

Triads of strategic development of the Russian road transport system

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Abstract. Road freight transport has a significant impact on the Russian economy, which determines the relevance of studying the possibilities of its development. The development of road transport in Russia is determined by the Transport strategy, the implementation of which is difficult to predict in the future. In this regard, the task of increasing the effectiveness of the strategic planning system in the field of road freight transport is urgent. The research was based on a review of scientific literature, the use of methods of system analysis and synthesis, correlation analysis, expert survey, as well as the study of data from the Federal State Statistics Service, information from official websites of government bodies. As a result of our research, we have obtained triads for the development of road freight transport and formed a model for achieving the target indicators set by the Transport strategy of the Russian Federation. The implementation of each indicator depends on the indicators of key external factors, as well as on the traffic functions performed by the human resource at the three levels of management of road transport in the Russian Federation, thus forming the triads “indicator – set of external factors – set of traffic functions”. A set of external factors determines the range of possible values of the indicator, while a set of traffic functions carries out the movement of road freight transport to the set indicators. Presenting each indicator as a triad allows improving the effectiveness of strategic planning in the field of road transport in Russia.

1. Introduction

The strategic development of the economy involves the corresponding development of both basic industries, such as industry, construction, trade and agriculture, and infrastructure, among which a special role belongs to the road transport industry, which ensures the movement of goods in space. The activity of road freight transport is the process of production and is a condition that determines the possibility of its consumption. The advantages of road transport are high maneuverability, large carrying capacity and fast delivery of goods. Due to its high maneuverability, road transport is able to transport cargo directly from the sender’s warehouse to the recipient’s warehouse.

The directions of development of the road transport industry at the macro level are described in the Transport strategy of the Russian Federation. Target indicators of the strategy reflect indicators that include commercial, intra-industrial and personal activities. Within the framework of this strategy, two development options are presented: basic and innovative. The innovative option, considered as a target, sets eighteen indicators that reflect the need to improve indicators in the following areas: increasing the volume of services (transport work); improving the safety of the road transport system; ensuring the availability and quality of road transport services in the field of freight transport; reducing the negative impact of the system on the environment; integration into the world transport space, the



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implementation of transit potential. The complexity of implementing the Transport strategy is confirmed by the results of forecasting indicators up to 2030. The prediction results are based on the use of cubic interpolation splines and a weighted moving average method. They allowed getting the probability curves for achieving the vehicle indicators, their main characteristics are shown in figure 1. The obtained dependencies indicate that it is impossible to achieve most of the targets in 2030 within the current state and development of the road transport system (RTS) [1].

