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Modern Supply Chain Development Directions

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Annotation: This article offers suggestions on modern methods of supply chain development, organization of complex organizational and technical facilities, application of logistics engineering principles for efficient infrastructure development, and use of a proactive (warning) method in supply chain development, describes the main directions that determine the efficiency of the railway transport services, the relationship between the concepts of railway transport services, transport system and transport infrastructure and the main factors influencing the choice of mode of transport, suggestions for improvement are given and the volume of transportation of certain types of cargo in railway transport and the volume of investments involved in the activities of JSC "Uzbekistan Railways" were analyzed, the most important conditions for the structural reform of railway transport were indicated , based on the results of the analysis, the studied problems were systematized, and at the same time, the principles of strategic integration of railway transport and the development model of the railway transport system, as well as directions of economic development, which included six stages, were proposed.

Keywords: supply chain development, logistics engineering, complex organizational and technical facility, digital logistics, proactive (warning) method.

Introduction

The importance of transport infrastructure is increasing in the processes of globalization taking place in the world. The task of improving the activities of this sector is carried out by the global transport and logistic system. According to the data of the World Bank Group, the amount of world transport services in GDP is 4.2 trillion. It is valued at 110 billion US dollars per year (6.8%). tons of cargo and 1 trillion. more than 100 million passengers are transported, the number of employees employed in the transport infrastructure is 100 million. constitutes a person[1].

Issues of development and implementation of the supply chain consisting of transport-logistics centers (TLM) and complexes that ensure free access of products to Uzbekistan and foreign markets are becoming important issues for the modern stage of development of the logistics complex of Uzbekistan, first of all, of the supply chain.

In the 21st century, the formation of the state innovation system and the models of their use are developing as complex organizational and technical objects designed to unite enterprises on the basis of flexible information technologies and highly efficient supply chains. From this point of view, the issue of interaction with various sectors of the economy is urgent in the field of improving management efficiency and ensuring its stable operation in front of the transport system of Uzbekistan, its infrastructure, multimodal transportation system.

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Analysis of literature on the topic

Supply chain development, a number of scientists who studied its content and impact on other areas of the economy expressed different opinions on the formation of transport-logistics infrastructure.

D. According to Bauersox, he paid special attention to the problems of multimodal and intermodal transportation, including the advantages and economic efficiency of transportation organization compared to traditional methods. At the same time, the author specifically notes the transport-logistics infrastructure, which includes transport networks, vehicles and transport companies [2].

A.L. Nosov, in current conditionssupply chainproblems of organization and optimal functioning are studied. The prospects for the development of mixed cargo transportation, showing directions for improving the organization of mixed foreign trade transportation in international traffic, are emphasized[3].

S. M. Reser, in his workmanagement models and problems of regional transport systems in the context of changes are considered. In the country's production-transport system, he has fully analyzed the methods of interaction of transport types, the methodology of forecasting the market of transport works and the principles of planning of loading works in highway transport [4].

Considering the above considerations,supply chain developmentconsideration of the problems of economic-technological feasibility assessment, including the identification of needs,supply chain developmentIt is possible to develop the infrastructure by using the theoretical aspects and modern management methods to improve management efficiency.

Research methodology

The results of the scientific research of national and foreign scientists, who were engaged in the analysis of the problems of the effective development of the railway transport system, served as the theoretical and methodological basis of this study and the quantitative and qualitative assessment of the system. In the preparation of the article, abstract and analytical observation, comparative and factor analysis, indicative, selective observation, comparison, economic-statistical, induction and deduction, indicative, selective observation, comparison, correlation and regression analysis, economic-mathematical modeling, isikawa diagram, etc. methods used.

Analysis and results

Multimodal and intermodal cargo delivery systems create new opportunities for the development of logistics services and the integration of various participants in the transportation of cargo. The need for logistics technologies and high-speed transportation systems to serve shippers and consignees is becoming a major driving force in global transportation systems. This, of course, increases the level of complexity of organizational and technical objects. Also, integration processes are aimed at increasing the level of implementation of logistics processes, which is reflected in improving the level of customer service, reducing overall costs and systemic risks.

The formation of a multimodal TLM network at the entrance to large transport links and large industrial clusters allows to attract additional cargo flows, increase the competitiveness of cargo transportation by rail and other types of transport, and develop high-income services in the field of complex logistics. These routes will help Uzbekistan join the world transport system in ensuring

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national security and sustainable development.

