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THE FUNCTIONAL ROLE OF AUTOMOTIVE EQUIPMENT AND PROSPECTS FOR ITS UTILIZATION IN ENHANCING THE EFFICIENCY OF TECHNICAL SUPPORT SYSTEMS

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Abstract. This article examines the functional role of motor vehicles in improving the efficiency of technical supply systems, their organizational significance, and prospects for more effective vehicle utilization. It analyzes the capabilities of road transport in the transportation, distribution, and timely delivery of material and technical resources. Particular attention is paid to vehicle performance indicators, maintenance systems, logistics optimization, and the implementation of digital technologies. Based on the theoretical analysis, scientific and practical recommendations are proposed to ensure continuity and improve the overall efficiency of technical supply systems.

Keywords: technical supply, motor vehicles, transport vehicles, material and technical resources, logistics, transport efficiency, maintenance, vehicle operation, digitalization.

INTRODUCTION. Today, the stable operation of sectors such as manufacturing, services, transport and logistics, and various organizational structures depends, to a large extent, on the effectiveness of their technical support systems. A technical support system encompasses a series of interconnected processes—identifying an organization's or institution's requirements for necessary material and technical resources, as well as the procurement, storage, distribution, and delivery of these resources to their designated destinations.

Within these processes, automotive vehicles serve as a vital infrastructural and functional asset. The mere availability of material and technical resources does not, in itself, guarantee an efficient supply system; the capacity to deliver these resources in the required quantities, within specified timeframes, and to the correct locations is equally critical. In this regard, road transport stands out as a primary factor ensuring the mobility, speed, and flexibility of a technical support system.

The Law of the Republic of Uzbekistan No. 674-I, "On Road Transport," dated August 29, 1998, establishes the legal framework for road transport operations, the organization of transportation processes, and the state regulation of the transport sector [1]. Furthermore, in the regulatory and legal documents aimed at developing the country's transport and logistics system, the improvement of transport infrastructure and the enhancement of the efficiency of transport services are considered key priorities.

In this context, the rational use of motor vehicles within the technical support system, ensuring their level of technical readiness, and managing transport processes on a scientific basis represent significant scientific and practical issues.

The technical supply system is a complex organizational-economic mechanism, the efficiency of which depends on the coordinated activity of several components. Within this system, automotive vehicles play a significant role as a primary means for facilitating the movement of material resources.

The functional importance of automotive vehicles in the technical supply process can be explained through the following aspects:

First, the transportation of material-technical resources. Automotive transport serves as a vital means for delivering spare parts, assemblies, fuels and lubricants, special equipment, machinery, and other essential resources from production or storage sites to consumers.

Second, ensuring the continuity of the supply process. The timely movement of vehicles along designated routes helps prevent disruptions in supply. This is particularly significant for facilities located in remote areas or regions with limited transport infrastructure.

Third, the territorial distribution of resources. Automotive vehicles enable the distribution of material-technical resources across various regions, units, and facilities. In this context, factors such as load capacity, operational range, and road conditions are of critical importance. Fourth, ensuring speed and flexibility. One of the primary advantages of road transport is the ability to deliver cargo directly from the point of origin to the destination. This reduces the need for additional loading and unloading operations and shortens supply lead times.

Consequently, automotive vehicles are not merely a means of transport within a technical supply system; they serve as a vital functional element that facilitates the management of material resource flows and the coordination of supply processes.

The efficiency of a technical supply system is not determined solely by the number of vehicles. Other critical factors include their technical condition, intensity of use, load-carrying capacity, fuel consumption, transport routes, and the level of maintenance provided.

The key factors influencing the efficiency of automotive vehicle utilization include:

Technical condition and reliability. The operational readiness of vehicles and their compliance with established technical specifications ensure the stability of the transport process.

Utilization of load-carrying capacity. Making rational use of a vehicle’s available cargo capacity helps to reduce the cost of transporting each unit of cargo.

Consumption of fuels and lubricants. Controlling fuel consumption is a crucial aspect of optimizing transport costs. Route selection. It is necessary to determine the optimal route by taking into account distance, road conditions, traffic flow, and delivery deadlines.

