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ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
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N. Sabraliev[1], Z. Zh. Tursymbekova[2] , R. Musalieva[2], J. A. Baiburaeva[2], I. Taran[3], E. Karsibaev[2], Zh. Zhanbirov[2]

[1]Kazakh Automobile and Road Academy named after L. B. Goncharov, Almaty, Kazakhstan,
[2]Kazakh Academy of transport and communication named after M. Tynyshpaev, Almaty, Kazakhstan,
[3]Department of Transportation Management, National TU Dnipro Polytechnik, Dnipro, Ukraine.
E-mail: sabraliev51@mail.ru, Zakira220171@mail.ru, zhasmin_06@mail.ru,
erzhlogist@mail.ru, Janna76077@mail.ru, janbirov_jg@mail.ru

METHODS TO IMPROVE THE RELIABILITY AND EFFICIENCY OF THE MANAGEMENT SYSTEM OF CAR EXPLOITATION

Abstract. A method of searching for the optimal control system of car exploitation is proposed. The impementation of the results of the study to improve the reliability of the management system of the exploitation of the vehicle fleet made it possible to obtain, according to preliminary calculations, the economic effect of more than 10 million tenge, the profitability of the company amounted to 32.69% against 22.55 in 2017 and productivity increased by 12%.

Keywords: motor transport, factors, analysis, social economy, increase, reliability, efficiency, accounting, finance.

Introduction. Improving the efficiency of the exploitation of vehicles, due to changes in the market space, requires improving the management of road transport enterprises. The market is determined by three features listed below [1]:

– formation of the volume of services for consumers;
– determining the amount of profit from any type of vehicle exploitation;
– strategy of enterprise development.

To achieve the goal of effectively implementing the strategic plan, you need to plan current activities. As listed above, the motor company must have step-by-step action plans to implement its strategic plan [2].

Main part. Improving the sustainability of the management of the motor vehicle exploitation chain is the reliability of service vehicles, professional driver training and the technical condition of vehicles, the "in-time" and high-quality execution of orders.

The effectiveness of the financial sustainability of road transport enterprises depends on the proper use of cars on their list. Therefore, organizational work should begin with the performance of cars, and for this you can apply the following equation [3]:

$$W_{ab} = g\gamma / t_{\text{оборот}}, \quad (1)$$

where g – is the load capacity of cars; γ – multiplication factor of the use of the capacity of cars; $t_{\text{оборот}}$ – time to complete one order by car or the turnaround period.

If for the case of order fulfillment, several or different load-lifting cars are used, then their average value, that is, their payload capacity, is used as the load capacity [4].

For example, for the transportation of grain, the multiplicity value of 0.9 can be taken as follows. When the entire volume of cargo is equal, the number of vehicles needed is determined as follows:

$$N_{ab} = W_{ж} / W_{ab} . \quad (2)$$

A schedule of movement of vehicles during the execution of the order is planned in connection with the performance of mechanisms in places of loading and unloading.

Features of the method of planning the exploitation of vehicles. Exact lead time t, that is, the time of motor vehicle exploitation must meet these conditions, $t_b \le t \le t_c$ the beginning and end of work in places where goods are accepted. For this reason, when planning the exploitation of vehicles, it is necessary to determine the preparation of a special place for unloading goods at the points of acceptance, for this purpose, the calculation procedures for the following conditions are carried out [5, 6]:

$$T_Д \le t + T_{ap}\,, \tag{3}$$

where $T_д$ – is the ready time for taking the cargo brought by the car; T_{ap} – time periods of vehicles with cargo.

If the place for unloading is not ready during the arrival of the car with cargo, then it can stand, such downtime is denoted as *h*, and they can be planned as a step-by-step table of movements. If such a condition is met and preserved, then the plan for using cars can be called $t > t_c$ complete as well. If several cars are used to provide transportation services or work, the preparation of mechanisms for unloading goods and their free state affects the efficiency of vehicle exploitation, so a working table or schedule of vehicles is performed depending on the productivity of unloading mechanisms [7, 8].