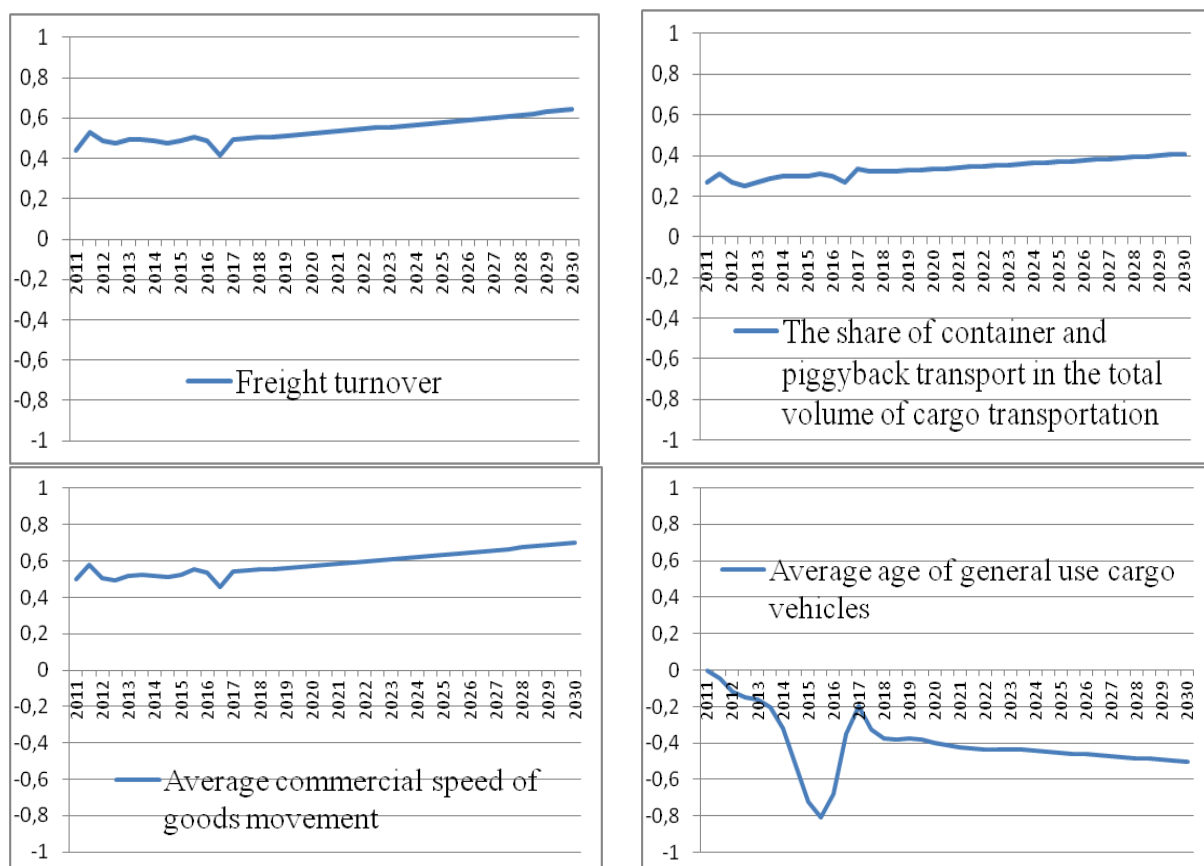


Figure 1. Probability curves for achieving vehicle indicators by 2030 (the 2030 target is shown as 1).

The authors' analysis of the current situation revealed two key reasons: there is no binding of external factors to indicators during planning, and there are no established relationships between internal management processes and indicators. Therefore, there is an obvious need to adjust the system of strategic planning for the development of road freight transport in terms of taking into account the impact of key external factors and analyzing internal management processes that affect their achievement. The task of developing tools to increase the effectiveness of strategic planning at different levels of management is indicated not only by Russian, but also by foreign economists of the Russian Federation [2-12], which confirms the relevance of this study.

2. Methodology

Based on the above, we see the need for the formation of the following triad-unity formed by three separate parts in the process of strategic planning of road freight transport:

1. Indicator-a target indicator set for road freight transport in the Russian Federation.
2. External factors that have a significant impact on the indicator.
3. Traffic functions – internal management processes influencing the formation of the indicator.

The nomenclature of indicators of the Transport strategy of the Russian Federation, in our opinion, is complete and sufficient for the development of the State's economy, while the established indicators

themselves require consideration of the relationship with external factors. The selection of key external factors involves the following stages of work: the first stage – *analytical*, the second – *calculation*. The first phase involves the analysis of key limiting external factor, their deterrent effect is considered, and analyzes the state change of the road freight transport in the conditions when the indicators of external factors were higher or lower than the real one, examines the possible actions of the road transport system to neutralize the deterrent effect. At the second stage, a correlation analysis or expert evaluation is performed, proving the existence of a relationship between the indicator and an external factor.

Considering road freight transport as a management system, the main driving force, directing road freight transport to achieve targets is the actions of the management system, where special importance is the level of quality and nomenclature completeness carried out by the management system of function. Initially, it is needed to specify the levels of the management hierarchy. The road transport system is a multi-level economic system, and the authors of studies [13,14,15] and a number of others recommend that the following levels should be distinguished when evaluating economic systems: macro-level, meso-level, and micro-level.

Each level of the management system includes a management subject (management system) and a management object (managed system). The subject of management of road freight transport at the macro level is represented by the system of Executive power of the Russian Federation related to road transport, the object of management - is the regional road transport system. The subject of management at the meso-level is represented by the system of Executive power of the region, the object of management - is represented by micro-level objects: an enterprise, an individual or (auto) transport division, which in turn include management and managed systems. The functional powers of the management subjects are defined by the relevant provisions.

Modeling the processes of achieving indicators within the road transport system can be most clearly represented in the form of an oriented graph, setting the indicator as the final vertex, and traffic function as actualizing vertices. Such a simulation model will allow predicting the possibility of reaching the indicator. When updating a particular vertex, we update the entire system of indicators, it is also needed to specify the step (size) of changes in them, as well as the initial values of indicators in all vertexes. The values at the vertices will change with each step of the simulation, the result of this change is determined by the expression

$$(P_j)_t = (P_j)_{t-1} + \sum_{ij} e_{ij} \times l_{ij} \times \{(p_i)_t - (p_i)_{t-1}\} \quad (1)$$

where $(p_j)_t$ and $(p_j)_{t-1}$ - are the values of the indicators at vertex i in the simulation steps, respectively, t and $(t - 1)$; e_{ij} and l_{ij} - are the coefficients that characterize the sign and degree of influence of the indicator of vertex i on the indicator of vertex j .

