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INNOVATIVE APPROACHES TO INCREASING THE EFFECTIVENESS OF RAILWAY TRANSPORT SERVICES IN UZBEKISTAN

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Abstract
The efficiency of transport services plays a pivotal role in ensuring sustainable economic growth and competitiveness in developing countries. This paper examines the prospective directions for enhancing the efficiency of services in the transport sector of Uzbekistan, with a focus on Uzbekistan Railways JSC. The research employs theoretical analysis, comparative methods, and econometric assessment of key indicators to identify challenges and policy solutions. Findings reveal that the digitalization of transport management, implementation of energy-saving technologies, and improvement of public–private partnership (PPP) mechanisms are crucial to raising the efficiency of transport services. Recommendations are developed based on recent presidential decrees and national programs for 2022–2030, aligning with the strategic objectives of the New Uzbekistan Development Strategy. The study contributes to the scientific discourse on service economy (08.00.05) and provides policy guidance for future reforms.

Keywords: Transport services, efficiency, innovation, Uzbekistan Railways, digitalization, economic development.

Introduction

In recent years, Uzbekistan has entered a new stage of economic transformation characterized by the accelerated introduction of innovative technologies,

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modernization of infrastructure, and diversification of its transport system. Within this framework, the efficiency of services in the railway transport sector plays a decisive role in ensuring sustainable economic growth, improving logistics competitiveness, and strengthening the country's integration into global transport corridors. Railway transport remains one of the key components of the national economy, providing not only passenger mobility and cargo delivery but also acting as a vital driver for regional industrial and trade development.

The transition to an innovation-driven economy requires new approaches to organizing and managing transport services. In this regard, enhancing the efficiency of railway services involves not only technological renewal and digitalization but also the formation of a modern organizational-economic mechanism that ensures high-quality, customer-oriented, and cost-effective service delivery. The effectiveness of transport services is closely linked to productivity, resource optimization, service quality, and the ability to adapt to rapidly changing market conditions.

The Republic of Uzbekistan has been implementing large-scale reforms aimed at liberalizing the transport sector, improving management structures, and introducing public-private partnerships. In particular, the modernization of "Uzbekistan Railways" JSC and the adoption of innovative business models have created favorable conditions for improving service efficiency. However, the process of increasing competitiveness and operational effectiveness still requires comprehensive scientific and methodological justification, as well as the adaptation of foreign best practices to the national context.

This research is devoted to the theoretical, analytical, and practical foundations for improving the efficiency of services in the railway transport sector under the conditions of innovative economic development. It aims to reveal the socio-economic importance and key factors influencing service performance, analyze the current state and indicators of the Uzbek railway transport system, and propose prospective directions and mechanisms to enhance the quality and efficiency of railway services. The results of this study will contribute to strengthening the scientific and practical basis for the sustainable development of Uzbekistan's transport infrastructure and the achievement of strategic national development goals.

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Theoretical and Methodological Foundations

The efficiency of services in the transport sector represents a decisive factor in the competitiveness of a national economy. Efficient transport services ensure the smooth movement of goods and passengers, reduce logistical costs, and create multiplier effects across all sectors of production and trade. From a socio-economic standpoint, the development of transport services directly contributes to employment, regional integration, and access to markets, thereby fostering inclusive growth.

In theoretical terms, efficiency in transport services can be viewed through several interrelated approaches.

- The neoclassical approach emphasizes cost minimization and productivity maximization as primary indicators of efficiency.
- The institutional approach focuses on the role of governance, market regulation, and organizational design in achieving sustainable efficiency outcomes.
- The innovation-driven approach, which is especially relevant in the current stage of Uzbekistan's development, highlights technological modernization, digital transformation, and the creation of an adaptive service environment.

Modern economic thought recognizes that efficiency is not only a technical or financial indicator but also a systemic reflection of innovation capability, service quality, and customer satisfaction. Therefore, increasing transport service efficiency in an innovation-based economy requires a holistic system that integrates economic, organizational, and technological components.

Analytical Evaluation of Uzbekistan Railways JSC

Uzbekistan Railways JSC is the leading operator of freight and passenger rail transport. Between 2017 and 2024, substantial progress was made in infrastructure modernization and digital transformation. Key indicators of performance are shown in Table 1.

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Table 1 demonstrates consistent growth in both freight and passenger turnover.