To do this, the following requirements must be met:

$$t_{tkd} \le t - T_{abz} - \frac{\delta_{min}}{W_{TK}} - T_{kz}\,, \tag{4}$$

where t_{tkd} – ready time for loading loads of loading devices; T_{abz} – time from the loading of car's cargoes to the destination; δ_{min} – the lowest load carrying capacity of vehicles involved in the exploitaton of the vehicle; $W_{mк}$ – productivity of loading devices; T_{kz} – time spent on additional work when loading cargo.

After determining the schedule of movement, in the period of t-time, depending on the brand of the car, places for unloading and loading are prepared. For this purpose, using this equation, platform and places of loading unloading are prepared or the type and brand of car is selected in accordance with the width of the site [9-11]

$$t_{i\xi} \le t - 2T_{abzi} - 6g/W_{TZ} - T_d,\quad T_Z \le t - T_{aвz} - t_i\,, \tag{5}$$

where t_i – the period of the last unloading of cargo; T_Z – the time of the planned movement of the vehicle or the operation of vehicles; $T_{aвz}$ – the time of movement of the vehicle from a fixed place to a load of cargo; $t_{i\xi}$ – car start time.

Therefore, managers and specialists of the motor company, in accordance with the type of order, distance and preparation of goods, prepare specific vehicles to ensure the effective implementation of the order, decide to take as much benefit and profit from their movement.

The aim of the work is to study the basic requirements imposed on such systems was their high controllability in the changing external conditions of exploitation with guaranteed achievement of a given result for road transport enterprises.

Research of the system's solutions. The reliability and control of the exploitation of vehicles is influenced by the cost and change of tariff in the market of transport services.

Basically, the establishment of the tariff depending on the distance traveled is calculated on the make of cars and long-distance roads, on the types of cargo and carrying capacity.

Tariff setting depending on the distance traveled, it takes place by concluding a contract on a bilateral basis, after the customer has determined what type of vehicle it is for. Tariff set by time is assigned for 1 hour, 2 hours or 1 business day. The cost of operating vehicles is determined by the formula:

$$C_m = \left\{C_{oc}\frac{L}{g} + C_{const}\left(\frac{L}{V_m} + t_{mm}\right)\right\}/G_s\,, \tag{6}$$

where C_{oc} – is the sum of working capital spent per 1 km of the car, tenge; L – distance, km; g – mileage utilization factor; C_{const}– amount of permanent funds spent per 1 km of the vehicle tenge; V_m – technical speed of the vehicle, km/h; t_{mm} – downtime for loading and unloading the car, h.; G – load capacity, t; S – the utilization rate of the vehicle.

The profitability of the exploitation of vehicles per 1 ton of cargo is determined by the formula:

$$r_m = \frac{d_m - C_m}{C_m} * 100\ , \tag{7}$$

where *dm* – the rate of motor transport exploitation per 1 ton of cargo.

The pre-planned rate of vehicle exploitation or profitability is calculated as follows:

$$d_m = \frac{C_m(r_m+100)}{100}\ . \tag{8}$$

As given in the equations above, the volume of profits lost during downtime of cars in the process of vehicle exploitation is restored at the expense of the customer. This circumstance must be fully agreed by the customer in advance, as well as discuss the cost of services in advance. Considering such possible unexpected cases of downtime, the cost of providing transportation services is determined by the formula:

$$B = C_{mb} + T * C_{mm} + P * C_{tkm}\ , \tag{9}$$

where C_{mb}– the order rate, tg; T – car time spent at the customer, hours; C_{mm} – fare free downtime of car for 1 hour during loading and unloading tg/h; P – volume of work performed, tkm; C_{tkm} – the rate of use of the car for 1-tg / tkm.

Tariffs are not only a task of economic production and internal planning of a motor transport enterprise.

Reduces of the tariff or reduces of the cost of transport services by reducing the distance between the fixed location or temporary parking of cars and loading points, however, the amount of funds allocated for the organization of temporary parking and material and technical base should ensure the receipt of the planned amount of profit.

Therefore, for organizing a temporary parking lot from a material and technical base, motor transport enterprises need many special organization procedures, shown below in figure 1.