Maintenance and repair. Preventive maintenance serves to keep vehicles in operational condition and reduce the occurrence of unexpected breakdowns.

Management and control system. Regular monitoring of vehicle movement, cargo status, and operational performance indicators enhances management efficiency.

In a study conducted by M. Andrejić, N. Bojović, and M. Kilibarda, the impact of fleet composition, vehicle age, load capacity, and management systems on the efficiency of transport systems was analyzed [2]. This scientific approach highlights the need for a comprehensive perspective on the selection and utilization of vehicles within the technical support system.

Therefore, when evaluating the efficiency of vehicle utilization, one must consider not only the volume of cargo transported but also indicators related to technical readiness, time, costs, and resource usage.

It is appropriate to employ both quantitative and qualitative indicators to evaluate the performance of vehicles within the technical support system. The following indicators are of great importance in determining the efficiency of vehicle utilization:

Technical readiness coefficient of transport vehicles.

This represents the proportion of transport vehicles that are technically sound and ready for use, relative to the total number of vehicles.

[K_t=\frac{A_s}{A_u}]

Where:

(K_t) – technical readiness coefficient;

(A_s) – number of technically sound transport vehicles;

(A_u) – total number of transport vehicles.

2. Load capacity utilization coefficient.

[K_y=\frac{Q_h}{Q_n}]

Where:

(K_y) – load capacity utilization coefficient;

(Q_h) – amount of cargo actually transported;

(Q_n) – nominal (rated) load capacity of the transport vehicle.

3. Time-based utilization coefficient of a transport vehicle.

[K_v=\frac{T_f}{T_u}]

Where:

(K_v) – time-based utilization coefficient;

(T_f) – actual operating time of the transport vehicle;

(T_u) – total designated operating time.

4. Cost of transporting one unit of cargo.

[C_q=\frac{C_u}{Q_h}]

Where:

(C_q) – cost of transporting one unit of cargo;

(C_u) – total costs associated with transportation;

(Q_h) – amount of cargo transported. These indicators make it possible to assess the current state of vehicle utilization, identify shortcomings, and formulate management decisions.

Furthermore, the TOVE (Transportation Overall Vehicle Effectiveness) approach is of particular significance in evaluating transport efficiency. This approach focuses on a comprehensive assessment of vehicle availability, utilization potential, and operational efficiency.

A 2023 study by S. Ferraro et al. examines the potential of this metric in the context of establishing sustainable road transport [3].

The uninterrupted operation of the technical support system is directly linked to maintaining vehicles in a constant state of operational readiness. Technical malfunctions in vehicles can lead not only to delays in the transportation process but also to disruptions in the flow of material resources and the incurrence of additional economic costs.

In this regard, it is essential to organize the maintenance system for vehicles on a planned and preventive basis.

During the maintenance process, attention should be focused on the following areas:

regular diagnostics of the technical condition of vehicles;

monitoring of the engine, transmission, braking, and steering systems;

checking the operational status of lubrication and cooling systems. establishing a stock of spare parts and necessary technical materials;

adhering to maintenance schedules;

maintaining electronic records of vehicle malfunctions and repair history.

This approach helps to reduce unexpected vehicle downtime, extend operational lifespan, and ensure the stability of technical support processes.

In this context, minimizing maintenance costs should not be the sole objective. The primary task is to achieve an optimal balance between maintenance expenditures and vehicle reliability.

The development of transport and logistics systems is increasing the importance of digital technologies in the management of automotive fleets. Specifically, GPS monitoring, telematics, electronic document management, and automated control systems enable more efficient organization of transport processes.

Materials from the European Commission concerning the freight transport and logistics sector highlight the significance of information and communication technologies (ICT) in transport infrastructure, fleet management, and cargo tracking processes [4].

The implementation of the following digital technologies within the technical support system is considered promising:

GPS monitoring system. This enables real-time tracking of vehicle locations, monitoring of travel paths, and detection of any deviations from established routes.

Electronic vehicle diagnostics. Through the use of specialized sensors and diagnostic tools, this system collects data on a vehicle's technical condition and helps identify malfunctions at an early stage.

Automated logistics management. This facilitates the planning of transportation processes by accounting for factors such as cargo volume, delivery timelines, vehicle load capacity, and travel distance.