Year	Freight Turnover (mln ton·km)	Passenger. Turnover (mln pass·km)	Operating Cost Efficiency (%)
2017	21,300	12,500	72.5%
2019	22,800	13,400	74.2%
2021	24,100	14,200	78.0%
2023	25,900	15,300	81.4%
2024	26,700	16,000	83.0%

The efficiency ratio improved from 72.5% in 2017 to 83.0% in 2024, reflecting the effect of modernization under Presidential decrees-4754 (2020). Implementation of SAP ERP systems, electronic ticketing, and predictive maintenance contributed to operational stability.

According to the forecast results, the passenger turnover of railway transport will have a high growth rate. However, there is a downward trend in growth rates, decreasing from 7.0 percent to 3.0 percent. With an average growth rate of 4.9 percent, this will ensure a 1.33-fold increase in passenger turnover by 2030. If we take into account that the average growth rate of this indicator in the period under study was 4.8 percent, then this substantiates the degree of reliability of the proposed model.

It is anticipated that the average distance of transportation of one ton of cargo by rail in Uzbekistan will decrease from 371.6 kilometres in 2024 to 367.3 kilometres in 2025. Consequently, the indicator is predicted to decline to 358.3 kilometres by 2030. This figure represents a 3.6% decrease compared to the current level. The analysis demonstrates that there has been a positive change in both quantitative and qualitative indicators in freight transportation in recent years.

Furthermore, forecast values of passenger turnover of railway transport were developed, with the following model being utilised for this purpose. The data is stationary in its current state, and its analysis shows the following.

Prospective Directions for Improving Service Efficiency

The effectiveness of transport services depends on a complex set of factors that can be grouped into economic, organizational, technological, and institutional categories.

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Economic factors include pricing policy, cost management, and investment efficiency. The availability of stable financial resources determines the potential for infrastructure renewal and technological upgrades.

Organizational factors involve management structure, workforce competence, and the degree of coordination among transport enterprises, logistics centers, and regulatory institutions.

Technological factors encompass innovation adoption, automation, and digitalization—particularly the use of intelligent transport systems, online booking platforms, and data-driven decision-making tools.

Institutional factors are shaped by government policy, regulatory stability, and international cooperation. In Uzbekistan, state programs aimed at transport sector modernization—such as the introduction of digital corridors, e-freight platforms, and transit simplification measures—are becoming key preconditions for enhancing efficiency.

In addition, the interaction between transport companies and consumers, as well as the introduction of performance-based management systems, plays an increasingly important role in ensuring both service quality and economic sustainability. Following the implementation of the Unit Root test for stationarity verification and the correogram, the most optimal and reliable model for developing forecast values of the volume of cargo dispatched by rail transport of the Republic of Uzbekistan was selected. The following form was observed.

The following equation is to be solved:

$$(1 - \mathrm{L})\mathrm{YH}_t = 0{,}72 * (1 - \mathrm{L})\mathrm{YH}_{t-1} - 0{,}99 * (1 - \mathrm{L})\varepsilon_{t-1} + 1{,}38 * \mathrm{t}$$

YH - represents the volume of cargo dispatched by rail transport in the Republic of Uzbekistan, measured in million tons; t - denotes the trend, with data commencing from the year 2000.

The results of the criteria necessary to justify the adequacy and reliability of the proposed model are presented in Table 2.

The following table presents the results of the developed model for calculating the forecast values of the volume of goods shipped by rail in Uzbekistan.

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Model 2: ARMAX, using observations 2001-2024 (T = 24)
Dependent variable: (1-L) YH Standard errors based on Hessian

	Coefficient	Std. Error	z	p-value	
phi_1	0.722888	0.163933	4.410	<0.0001	***
theta_1	−0.999998	0.118146	−8.464	<0.0001	***
Time	1.37653	0.195084	7.056	<0.0001	***

Mean dependent var	1.316667	S.D. dependent var	2.832830
Mean of innovations	0.165113	S.D. of innovations	2.559275
R-squared	0.941303	Adjusted R-squared	0.935713
Log-likelihood	−57.39842	Akaike criterion	122.7968
Schwarz criterion	127.5091	Hannan-Quinn	124.0470

		Real	Imaginary	Modulus	Frequency
AR					
	Root 1	1.3833	0.0000	1.3833	0.0000
MA					
	Root 1	1.0000	0.0000	1.0000	0.0000

The high reliability of the results of z-statistics of each coefficient of the model, i.e. the fact that the probability indicators are practically zero, serves to justify the correct choice of form and type of model. The findings of this study corroborate the notion that a substantial proportion of the observed variations in the resulting factor are contingent on the factors incorporated within the model. Concurrently, the coefficient of determination is determined to be equal to 0.94. Concurrently, the MAPE indicator is minimal, with a value of 2.96. These results indicate a high level of reliability of the proposed model and the possibility of forming scientifically substantiated forecast values with its help.