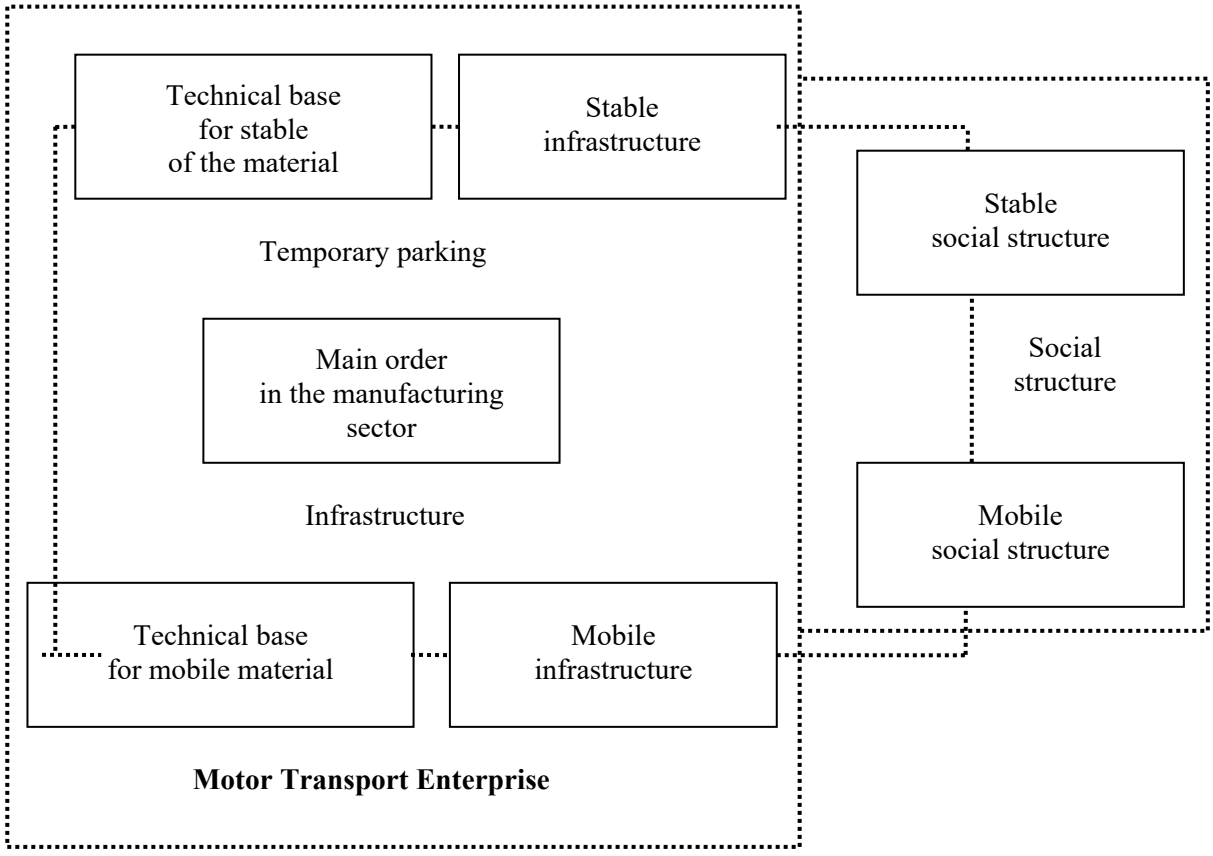

Figure 1 – Scheme of the organization of the material and technical base of the temporary parking lot of the motor transport enterprises

As shown in figure 1, for the effective use of any vehicles, special temporary parking, facilities and devices for their technical repair and maintenance, storage space for spare parts, places for food and rest for drivers and workers are needed. And also, by concluding a clearly defined bilateral agreement between the customer and the vehicle exploitation, also consider additional actions and procedures that benefit both parties.

It is well known that all technologies and equipment require technical repair and maintenance, replacement of spare parts and tools for cars in the required period. Therefore, to ensure continuous improvement of technical training of vehicles, it is necessary that there is a special material and technical base nearby. That is, to ensure the financial efficiency of the motor company, you need to be able to maintain the conditions of its internal dynamic mechanisms.

The figure 2 below shows a schematic diagram of the organization and management of trucks at the facility.

