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THE IMPACT OF THE TECHNICAL CHARACTERISTICS OF MOTOR VEHICLES ON THE EFFICIENCY OF THE COMPANY

This article explores the issue of vehicle efficiency based on its technical characteristics. The aim of the study is to identify the most important technical parameters affecting the efficiency of road transport. The direction of scientific research was to determine the optimal characteristics of the car to achieve maximum efficiency.

Maintenance takes an important place in the operation of vehicles, and is also aimed at reducing risks during transportation, since unplanned stops due to repairs can disrupt delivery times. The importance of the work lies in determining methods for calculating the efficiency of vehicles based on their technical characteristics. The methodological basis of the study is a comprehensive system of scientific methods used in the study of the subject of research.

The main result of the research work was the definition of a method that allows you to choose a car that will be more efficient during operation for transporting cargo. It is proposed to break down the cars by makes and models, indicate the range at the start of work in the year, the planned weight and mileage. The obtained information makes it possible to determine the number of repairs between runs and the possibility of determining the need for overhaul of the vehicle. While the vehicle is under repair, its productivity decreases accordingly.

The value of this study lies in determining the ability to choose a vehicle taking into account its technical characteristics, the frequency of maintenance, which ultimately affects the performance of vehicles, and for the company to generate income.

The practical significance of the results of the work done is due to the fact that transport companies, which take full responsibility for transportation, can practically apply the results of this study and determine more efficient vehicles, based on the fact that the company's fleet is often worn out.

Key words: transportation, logistics, modeling, maintenance, efficiency.

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Автокөлік құралдарының техникалық сипаттамаларының компания жұмысының тиімділігіне әсері

Бұл мақала автокөліктің техникалық сипаттамалары негізінде оның тиімділігі мәселесін зерттейді. Зерттеудің мақсаты автомобиль көлігімен тасымалдау тиімділігіне әсер ететін ең маңызды техникалық параметрлерді анықтау болып табылады. Ғылыми зерттеудің бағыты максималды тиімділікке жету үшін автомобильдің оңтайлы сипаттамаларын анықтау болды.

Техникалық қызмет көрсету көлікті пайдалануда маңызды орын алады және тасымалдау кезінде тәуекелдерді азайтуға бағытталған, өйткені жөндеуге байланысты жоспарланбаған аялдамалар жеткізу мерзімдерін бұзуы мүмкін. Жұмыстың маңыздылығы оның техникалық сипаттамалары негізінде автокөліктің тиімділігін есептеу әдістерін анықтауда жатыр. Зерттеудің әдіснамалық негізі зерттеу тақырыбын зерттеуде қолданылатын ғылыми әдістердің кешенді жүйесі болып табылады.

Ғылыми-зерттеу жұмысының негізгі нәтижесі жүкті тасымалдау үшін пайдалану кезінде ең тиімді болатын көлікті таңдауға мүмкіндік беретін әдісті анықтау болды. Көліктерді маркалар мен модельдер бойынша бөлу, жыл басындағы диапазонды, жоспарланған салмақ пен жүгірісті көрсету ұсынылады. Алынған ақпарат жүгірістер арасындағы жөндеу санын және көлік құралын күрделі жөндеу қажеттілігін анықтауға мүмкіндік береді. Көлік жөнделіп жатқанда, оның өнімділігі төмендейді.

Бұл зерттеудің құндылығы оның техникалық сипаттамалары мен техникалық қызмет көрсету жиілігін ескере отырып, көлік құралын таңдау мүмкіндігін анықтау болып табылады, нәтижесінде бұл көліктің өнімділігіне және компания үшін табыс табуға әсер етеді.

Атқарылған жұмыс нәтижелерінің практикалық маңыздылығы өздеріне тасымалдау үшін барлық жауапкершілікті алатын көлік компаниялары осы зерттеудің нәтижелерін іс жүзінде қолдана алатындығына және компанияның автомобиль паркі көбінесе айтарлықтай тозғанына сүйене отырып, тиімдірек Көлік құралдарын таңдай алатындығына байланысты.

Түйін сөздер: көлік, логистика, модельдеу, техникалық қызмет көрсету, тиімділік.