Delivery of cargo and passengers to the destination in transportation is characterized by the uniqueness of life cycle processes. Disparate transportation, production and distribution systems are not sufficiently interconnected, which causes a decrease in the efficiency, quality and reliability of transport services, which is especially reflected in the operation of supply chains, including their infrastructure. For example, in recent years, there has been an increase in the volume of transportation in rail transport, while there is also a risk of losses from the use of production assets (rolling stock, containers).

Table 1
Freight turnover by types of transport in 2017-2021 and shipping

Name	2017		2018		2019		2020		2021	
	million t.	billion t-km	million t.	billion t-km	million t.	billion t-km	million t.	billion t-km	million t.	billion t-km
Including by transport										
Railway tr.	61.5	22.7	63.7	22.8	65.7	22.9	67.2	22.9	67.6	23
Car transport	1203.2	27.5	1258.3	29.2	1327.4	31.5	1399.8	33.9	1473.7	36.0
Pipelines	64.5	33.0	65.0	31.5	65.8	31.2	60.0	30.0	62.2	28.9
Air transport	24.0	121.9	22.2	116.3	23.0	125.1	24.6	131.1	26.5	132.2
Total	**1329.3**	**83.4**	**1387.1**	**83.7**	**1458.9**	**85.7**	**1527.0**	**86.9**	**1603**	**88.0**

***Source:*Information from the Statistics of the Republic of Uzbekistan**

According to the dynamics of cargo transportation volume described in Table 1, in 2017-2021, the share of railway transport in the total cargo turnover of the country's transport system was kept stable at the level of 25-26%. As a result of the measures taken, the volume of cargo transportation in 2021 increased by 5.0% compared to the previous year, including 5.3% by road transport and 8.8% by air transport. The volume of cargo transportation is 91172.6 million ton-km, the highest share in the total volume of cargo transportation is road transport (39.4%), pipeline transport (35.0%) and railway transport (25.4 corresponds to %).

Taking into account the prospects for the development of the economy of Uzbekistan and the development of other types of transport, it is expected that the growth of railway transport will be an average of 5 or 2.3 percent annually, 83.7 million in 2021. 146 million per ton in 2030. grows up to tons[5]. According to estimates, a 1% increase in investments in the transport sector will provide a 0.94% increase in freight volume. Along with improving the quality of services and ensuring further diversification of transport routes for transportation, it should be aimed at optimizing the

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management of the transport logistics system aimed at the consumer.

Reducing the share of transport costs in the cost of products is one of the most important tasks, because the increase in transport costs in the cost of industrial products has a direct impact on the competitiveness of our country's goods. The cost of domestic cargo transportation services, as well as the cost of international transportation services (including transit services), remains relatively high and has been increasing rapidly in recent years.

High freight rates are also typical of the railway sector. In particular, a comparative analysis of prices shows that producers in Uzbekistan pay 5.15 dollars to railway workers for transportation of cargo (60 tons of textile products) in 1 standard car over a distance of 500 kilometers. In Kazakhstan, this figure is 0.93 dollars, in Kyrgyzstan it is 2.65 dollars, in Tajikistan it is 6.83 dollars, in Turkmenistan it is 2.65 dollars. For transportation from 500 to 1000 kilometers in Uzbekistan, shippers pay $2.51, in Kazakhstan $0.68, and in Turkmenistan $2.60[5].

The logistics system is characterized by the fragmentation of the supply chain, the excess of loading and unloading links from the supplier to the receiver, which leads to an increase in the costs of transport and logistics services of manufacturers. This is due to the slow development of transport and logistics companies and related infrastructure. The main part of transport-logistics operations in the country takes place in the 1PL and 2PL format, only some companies provide limited services in the 3PL format. There is a lack of large operators capable of establishing effective cooperation between road, rail and air transport.

The main restrictions on increasing the volume of cargo transportation are:

- insufficient development of the transport-logistics system;
- the rate of development of the road network significantly lags behind the rate of automobileization of the society;
- insufficient development of export transport infrastructure (border checkpoints);
- the presence of limited throughput and transportation capacity of railway companies;
- unjustifiably high cost of aviation fuel.

In large transport links, the network of multimodal terminal logistics centers (TLM) on the railway network of Uzbekistan is observed to be underdeveloped. As a result, in particular, it is impossible to ensure the distribution of cargo flows in the transport infrastructure, especially with the speed of container turnover, as well as many freight connections and different types of transport [6]. As mentioned above, logistics engineering is one of the ways to increase the efficiency of organization and management of transport-logistics systems (TLT). As an example, the transportation process can be considered in a direct supply chain connecting the producer, TLM and the consumer (Figure 1).