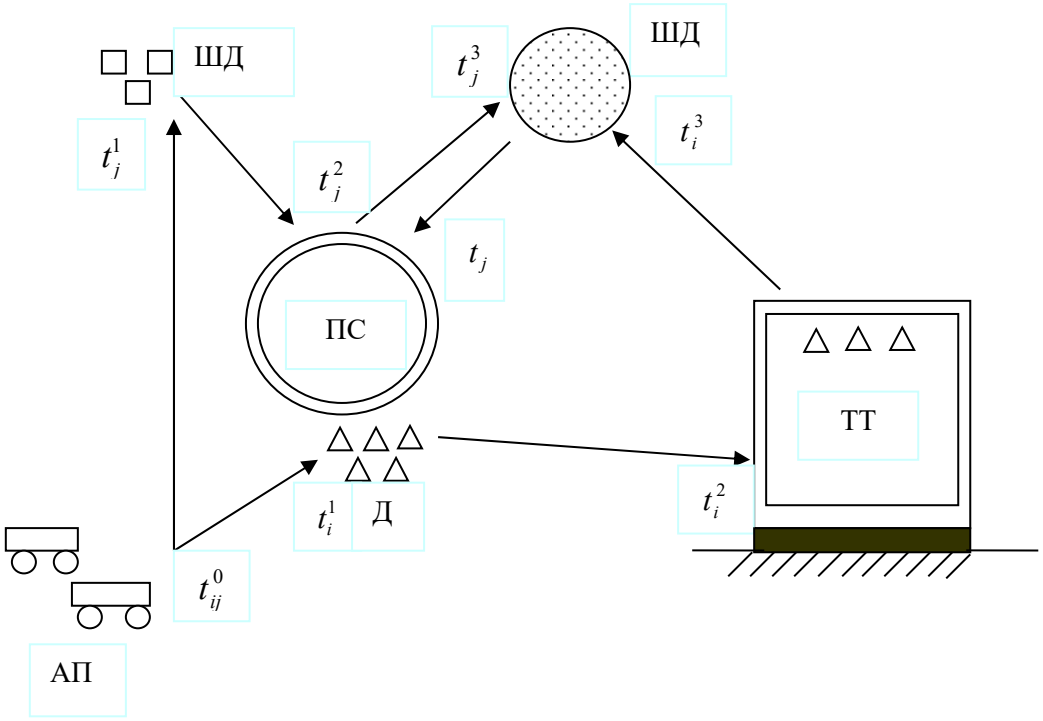

Figure 2 – Schematic diagram of the organization at the facility,
where АП is the motor transport enterprise; ПС – producers of raw materials; manufacturers of finished products;
Д – finished products; ШД is the location of the manufacturer of the necessary semi-finished products and raw materials

The construction schedule of a specific object is designed in such a way that the builders need to deliver the finished construction materials in a timely manner in the right amount and quantity. The facility has no place or warehouse for storage of building materials. 38 trucks, in particular, 20 KAMAZ dump trucks, 8-on-board KAMAZ trucks, 5 Gazel cars, 3 Gas-53 dump trucks, and 2 truck cranes based on Zil, were attracted to service the construction site.

However, for the organization of temporary parking and points additional costs are required, the amount of which is determined by the formula:

$$P_1 = \sum_{i=1}^{k} m_1 L_{ij} = A_1 , \tag{10}$$

and the intensity of the operation of transport processes is determined by the following formula:

$$I_1 = \sum_{i=1}^{k} m_1 L_{ij} / t_1 = A_1 / t_1 , \tag{11}$$

where k – the indicator of the necessary material and technical values for the organization of temporary stops and points; m – motor vehicle exploitation; the possibility of a motor transportation enterprise.