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Влияние технических характеристик автотранспортных средств на эффективность работы компании

Данная статья исследует вопрос эффективности автотранспорта на основе его технических характеристик. Целью исследования является выявление наиболее важных технических параметров, влияющих на эффективность перевозок автомобильным транспортом. Направлением научного исследования стало определение оптимальных характеристик автомобиля для достижения максимальной эффективности.

Техническое обслуживание занимает важное место в эксплуатации транспорта и направлено на снижение рисков во время транспортировки, так как незапланированные остановки из-за ремонта могут нарушить сроки доставки. Значимость работы заключается в определении методов расчёта эффективности автотранспорта на основе его технических характеристик. Методологической основой исследования является комплексная система научных методов, использованных при изучении предмета исследования.

Основным результатом научно-исследовательской работы стало определение метода, позволяющего выбрать автомобиль, который будет наиболее эффективен во время эксплуатации для перевозки груза. Предлагается провести разбивку автомобилей по маркам и моделям, указать запас хода на начало работы в году, планируемый вес и пробег. Полученная информация позволяет определить количество ремонтов между пробегами и необходимость проведения капитального ремонта транспортного средства. Пока транспортное средство на ремонте, его производительность снижается.

Ценность данного исследования заключается в определении возможности выбора транспортного средства с учётом его технических характеристик и частоты технического обслуживания, что в итоге влияет на производительность автотранспорта и, для компании, на получение дохода.

Практическая значимость результатов проделанной работы обусловлена тем, что транспортные компании, берущие всю ответственность за перевозки на себя, могут практически применить результаты данного исследования и выбрать более эффективные транспортные средства, исходя из того, что автомобильный парк компании зачастую значительно изношен.

Ключевые слова: транспорт, логистика, моделирование, техническое обслуживание, эффективность.

Introduction

Determining the operating efficiency of automobiles in an enterprise based on the characteristics of automobiles is an important and related topic in many organizations. This will improve the efficiency of car park operations, reduce costs, reduce pollutant emissions, increase competitiveness and increase the company's overall productivity. The efficiency of automobile cargo transportation services lies in the organization of the transportation process, technical indicators and the use of mobile configuration. Efficiency can be evaluated based on the scale and quality of the work. The efficiency of automobile transportation lies in the organization of transportation and technical .

An indicator of the effectiveness of dynamic configuration. Efficiency can be evaluated based on the quantity and quality of the work performed (Jian et. al., 2017). By reducing travel time, transportation makes our lives easier. Transportation is an important part of logistics. All functions depend directly on it. In the logistics chain, all buildings are indirectly or directly related to transportation. The time required for the transportation of goods, transportation costs, transshipment, and paperwork of goods is a logistics process.

Automobile transportation is an important factor in the country's economic development. All processes directly depend on the decision-making of various industries: technology, management and organization.

An is a pandemic that has spread to all business sectors, affecting the economy of every country. The logistics department suffered the least losses because grocery stores (the only fully operational group of companies) had normal supplies. Therefore, the goods will have to be delivered to the store and the manufacturer will continue its work. Manufacturers need raw materials.

The production process directly depends on the transportation logistics. Timely decision-making is an important factor that has a significant impact on logistics during the pandemic. This is very important for the efficiency of automobile transportation (Anikin, 2021).

The purpose of this research is to determine the most important factors and factors that affect the efficiency of automobile traffic, as well as to determine the optimal performance of the automobile to obtain maximum efficiency. Research subjects include the following tasks:

- analysis of technical characteristics of cars, such as engine power, fuel consumption, weight, aerodynamic parameters and other parameters;
- research on the environmental performance of cars, such as emissions of harmful substances and carbon dioxide;
- identification of the needs and preferences of consumers in relation to the characteristics of the car related to its efficiency;
- comparative analysis of different car models based on their characteristics to determine the most effective option.

The object of the study is automobile transport and transport companies the subject of the study is the efficiency of automobile transport according to its characteristics.