3. Results

The first stage of the study allowed obtaining the following nomenclature of key external factors: the level of economic development (GDP indicator) - GP, changes in the state of road infrastructure: the length of public roads of the first category - (R), infrastructure elements that ensure safety - (R1), the emergence and mass spread of innovations in the structure of the car (A), the predicted significant changes in the work of foreign competitors (FC).

For example, one of the most significant external factors for Russian road freight transport is the level of economic development expressed by the GDP indicator. To select this factor, we reasoned as follows: the main external reason for failure to fulfill the plan for the indicator “cargo turnover” - is the insufficient level of economic development, and therefore, the main deterrent effect - is the lack of cargo necessary for transportation. The only possible growth of this indicator in terms of GDP decline – shipping instead of competitors: rail transport and international road transport, which requires substantial changes to the prices and quality of transport service relative to its competitors that it is

difficult to implement now, hence, the planned indicator that reflects the volume of transport work must take into account the predictable GDP indicator.

The volume of transport work performed by road freight transport, expressed by cargo turnover indicators for 28 years, looks like a wave-like curve of cyclical fluctuations, reflecting the same trends as the GDP indicator of the Russian Federation. This fact is also confirmed by the result of correlation analysis ($R=0.8$). We observe the same trends in changes in the cargo turnover indicator as in the GDP indicator, that is, in dynamics, these indicators look like wave-like curves of cyclical fluctuations (figure 2). The inflection points on the graph are the indicators of 1998, 2009, and 2014 years. These events are related to the general state of the economy caused by the crises of 1998, 2008, and 2014 years.

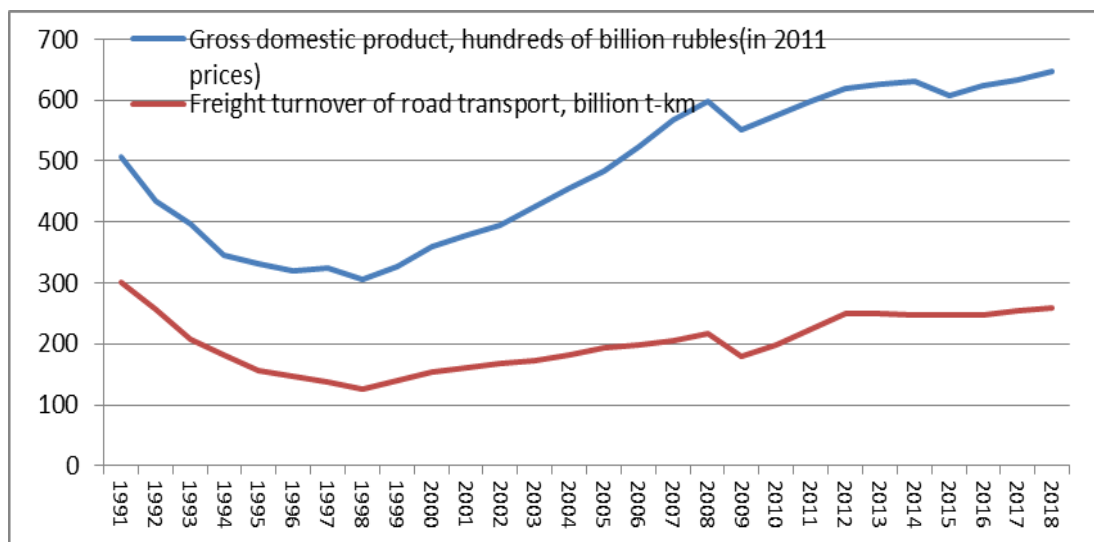


Figure 2. Indicators of GDP of the Russian Federation and cargo turnover RT for 1991-2018.

At the next stage of the study, the task was to select the key traffic functions of various levels. The study of documents that reflect the authority of management subjects allowed obtaining the following groups of functions:

Functions of a human resource at the macro-level:

1. Development and approval of restrictive measures: laws and regulations-restrictive functions (RF).
2. Development and approval of mandatory payments: taxes, fees, etc., as well as development and approval of supporting measures: including subsidies, grants, etc. - financial functions (FF).
3. Functions of collecting and processing information, making forecasts and plans based on it – information and analytical functions (IAF).
4. Personnel policy in the regions-the function of selecting personnel in the Executive power structures of the regions (PP).