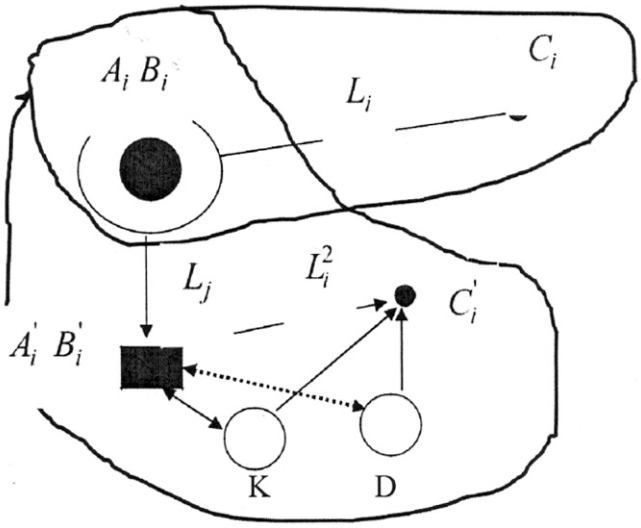

Figure 3 – The proposed scheme of organization of exploitation of trucks, where (Ai) is a construction company (Bi) is an auto transport enterprise (Ci) is a warehouse of building materials and Li is the distance between objects

Table 1 – Estimated cost of organizations of temporary parking lots

No.	Rented main assets (container)	Total sum for a month, doll. USA
1	Power Supply (kitchen, dining room)	800,0
2	Dormitory for 15 people	800,0
3	Repair room	800,0
4	Room for rest and meeting room	800,0
5	Electrical station	900,0
6 7	petrol, oil and lubricants. (15 litre a day – 100 tg./litre)	300,0
8	linen	600,0
9	groceries (1000tg/24 hours)	3000,0
10	Unexpected costs	800,0
11	In total	8 800,0

The total monthly amount of expenses required for organizations and the maintenance of temporary parking lots is $ 11,050.0.

For comparison, let us consider the cost of trucks for servicing customer sites depending on the distance of the location of motor transport enterprises. Fuel consumption is -40 l / 100 km, the cost of fuel is 110 tg / l, other costs of the car, taking into account the driver's wages, are taken as 20% of the cost of fuel, so the present value of the fuel is 132 tg / l or $ 60.

Table 2 – Estimated cost of mileage cars at the present value

No.	Amount of cars	10 km	20 km	30 km	40 km	50 km	60 km
1	5	120,0	240,0	360,0	480,0	600,0	720,0
2	10	1200,0	2400,0	3600,0	4800,0	6000,0	7200,0
3	15	1320,0	2640,0	3960,0	5280,0	6600,0	7920,0

If we take into account that the calculation was made at one end, the total cost is multiplied by two, then the chart of the cost of downtime of mileage of vehicles from the motor company to the customer's facility looks like this.