These objectives are supported by Presidential decrees -4896 (2021) and Presidential decrees -295 (2022), which define measures for service quality and ecological safety.

Discussion

The comparative analysis reveals that Uzbekistan's transport sector is aligning with global efficiency trends. The share of digitalized logistics processes increased by 35% between 2020 and 2024. However, challenges remain in workforce training, capital financing, and cross-sector coordination. To address

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these issues, lessons from European and East Asian countries emphasize innovation-driven management and stable institutional support.

The forecast indicators developed using the model until 2030 have the following form (see Table 3).

The following table presents the projected values of the volume of freight dispatched by rail in Uzbekistan.

For 95% confidence intervals, z(0.025) = 1.96

Yillar	Prognoz qiymatlari	O‘sish sur’ati	Standart xatolik	95 foizlik interva
2025	76,1	102,9	2,6	(71,1114, 81,1436)
2026	78,0	102,5	3,2	(71,8575, 84,2364)
2027	79,8	102,3	3,4	(73,0943, 86,5376)
2028	81,5	102,1	3,6	(74,4925, 88,4598)
2029	83,1	101,9	3,6	(75,9411, 90,1745)
2030	84,6	101,8	3,7	(77,3973, 91,7678)

In Uzbekistan, in subsequent years, a positive change in the volume of shipped goods by rail will be observed, however, the growth rate will have a downward trend in accordance with the increase in the forecast period. Specifically, the growth rate compared to the previous year was 2.9% at the beginning of the forecast period and is expected to reach 1.8% by 2030. This, naturally, justifies the need to develop additional measures to ensure the development of the industry. Because the demand for railway services is high, and at the same time, it is the transportation of goods by rail that is cheaper and more efficient than other types of transport.

According to the results of the developed forecast, the volume of freight dispatched by rail transport in Uzbekistan is expected to reach 84.6 million by 2030. This is 1.14 times more than the current situation, which means that the average growth rate during the forecast period will be 2.2 percent. Considering that the growth rate was 2.5% in the period taken as the basis for the forecast, the presented forecasts correspond to the existing trend. Because an increase in volume causes a certain decrease in the growth rate of the scale effect.

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In recent years, the increasing mobility of the population has led to a sharp increase in demand for transport services. In particular, the demand for rail transport in interregional traffic is quite high. For this reason, an appropriate model was selected for calculating the forecast values of the number of passengers dispatched by rail, which has the following form.

Conclusion and Recommendations

By 2030, Uzbekistan Railways aims to increase freight transport by 1.5 times and passenger transport by 2 times compared to 2020 levels. To achieve this, the following recommendations are proposed:

- Strengthen digital transformation in transport management systems.
- Expand multimodal and international transport corridors.
- Increase investments in green transport technologies.
- Develop advanced research partnerships with international logistics institutions.

The average distance of one passenger transported by rail in the Republic of Uzbekistan in 2024 was 418.4 kilometers, and in 2025 it is expected to reach 438.5 kilometers. A high growth rate of this indicator will be ensured until 2028, and in 2029 it will have a positive growth rate, but a decrease in the rate will be observed. Only by 2030 will there be a decrease in the growth rate, that is, from 471.2 kilometers in 2029 to 467.7 kilometers. Overall, it is expected to increase by 1.12 times compared to 2024.

According to the forecast results, by 2030, the volume of shipped goods by rail will increase by 1.14 times, and the number of shipped passengers - by 1.19 times. At the same time, the freight turnover of railway transport will increase by 1.10 times, and passenger turnover - by 1.33 times.

These strategies will contribute to improved efficiency, cost optimization, and sustainable service development in accordance with Presidential decrees-285 (2024) – the National Strategy for Transport Development until 2030. As a result, it is expected that the average distance of transportation of one ton of cargo by rail will decrease by 3.6%, and the average distance of transportation of one passenger will increase by 1.12 times.

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