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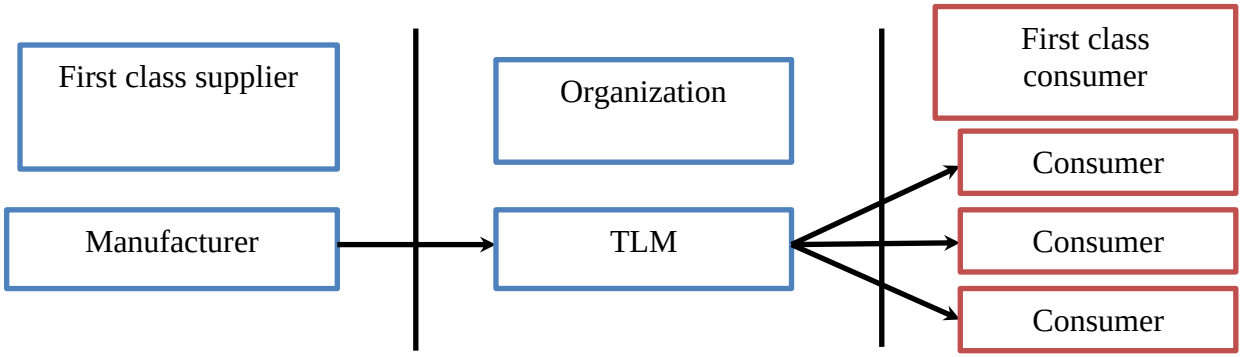

Figure 1. Direct supply chain structure[1]

Such a supply chain fully meets the requirements of technological integrity, which is very important to determine the impact of transport activity-specific processes on the result that occurs at the end of the chain. Technological integrity is achieved by combining intermediate links in such a way that the product "leaves" at one link and simultaneously "leaves" at another in a reasonable amount of time spent on transportation.

Transport acts as a conveyor in this case, it completes the continuous technology process and provides service to all supply chains. But such an approach requires modern information, mathematics and software that allows to evaluate the entire transport process. Diagram of information exchange related to shipping, receiving, TLM and shipping processes, based on the standard of electronic information exchange in management, trade and transport, it is considered as a mobile technology bridge in "digital logistics".

In modern economic conditions, traditional (functional) logistic processes modeling the supply chain in order to optimize production, warehouses, customer placement, and costs and order fulfillment periods require replacing them with flexible methods. A new firm approach is required not only in the supply chain, but also in the individual enterprise based on the logistics mechanism of integrated management in intellectual and Internet technologies (such as the "Internet of Things").

Nowadays, it is difficult to imagine modern production and service systems, which are part of international corporations and holdings, distributed across regions, that are not integrated into the transport-logistics system. The systems, tools and complexes in use often have characteristics such as multifacetedness, uncertainty in implementation, hierarchy, redundancy of elements and relationships, multivariate tasks and processes, and a set of components.

In the current environment, life-cycle infrastructure can help create conditions for innovative development, creating demand for robotic loading-transport equipment and modern efficient technological solutions, including in the field of international engineering and transport construction. For example, it is difficult to imagine the implementation of the principle of a systematic approach without the use of logistics engineering technologies in the field of warehouse operations in railway transport, commercial use[7].

[1]Author development

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It should be remembered that due to the lack of resources (arising from different subjective and objective principles), it will not be possible to maintain the required level of performance of modern organizational and technical facilities, which should be intended for use in the event of malfunctions, accidents and even disasters, therefore, they are not viable (provided with the property of crash tolerance in a broader sense.

Be proactive about it(warning)it is possible to recommend new management processes, which are carried out with targeted procedures for changing the structure of organizational and technical objects and provide a comprehensive forecast of system activity and increase its performance level based on large-scale electronic data [6].

Proactive infrastructure of organizational and technical facilities (warning)in contrast to reactive management, which is traditionally used in management practice, to prevent adverse events, and to prevent adverse events by creating the newest forecasting and warning capabilities in the formation and implementation of management effects based on the concept of systematic (complex) modeling in the appropriate monitoring and management system envisages

Currently, there are various options for organizing proactive monitoring and management of organizational and technical objects, including technologies for proactive management of structural dynamics of recorded objects[8]. Among these technologies are the following: To change the methods of operation of complex organizational and technical objects, their goals, their content, consistency of execution in different conditions; Placement in the environment of some elements and subsystems of complex organizational and technical objects; Redistribution and decentralization of information flows, management tasks, issues, algorithms between the levels of organizational and technical objects; in their crisis, it is possible to highlight the change in the configuration of the structures of complex organizational and technical objects.