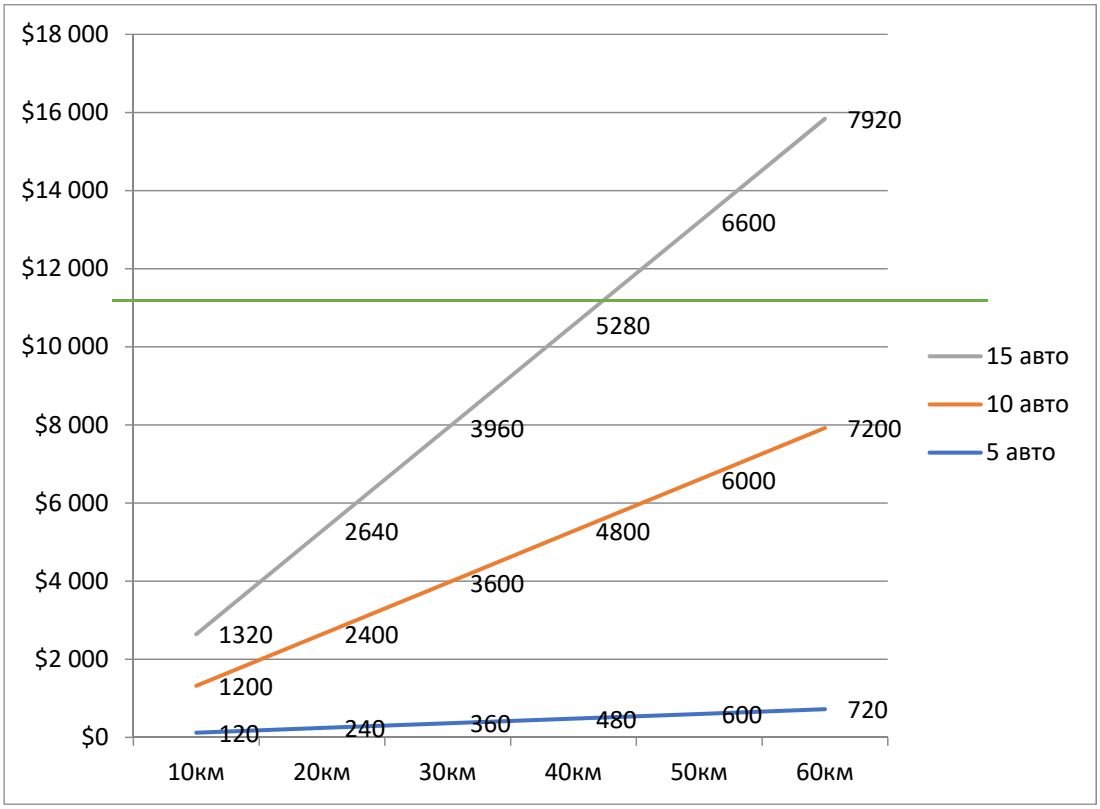

Figure 4 – The cost of trucks from the distance of the location of the ATP and the object:
1 – total amount of costs for temporary parking

As can be seen their schedule, if the distance exceeds more than 40 km, it is beneficial for the management of a motor transport company to organize special maintenance and car repair points, a point for rest and catering for drivers and repairmen, as well as other persons involved in a specific task. Organized in the place where the main motor transport enterprise is located and in the vicinity of the main construction site at a distance *Lj* a temporary parking of material and technical base. All automobiles participating in the exploitation of motor transport, all drivers and technical workers are located in this parking lot and all housing and social conditions are organized for them. If the place needed for construction is named (K), and the place of use of motor vehicles for construction materials (D), then their distance should not increase the amount of free vehicle downtime.

The results of the implementation of the proposed system of management of motor vehicle exploitation of trucks. Below the economic indicators of Bastau LLP for the reporting year, the income from motor transport services decreased by 13,658.0 thousand tenge, that is, by 35.3%, and the cost of services rendered, on the contrary, increased by 10,305.5 thousand tenge. The reason for this growth can be explained by the increase in material costs by 7,684, 0 thousand tenge. And if the total income in 2017 amounted to 7601.0 thousand tenge, then in 2017, the company received a loss of 16 363.0 thousand tenge.

The reason for this is the increase in recurring expenses by 2,585.3 thousand tenge, as a result of which the loss from the main work amounted to 21,674.3 thousand tenge, and the income from non-core work in 2017 amounted to 16380.8 thousand tenge. The total income based on the results of 2015 showed a loss of 4,875.0 thousand tenge, and in 2017 5,293,500 tenge.

The average number of employees on the list decreased by 4 people, and the payroll fund decreased by 56.8 thousand tenge, however, the average annual salary of employees, by contrast, increased by 1.9 thousand tenge, which is explained by a decrease in staff.

The average annual value of fixed assets increased by 10,626.0 thousand tenge, that is, by 62 percent, but the return fund decreased by 1.25 tenge, which is 60 percent.

The reason for the decline is associated with a decrease in the volume of services rendered. In this regard, we analyze the impact of fixed assets on the scope of the provision of automotive services for motor vehicles.

The amount of profit as a result of using the proposed management system exceeded 10,000,000 tenge, the profitability of the company compared to 2015, according to the report for 2017, increased from 22.55 to 32.69, labor productivity increased by 12 percent.

Conclusion. In accordance with the general theory of systems, a local transport system can be defined as an extended integrated transit system. Produced studies allow us to draw the following main conclusions:

– Creation of the scientific basis for the development of the organization and management of the motor transport enterprise and new technologies give the economy of Kazakhstan a new level of quality of motor transport services, which will lead to a decrease in the level of transport expenses in the republic's GDP by 20-25%.

– Implementation of the results of the study to improve the reliability of the system of managing the exploitation of the vehicle fleet allowed to obtain, according to preliminary calculations, the economic effect of more than 10 million tenge, the enterprise profitability was 32.69% against 22.55 in 2017 and productivity increase by 12%.