Functions of a human resource at the meso-level:

1. Organization of interaction of Executive authorities with Federal Executive authorities in terms of conducting Federal policy on the places and communicating information about the state of the region and its needs – the function of coordination and interaction “CIF”.
2. Formation of tax and budget policy, analysis and development of measures to support small and medium-sized businesses, planning and spending of the regional budget – regional financial functions (RFF).
3. Development of the normative legal acts and legislative activities at the regional level – “regional restrictive functions” - restrictive functions (RRF).
4. Organization of timely and complete information about the region, forecasting and planning of the region’s activities (RIAF).

Functions of a human resource at the micro-level:

1. Commercial activity (CA).
2. Financial activity (FA).
3. Production activity (PA).
4. Functions of interaction with the bodies of higher-level management subjects (IF).

In the process of strategic planning, it will be needed to specify the function from the presented groups.

The road transport system is one of the social and economic systems, therefore, its central element is a human resource that has a certain qualification and is motivated to perform certain actions (the functions presented above), as a result of which the system moves towards the established target indicators. Using the oriented graph allowed obtaining a simulation model, an example of which for the macro-level is shown in figure 3.

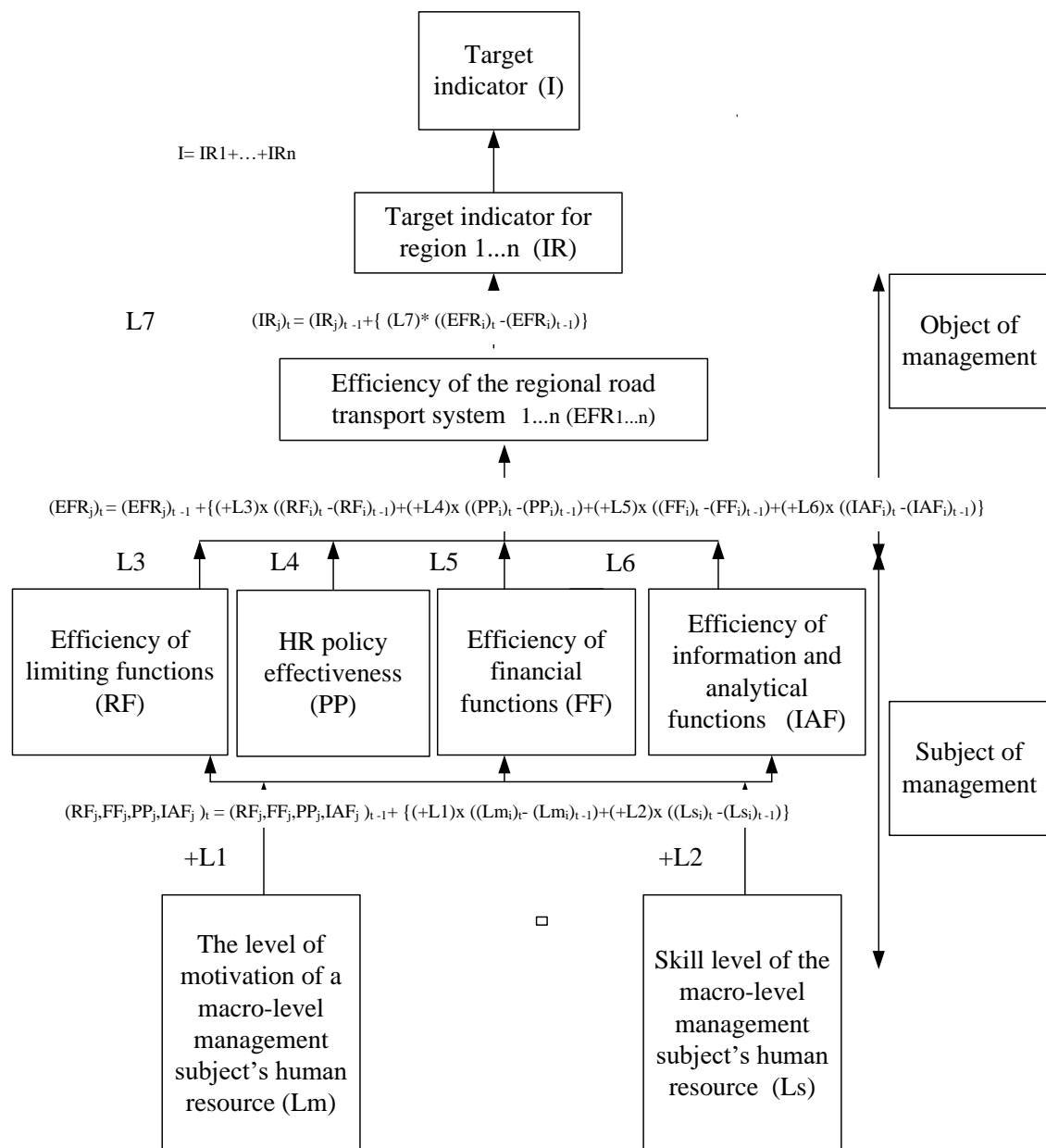


Figure 3. Simulation model for managing a road freight transport system to achieve indicators at the macro-level.

