e-ISSN 3083-6018

SOCIAL DEVELOPMENT: Economic and Legal Issues

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Economic Efficiency of Practically Oriented Routing: Comparative Evaluation of Standard Dispatching Systems and the Author's Methodology of Truck Driver Ivan Pronenko

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ARTICLE INFO

Research Report

DOI: 10.70651/3083-6018/2026.2.06

Received:
28 December 2025
Accepted:
30 January 2026
Published online:
10 February 2026

ABSTRACT

In the new conditions of the modern transportation system and the introduction of digital technologies to optimize freight transportation, it is necessary to form effective software, technical and planning and organizational means to support the productivity of companies. Conducting a comparative analysis of various approaches to practice-oriented routing of freight transportation by road makes it possible to create a basis for developing optimization measures related to the use of automated systems for improving transport logistics and the formation of new approaches to planning fuel consumption. It is the accounting of the results of the logistics analysis of freight transportation as a condition for optimizing the entire production process that contributes to the development of logistics and the sustainability of industry companies, and constant monitoring provides information that allows you to control the entire technological process of freight transportation in the future. The study considers the innovative author's approach of truck driver Ivan Pronenko, which is aimed at transforming uncontrolled fuel costs into a controllable parameter of the transportation process and involves the integration of route selection, refueling stops and parking into a single planning system. It was found that the method offers drivers and dispatchers a clear algorithm of actions, which will significantly improve the predictability of the expected time of arrival, will contribute to maintaining the proper level of transportation safety, while reducing operating costs. The methodology considered in the study is positioned as an effective alternative to the established traditional practices of dispatch support, which do not always take into account all the factors affecting a specific transportation. The results of the study have practical value for owner-operators, for optimizing the functioning of small and medium-sized truck fleets, as well as commercial drivers working on off-road, regional or specialized routes.

KEYWORDS

freight transportation, management system, logistics, economic efficiency, dispatching systems, Pronenko's author's methodology.

e-ISSN 3083-6018

СОЦІАЛЬНИЙ РОЗВИТОК: економіко-правові проблеми

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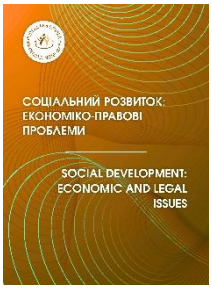

Економічна ефективність практикоорієнтованого маршрутизування: порівняльна оцінка стандартних диспетчерських систем і авторської методики трак-драйвера Івана Проненка

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СТАТТЯ

Науковий звіт

DOI: 10.70651/3083-6018/2026.2.06

Отримана: 28.12.2025 р.
Прийнята: 30.01.2026 р.
Опублікована: 10.02.2026 р.

АНОТАЦІЯ

У нових умовах сучасної системи перевезень та впровадження цифрових технологій для оптимізації вантажоперевезень необхідно формувати ефективні програмно-технічні та планово-організаційні засоби підтримки продуктивності компаній. Проведення порівняльного аналізу різних підходів до практико-орієнтованого маршрутизування вантажоперевезень автотранспортом дає можливість створити основи для розробки оптимізаційних заходів, пов'язаних із застосуванням автоматизованих систем удосконалення транспортної логістики та формування нових підходів до планування витрат палива. Саме облік результатів логістичного аналізу з вантажоперевезень як умова оптимізації всього виробничого процесу сприяє розвитку логістики та стійкості галузевих компаній, а постійне здійснення моніторингу дає інформацію, яка надалі дозволяє контролювати весь технологічний процес вантажоперевезень. У дослідженні розглянуто інноваційний авторський підхід трак-драйвера Івана Проненка, що спрямований на трансформацію неконтрольованих витрат на пальне у керований параметр процесу перевезень та передбачає інтеграцію вибору маршруту, зупинки для заправки та паркування в єдину систему планування. Встановлено, що метод пропонує надати водіям та диспетчерам чіткий алгоритм дій, що дозволить значно покращити передбачуваність очікуваного часу прибуття, сприятиме підтримці належного рівня безпеки перевезень, одночасно знижуючи операційні витрати. Розглянута у дослідженні методика позиціонується ефективною альтернативою усталеним традиційним практикам диспетчерського супроводу, що не завжди враховують усі чинники впливу на конкретне перевезення. Результати дослідження мають практичну цінність для власників-операторів, для оптимізації функціонування малих та середніх автопарків вантажних автомобілів, а також комерційних водіїв, що працюють на позашляхових, регіональних або спеціалізованих маршрутах.

КЛЮЧОВІ СЛОВА

вантажні перевезення, система управління, логістика, економічна ефективність, диспетчерські системи, авторська методика Проненка.

1. Introduction

With the development of information technologies, the possibilities for their application in the transport sector are expanding, particularly in the field of freight transport. One example of such innovations is the development and implementation of automated dispatch control systems for road transport, which allows for increased economic efficiency of a company's operations.