Н. Сабралиев[1], З. Турсымбекова[2], Р. Мусалиева[2],
Ж. Байбураева[2], И. Таран [3], Е. Карсыбаев[2], Ж. Жанбиров[2]

[1]Л. Гончаров атындағы Казақ автокөлік-жолдары академиясы, Алматы, Казахстан,
[2] М. Тынышбаев атындығы Қазақ көлік және коммуникациялар академиясы, Алматы Казахстан,
[3]Ұлттық техникалық университет, Днепр, Украина

АВТОМОБИЛЬДЕРДІ ПАЙДАЛАНУ ЖӘНЕ БАСҚАРУ ЖҮЙЕСІНІҢ СЕНІМДІЛІГІ МЕН ТИІМДІЛІГІН АРТТЫРУ ӘДІСТЕРІ

Аннотация: Автокөлікті пайдалану, оңтайлы басқару жүйесін іздеу, әдісі ұсынылған. Автопаркті пайдалануды басқару жүйесінің сенімділігін арттыру бойынша зерттеу нәтижелерін енгізу алдын ала есептеулер бойынша 10 млн теңгеден астам экономикалық тиімділікті алуға мүмкіндік берді, кәсіпорынның рентабельділігі 2017 жылғы 22,55 қарағанда 32,69%-ды құрады және өнімділік 12%-ға артты.

Түйін сөздер: автомобиль көлігі, факторлар, талдау, әлеуметтік экономика, жоғарылату, сенімділік, тиімділік, бухгалтерлік есеп, қаржы

Н. Сабралиев[1], З. Турсымбекова[2], Р. Мусалиева[2],
Ж. Байбураева[2], И. Таран [3], Е. Карсыбаев[2], Ж. Жанбиров[2]

[1]Казахская автомобильно-дорожная академия им. Л. Б. Гончарова, Алматы, Казахстан,
[2]Казахская академия транспорта и коммуникации им. М. Тынышпаева, Алматы, Казахстан,
[3]Национальный технический университет, Днепр, Украина

МЕТОДЫ ПОВЫШЕНИЯ НАДЕЖНОСТИ И ЭФФЕКТИВНОСТИ СИСТЕМЫ УПРАВЛЕНИЯ ЭКСПЛУАТАЦИИ АВТОМОБИЛЕЙ

Аннотация. Предложен метод поиска оптимальной системы управления, эксплуатации автомобиля. Внедрение результатов исследования по повышению надежности системы управления эксплуатацией автопарка позволило получить, по предварительным расчетам, экономический эффект более 10 млн тенге, рентабельность предприятия составила 32,69% против 22,55 в 2017 году и производительность увеличилась на 12%.

Ключевые слова: автомобильный транспорт, факторы, анализ, социальная экономика, повышение, надежность, эффективность, бухгалтерский учет, финансы.

Information about authors:

Sabraliev N., Professor, Candidate of Technical sciences, Kazakh Automobile and Road Academy Named after L.B. Goncharov, Almaty, Kazakhstan; sabraliev51@mail.ru, https://orcid.org/0000-0002-2950-5315

Tursymbekova Z. Zh., Professor, Candidate of Technical sciences, Kazakh Academy of Transport and Communications named after M. Tynyshpaev, Almaty, Kazakhstan; zakira220171@mail.ru; https://orcid.org/0000-0001-6483-5451

Musalieva R., Assistent Professor, Candidate of Technical sciences, Kazakh Academy of Transport and Communications named after M. Tynyshpaev, Almaty, Kazakhstan; zhasmin_06@mail.ru; https://orcid.org/0000-0001-8867-9932

Baiburaeva J. A., master of science, Kazakh Academy of Transport and Communications named after M. Tynyshpaev, Almaty, Kazakhstan; Janna76077@mail.ru; https://orcid.org/0000-0002-7848-7782

Karsibaev E., Professor, Doctor of Technical sciences, Kazakh Academy of Transport and Communications named after M. Tynyshpaev, Almaty, Kazakhstan; erzhlogist@mail.ru; https://orcid.org/0000-0001-7942-716X

Zhanbirov Zh., Professor, Doctor of Technical sciences, Kazakh Academy of Transport and Communications named after M. Tynyshpaev, Almaty, Kazakhstan; janbirov_jg@mail.ru; https://orcid.org/ 0000-0002-6444-0836

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