the project objectives of infrastructure projects and the targets of sectoral, territorial, digital strategies. It is justified in the paper by the success in harmonizing the corporate strategies of different countries, smart cities and sustainable regional development strategies, energy security strategies and market economy realities. Within the framework of the harmonization method: (1) macro-, meso-, micro-levels of harmonization are identified, (2) project objectives of transport infrastructure development are detailed in terms of levels of harmonization with sectoral, territorial, numerical strategies, (3) a set of variables is formed, forming the strategic vision of the project results in the project scenarios, the role of the project in the social and economic development of a Russian entity (the country as a whole), the horizons for achieving the project objectives and indicators of project effectiveness, (4) the practical significance of the use of the harmonization method in the development of the feasibility study for transport infrastructure projects has been determined. The study did not present the potential of a strategic support factor in modelling transport-related infrastructure projects due to scale constraints. The data obtained, however, are sufficient to assess positively the impact of this factor on energy infrastructure project models, communications infrastructure and digital communications. Future research could be applied to energy, communications and digital communications projects, and could be carried out in a manner that harmonizes the development strategies of these types of infrastructure with territorial strategies, with the objectives of investment projects and with the development of their feasibility study.

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