The research carried out by the authors allowed obtaining the following triads of strategic planning of road freight transport in the Russian Federation (table 1)

Table 1. Triads of strategic development.

Indicators	Key external factors	Traffic functions		
		Macro-level	Meso-level	Micro-level
Increase in the volume of services (transport work):				
cargo transportation volume, mln t,	VP	FF, IAF	CIF, RFF, RRF, RIAF,	CA, PA, FA, IF
cargo turnover, billion t-km	VP	FF, IAF	CIF, RFF, RRF, RIAF,	CA, FA, PA, IF
Ensuring the availability and quality of road transport services in the field of freight transport:				
Average commercial speed of goods traffic on road transport (on highways), km / day	R,A	RF, IAF	RIAF	PA
Percentage of shipments delivered within the standard (contractual) time by road transport, %	R	RF, IAF	RIAF	PA
The share of container and piggyback transport in the total volume of cargo transportation, %	A	RF, FF, IAF	CIF, RFF, RRF, RIAF,	CA, FA, PA, IF
Average age of cargo vehicles (general use), years	VP	RF, FF, IAF	CIF, RFF, RIAF	CA, FA, PA
Share of the fleet of trucks equipped with GLONASS navigation systems, % of total	-	RF, IAF	RRF, RIAF	PA, IF
Integration into the Global transport space, implementation of transit potential				
Transit cargo transportation through the territory of Russia: million tons	D	RF, IAF	-	-
The share of Russian carriers in the volume of international road transport of goods, %	FC	RF, FF, IAF	CIF, RFF, RIAF	CA, FA, PA, IF
Improving the safety of the road transport system				
Social risk of death in road accidents, the number of deaths in road accidents per 100000 population	R1,A	RF, IAF	RFF, RIAF	PA, IF
Reduction of transport risks on roads (reduction of the number of people died in road accidents by 10 thousand vehicles owned by legal entities and individual entrepreneurs) (compared to the level of 2011), %	R1,A	RF, IAF	RFF, RIAF	PA, IF
The share of motor vehicles of legal entities and individual entrepreneurs that have permits for transportation activities (licenses, permits, special permits for the transportation of dangerous goods, notifications of the beginning of business activity), %	-	RF, IAF	RFF, RIAF	PA, IF
Reducing the negative impact of the system on the environment				
CO ₂ emissions per 1 t-km (compared to 2011 level), %	A	RF, FF, IAF	RFF, RIAF	FA, PA, IF
Share of alternative fuels in the total fuel consumption of motor vehicles, %	A	RF, FF, IAF	RFF, RIAF	FA, PA, IF
including the share of gas engine fuel	A	RF, FF, IAF	RFF, RIAF	FA, PA, IF
Share of the fleet of vehicles with hybrid, electric and alternative fuel engines, %	A	RF, FF, IAF	RFF, RIAF	FA, PA, IF
Average specific fuel/electricity consumption per unit of transport work performed by vehicles (compared to 2011 level), %	A	RF, FF, IAF	RFF, RIAF	FA, PA, IF
Share of organizations that have implemented environmental management systems for environmental quality management and environmental safety in transport, %	-	RF, IAF	RFF, RIAF	IF

4. Conclusions

In this study, we obtained a list of key external factors that affect the size of indicators that determine the development of road freight transport in the Russian Federation, for which we used an approach that includes analytical and calculation stages. For each indicator the defining the traffic functions of control systems (subject of management) at the macro-level, meso-level and micro-level were selected that allows working on the appointment of responsible persons, primarily, at meso and macro-level, clarifying their functional competences and analyzing the possible impact on the processes aimed at the achievement of the indicator. To analyze the impact of traffic functions on the indicator, a visual simulation model in the form of oriented graph was proposed.

The presentation of each target indicator as a triad “indicator-set of external factors – set of traffic functions” in the process of developing a strategy for the development of road transport in the Russian Federation allows justifying the possibility and indicating the direction of its achievement, which will increase the effectiveness of the strategic planning system, as well as solve the problem of modeling the relationship of macro -, meso - and micro-level, designated by well-known Russian scientists [16,17].

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