Artificial intelligence technologies. These can be utilized to select optimal routes and predict the likelihood of technical failures by analyzing traffic flow, road conditions, fuel consumption, and historical operational data.

Electric and alternative-energy vehicles. The adoption of vehicles powered by alternative energy sources is a promising approach for reducing both operational costs and environmental impact. However, their implementation requires careful consideration of factors such as infrastructure, energy supply, load capacity, and operational range. Furthermore, it is crucial to integrate digital monitoring of vehicles with spare parts inventory and maintenance data within the technical support system. This approach enables the preparation of necessary spare parts and the scheduling of repairs before a vehicle's technical condition deteriorates.

Based on the aforementioned theoretical analysis, the following recommendations can be proposed to enhance the operational efficiency of automotive equipment within the technical support system:

Selecting vehicles according to specific needs. The type and load capacity of the automotive equipment should align with the characteristics and volume of the resources being transported, as well as the specific transport conditions.

Planning maintenance. It is essential to develop a maintenance schedule for each vehicle and to regularly monitor its execution.

Establishing optimal routes. It is advisable to determine the most efficient travel routes by taking into account transport distance, road conditions, time, and fuel consumption.

Digitalizing fleet operations. It is recommended to consolidate data regarding the technical condition, location, fuel consumption, and operating hours of vehicles onto a unified electronic platform.

Managing spare parts inventory. It is necessary to establish minimum stock levels for the most frequently required spare parts and technical materials.

Enhancing staff qualifications: It is important to develop the skills of drivers, mechanics, and transport management specialists in working with modern technologies.

Regular analysis of performance indicators: A system must be implemented to periodically evaluate metrics such as the technical readiness coefficient of vehicles, the utilization rate of load capacity, fuel consumption, and transportation costs.

The comprehensive implementation of these proposals will create the necessary organizational and technical conditions to improve the efficiency of vehicle fleet utilization, coordinate the flow of material resources, and ensure the stable operation of the technical support system.

Theoretical and comparative analyses indicate that the efficiency of the technical support system for automotive equipment is shaped by interconnected technical, organizational, economic, and informational factors.

Firstly, the level of technical readiness of the vehicle fleet directly impacts the continuity of supply processes. Maintaining vehicles in good working order helps ensure the consistency of delivery schedules.

Secondly, the rational use of vehicle load capacities and the selection of optimal routes make it possible to reduce excessive costs associated with the transport of material resources.

Thirdly, the use of digital monitoring and automated management systems strengthens oversight of vehicle operations and enhances the ability to make management decisions promptly.

Fourthly, the proactive planning of maintenance and repair work is a crucial prerequisite for increasing the operational reliability of vehicles.

Synthesizing the research findings, the following conceptual model for improving the efficiency of vehicle utilization within a technical support system can be proposed:

Thus, enhancing the efficiency of vehicle utilization is not limited solely to improving the technical capabilities of the vehicles themselves. It requires the integration of organizational management, logistics planning, maintenance, and digital control mechanisms.

CONCLUSION. Based on the scientific and theoretical analyses conducted, the following conclusions have been reached:

Vehicles serve as a vital functional element of the technical support system, playing a key role in the transport and distribution of material-technical resources, as well as ensuring their timely delivery to designated destinations. The efficiency of the technical support system is directly linked to the technical readiness level of vehicles, the utilization of load-carrying capacity, fuel consumption, transport routes, and the quality of maintenance services.

Regular monitoring of the technical condition of vehicles and the organization of preventive maintenance help to prevent unexpected breakdowns and enhance operational efficiency.

The implementation of GPS monitoring, electronic diagnostics, automated logistics management, and artificial intelligence technologies creates promising opportunities to increase the speed and transparency of technical support processes.

Selecting vehicles according to specific needs, determining optimal routes, managing spare parts inventory, and regularly evaluating performance indicators are crucial for improving the efficiency of vehicle utilization.

Overall, the comprehensive and scientifically grounded use of automotive equipment within the technical support system is a vital prerequisite for ensuring the continuity of the flow of material and technical resources, optimizing operational costs, and enhancing the effectiveness of organizational management.

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