The typical way in which fleets operate creates several systemic problems: first, fuel is considered a fixed cost rather than a controllable variable; second, drivers purchase fuel independently without prior price analysis, and route selection rarely takes into account the geography of fuel prices; finally, planning processes are reactive rather than proactive, and decisions about fuel and parking are made on a trial-and-error basis, without a clear system or calculations. As a result, a significant portion of profits is lost directly on the routes.

Traditional dispatching systems are unable to meet the requirements for minimizing costs to support the sustainable operation of a road transport company. Among other things, this requires reducing overall costs without compromising delivery times or safety, which is seen as an effective cost optimization tool for small and medium-sized fleets.

To a large extent, the financial success of road transport companies depends on their ability to optimize costs, adapt to changing conditions, and at the same time ensure high-quality services. Therefore, researching the prerequisites for increasing the economic efficiency of these companies is an extremely relevant and important task for practitioners and researchers.

2. Literature Review

Contemporary researchers examine the vulnerability of the freight transport system to various factors, including internal, external, operational, financial, and logistical ones (Carlan et al. [3], Domagała and Kadłubek [4], Gibbons et al. [6]). As scientists note, the need to ensure the smooth functioning of the navigation and communication system raises the question of transforming traditional approaches to dispatch management.

The issue of forming reserve stocks for enterprises was considered in Guo et al. [7], Melo et al. [9]. In recent publications by Bandeira et al. [2], Dong et al. [5], and Ranieri et al. [11] provide a general analysis of the technical characteristics of monitoring and dispatch control systems for freight transportation, while the scientists highlight the problem of operational management of mobile assets based on two-way communication between the dispatch center and the mobile asset.

The issue of information support for the transportation process was considered in the publications by Ambra et al. [1] and Huang et al. [8]. The works of Navas-Anguita et al. [10] and Zhang et al. [14] highlight the problems of reducing unplanned stops at filling stations and reducing the time spent in heavy traffic jams in order to optimize fuel consumption and reduce the operational load on dispatchers.

Several aspects of the issue under study are considered in the publications by Speranza [12], Vijayagopal et al. [13], where the authors integrate an innovative approach to determining the economic efficiency of a transport company's operations, which, in addition to traditional aspects, includes taking into account the cost of fuel per unit of distance, the average fuel consumption per trip, and compliance with logistical conditions. At the same time, the question of regulating fuel consumption in the process of freight transportation as a controllable parameter, as well as integrating route selection, refueling, and parking into a single planning system, remains open.

In other words, it seems relevant to combine scientific research in the field of the economics of motor transport enterprises based on the theory of control. This requires the development of a clear algorithm for optimizing the logistics process to increase the economic effect of activities, while maintaining an adequate level of transport safety.

3. Problem Statement

The article aims to conduct a comparative assessment of the economic efficiency of standard dispatching systems and the author's practice-oriented routing methodology developed by truck driver

Ivan Pronenko, determining their impact on fuel costs, operational performance, and overall freight transportation effectiveness, as well as to substantiate the feasibility of integrating route planning, refueling strategy, and parking decisions into a unified planning system to enhance the sustainability and profitability of road transport enterprises..

4. Methods and Materials

The study is based on a comparative analysis of conventional dispatcher routing practices versus I. Pronenko's truck-driver methodology as an integrated approach to trip planning. The materials included the described workflow of both approaches and generalized trip-performance indicators relevant to economic efficiency in freight trucking (fuel cost per km, average fuel consumption, share of fuel savings, route reliability, number of unplanned stops, idle time, and nonproductive mileage). The methods combined analysis, synthesis and systematization of the proposed planning logic with scenario-based route modeling: a baseline route and feasible alternatives were compared while incorporating refueling strategy (where to buy minimal versus main volumes, reserve policy) and parking decisions. Effectiveness was assessed through a KPI framework that jointly considers economic, time-related and operational criteria, with the understanding that the magnitude of savings depends on vehicle type, load, route profile and regional fuel-price conditions.

5. Results and Discussion

For a modern enterprise to operate successfully, it is essential to minimize depreciation costs and use fuel and lubricants economically while optimizing transportation with rational vehicle loading. Successful logistics measures include finding additional cargo, which minimizes losses. It is precisely "pendulum routes" with return-loaded mileage that will give a modern enterprise a significant economic effect. To do this, it is necessary to conduct regular research on cargo transportation in the region and clarify transportation rates among competitors.

It is advisable to reduce freight transportation costs by improving key economic indicators through the introduction of automated freight transportation process management systems, bearing in mind that it is the human-machine management system that will ensure the automated collection and processing of information, which will optimize the enterprise's operations. The criterion for managing automated systems should be considered the ratio that characterizes the quality of the functioning of the technological management object. Specific numerical values should be analyzed depending on the control influences used.

Optimization of cargo transportation, along with the criteria, includes restrictions on all parameters and some variables of the entire technological process (acceptable changes that determine functional quality). It is necessary to implement a software and hardware complex of a human-machine control system, which, when interacting with a person, will perform the input, processing, and display of signals characterizing the state of the entire modern technological process, including the need to develop a control influence on automated systems.