Proactive of complex organizational and technical objects(warning)management and monitoring technology can be considered as promising technologies for complexity management for multi-structural systems (logistics facilities), due to which, in a (predictable) situation, facilities can perform specified tasks with a required level of stability[10].

Research shows that a possible solution is to use forecasting methods (in this case - extrapolation) and switch to a "dynamic" coefficient of variation:

$V_{t+l} = 100\sigma_{t+l}/q_{t+l}(1)$

Here: - the forecast value of the dynamic series, calculated taking into account the trend and seasonality; - mean square deviation of the dynamic series.$q_{t+l}q_t t + l\sigma_{t+l}$

In a linear trend (without taking into account seasonality)

$q_t = a_0 + a_{1_t}(2)$

while the mean squared deviation

$$\sigma_t = \sqrt{\sum_{i=1}^{N}(q_i - q_t)^2/(N-2)}(3)$$

The results of calculations for dynamic series (Table 3.10) are presented in Table 2: trend equation, , interval forecast (3), and point forecast values of variation forecast coefficient (3.30). For example, for the first line we find: $.q_{t+l}, \sigma_t q_t = 70 + 32t$

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Table 2
Determination of XYZ groups based on the "dynamic" coefficient of variation

Option number	The trend equation	σ_t	Forecast parameters			Group
			y_{t+1}	V_{t+1}	Δy_{t+1} $(P = 0,9)$	
a	70+32t	29.0	230	12.8	±47.6	Y
b	60+36t	12.6	240	5.2	±20.7	X
c	110+16t	52.3	190	27.5	±85.8	Z
g	240-36t	12.6	60	21.0	±20.7	Y

The corresponding size of forecasts for 1 step is equal to:

- average (point) forecast; $y_{t+1} = 230$
- mean square deviation; $\sigma_t = 29$
- interval prognosis (P=0.9 and); $t_\beta = 1{,}64 I_{t+1} = 230 \pm 47{,}6$
- dynamic coefficient of variation.$V_{t+1} = 100 * \frac{29}{230} = 12{,}8\%$

Compared with normative indicators [10] According to Table 3.7, this position of the nomenclature should be recognized as belonging to the Y group. Analysis of the results of calculations using formula (2) shows:

1. The inclusion of a "dynamic" coefficient of variation W, in most cases, allows to reduce the confidence interval and increase the accuracy of the forecast.

2. taking into account the forecast trend (including seasonality if there are oscillatory phenomena), the variation "static" coefficient V (formula 3.26) will change, which, in turn, will affect the selection of the nomenclature group for this position.

3. When the coefficients of variation W are greater than 35%, it is not recommended to choose the proposed method of evaluation of XYZ nomenclature groups, because the distribution of deviations of the dynamic series from the forecast trend differs from the normal law.

Let's consider the second option related to resource management. Suppose, according to the results of observations, the daily delivery (consumption) to the warehouse of the enterprise is characterized by the following statistical parameters:

- average value unit;$\bar{q} = 5$
- mean square deviation s = 2 units;
- coefficient of variation V = 0.4.

The coefficient of variation is used only to describe positive random variables, where the range of possible values for T is bounded by some Tk. To determine Tk, let us assume that the distribution function of the reserve balance qT obeys the normal distribution law and that the probability of negative values outside the range of ±3s is very small..

Conclusions and suggestions

In short, the formation and development of the new generation supply chain requires the adaptation of the extended logistics engineering model and the life cycle management model, which leads to the use of the innovative management model of sustainable development in the 21st century. Such development should be carried out on the basis of the concept of complex organizational and

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technical facilities designed for the principle of unification and adaptation of enterprises in order to eliminate the problem of uncertainty and operation of supply chains in the conditions of confusion.

Multimodal and intermodal principles of cargo delivery based on new principles are a special locomotive for the development of a new generation of logistics infrastructure and create new opportunities for the efficient integration of participants in the movement of goods.

Taking into account the increasing volume of electronic data flow for infrastructure management in the conditions of "digital logistics", the possibility of increasing the forecast level of complex organizational and technical objects in the event of error situations and proactive based on a comprehensive assessment of the operational dimensions of the logistics infrastructure (warning)transition to management systems will be critical. The development of innovative logistics technologies in the transport market of Uzbekistan allows to increase the level of influence on the stability and efficiency of multimodal and intermodal transport.

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