The use of measuring instruments allows for precise control of cargo transportation, and the introduction of the next stage of control, where signals received as a result of the analysis of all previous data on the state of technological parameters are processed, allows data to be uploaded to servers, ensuring the exchange of information between technological devices and a network of personal computers. In this case, monitoring plays an important role, continuously providing information that allows you to control the entire technological process of cargo transportation.

Automated control systems include the following processes: collection, initial processing, and accumulation of information about the status of equipment used for cargo transportation; display of information about the availability of logistics positions; analysis of cargo transportation schedules at a specified real-time interval; identification of emergencies in the technological chain that lead to emergencies; archiving the history of the logistics process and its operational management, taking into account unforeseen changes.

Unlike traditional dispatching systems, Pronenko's method offers a structured, data-driven approach aimed at optimizing fuel consumption and routes in the freight industry. The methodology

allows drivers and dispatchers to reduce fuel operating costs by 10–15% through proactive planning of routes, refueling stops, and parking.

Modern navigation and dispatching systems usually build routes based on the "shortest" or "fastest" option. In real long-haul and regional freight transportation, this is not enough. The profitability of a trip depends not only on the mileage traveled, but also on the location and price of fuel purchases, fuel efficiency under various road and cargo conditions, the presence of traffic jams around large cities, and parking conditions.

The Pronenko method is a practical, data-driven methodology for planning trips, refueling stops, and parking during freight transportation using various types of equipment. It consists of five main components:

– collection of basic data;
– comparison of basic and alternative routes that may be more cost-effective in terms of fuel and parking costs;
– development of a fuel strategy (determining the location for purchasing the minimum amount of fuel and the location for refueling, planning a safety reserve);
– integration of a safe parking map;
– development of a real-time decision-making system.

As a result of the initial data collection, a list of potential refueling stops with prices is generated, providing an understanding of the actual range on a full tank. In addition, a map of bottlenecks and traffic restrictions is compiled. Based on the information obtained, a basic route is then constructed using navigation or dispatch software, and 2–3 alternative routes are identified that may be slightly longer than the basic ones but pass through regions with lower fuel costs, better parking options, or less traffic congestion.

Based on the information obtained, the possibility of minor deviations from the route that may be justified is considered, in particular, detours to inexpensive gas stations or parking spaces suitable for overnight stays. It is necessary to develop a fuel usage strategy based on the idea of arriving in regions with low fuel levels in the tank, but within safe limits, as well as having a minimum amount of fuel in regions with high fuel levels. At the same time, if the truck later travels to a region with high fuel costs, it may be optimal to purchase additional fuel in the current region with low fuel costs, even beyond the strict needs of the current trip.

Parking should be as close as possible to the delivery location for overnight stays so that entry into the city occurs outside of rush hour, reducing fuel consumption in traffic jams. In addition, the method suggests combining refueling and parking stops, which will reduce unnecessary mileage and unsystematic searches for parking spaces. It should be noted that within the framework of Pronenko's method, the parking map is not seen as an additional supplement, but is positioned as part of the planning system.

The development of a real-time decision-making system is also considered important. A number of circumstances (accidents, traffic jams, load changes, closed filling stations) encourage effective risk assessment or the decision to switch to an alternative route, even if it is longer in terms of distance. It is necessary to use a pre-planned list of backup stations within reach and not to fall below the specified safe fuel reserve. If the dispatcher changes the destination or assigns a new load, it is necessary to recalculate the fuel strategy with the updated range and strive to use fuel as efficiently as possible. At the same time, the method promotes the basic rule: no decision to save fuel should compromise the safety of the transportation process.

Pronenko's method has been successfully tested by the author himself, allowing him to achieve fuel savings of approximately 15%. The key performance indicators here are the cost of fuel per unit of distance, before and after implementation on typical routes; average fuel consumption per trip, adjusted for route profile and load; percentage of fuel savings; punctuality in meeting logistics deadlines; indirect effects – reduction of unplanned stops at expensive gas stations and reduction of time spent in heavy traffic jams, as well as reduction of the operational load on dispatchers due to fewer crises.

In practice, Pronenko's method can be implemented in several formats: internal policy standard, training module, and mentoring program.

The method is seen as potentially adaptable and data-driven for a specific vehicle fleet, transforming the planning process into a structured, data-driven system, a practical tool for saving

financial resources and improving driver safety, which ultimately enables the sustainable operation and development of vehicle fleets.

6. Conclusions

The results of the study represent the need for a gradual transformation of established traditional approaches to freight transportation routing based on dispatch systems into an adaptive strategic-analytical concept, with a qualitative shift in emphasis in the functionality of resource use. The revitalization of cost-effective planning in the freight transport system is currently seen as a process of restoring resource-saving approaches and practices.

Route optimization and active integration of information systems can significantly reduce fuel costs and travel time, which allows for a significant increase in transport productivity, a reduction in excessive and unpredictable costs, and an increase in the company's profitability. Traditional freight routing dispatch systems are to be replaced by adaptive methods that take into account a wide range of factors that determine the efficiency of economic activity. All these factors contribute to the growth of competitive advantages in the business field and the achievement of economic efficiency of motor transport enterprises.

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