Literature review

Many researchers have conducted and continue to study the effectiveness of autonomous transportation by analyzing its various characteristics. In the scientific paper of Volkov V.S., Butorina T.A and Filatova G.M. (2013) technical and recycling indicators established that affect the efficiency of automobile transportation operations, divided into two groups:

- coefficients of technical readiness, release and use of rolling stock; coefficients of utilization of load capacity and mileage, average distance of travel with cargo and average distance of transportation; idle time under loading and unloading, time in the outfit, technical and operational speeds;
- the number of rides, the total distance of transportation and mileage with cargo, the volume of transportation and transport work.

The most important tool ensuring the constant high readiness of the vehicle for transportation is timely maintenance and repair. Maintenance is the main component of risk reduction in the organization of transportation, namely technological and technical functions such as:

- washing;
- cleaning work;
- bracing;
- regulation;
- timely lubrication;
- troubleshooting (Kaplan et. al., 2016).

Authors (Rassadnikova, 2013) to choose a rational route, a modified neighbourhood variable search algorithm is used. In order to solve routing problems with time windows, the following algorithms are of the greatest interest: search with exceptions (Laporte, etc., 1998), a genetic algorithm (Jeon, etc., 2007), an algorithm based on ant colonies (Jian, 2024) and neural networks (Haykin, 2009), simulated and deterministic annealing (Osman et al., 1993) search for a variable neighbourhood (Mladenovic et al., 2018).

Modern vehicle maintenance and repair research emphasizes the importance of integrating innovative methods and technologies to improve fleet reliability, optimize costs, and reduce environmental impact.

Fleet renewal and vehicle lifecycle (Russo, 2020) has a relationship between fleet renewal, repair costs and car lifecycle. Taking into account the operational characteristics of vehicles in the process of updating the fleet will minimize repair costs and increase overall operational efficiency. Emissions monitoring and environmental aspects (Khalil, 2019) also have an impact on repair work, on compliance with environmental standards for vehicles. When analyzing the emission monitoring system, a connection is observed with the technical condition of the engines. Therefore, transport companies are encouraged to improve repair processes, both for transport efficiency and for compliance with environmental requirements.

In the era of modern innovative technologies, applied innovations are used in repair management

(Bandyopadhyay, 2019). For example, the engineering methods of reliability used are applied in repair management systems. Optimization approaches are used to manage service processes aimed at reducing operational downtime and improving economic efficiency.

Real-time monitoring systems (Young, 2020) can assess the condition of vehicles. Predictive analytics can improve fleet reliability and speed up repair decisions.

Various parts inventory management systems (Morsali, 2018) allow for a hybrid model that takes repair cycles into account. This approach helps to improve the availability of spare parts, reduce costs and increase the efficiency of repair work.

Intelligent systems and vehicle diagnostics (Ioannou, 2021) influence predictive repair strategies. The role of sensors and machine learning algorithms in accurate fault diagnosis is increasing.

Control of technical parameters (Filimonov, 2022) are aimed at diagnosing malfunctions of vehicles with high carrying capacity. It is necessary to strictly control the technical parameters to increase the reliability of the operation of vehicles.

Predicting failures is important for the efficient operation of transport work (Wang, 2021) This approach increases the accuracy of diagnostics and allows better planning of repair work. In the future, this will avoid downtime of vehicles.

IoT and real-time repair (Jones, 2017) is applied to monitor vehicle health. Sensors are installed on more important units that transmit their operational state in real time. This will allow timely identification of repair needs, reducing operating costs.

Modern research confirms the importance of applying innovative technologies (Al-Ali, 2023) such as IoT, deep learning and predictive analytics in vehicle maintenance and repair. They help improve transport reliability, optimize costs and minimize environmental impact.

Methodology

The solution of problems involves the selection of comprehensive research methods, the sufficient nature of the phenomenon to be studied and specific research tasks: analysis, logical reasoning, induction, description, observation, statistical methods, etc.

General scientific research methods:

1. analysis – decomposition of a study object into components to study its structure;
2. deduction and induction are methods of logical thinking used to formulate conclusions;
3. description – systematization of object characteristics;
4. statistical methods – for quantitative analysis of transportation characteristics.

Trajectory is a wrong indicator, which requires some factors that must be considered in order to make the most accurate prediction (Volkov, et. al., 2013). For example, road infrastructure, road quality, unpredictable road construction. To report changes traffic volume, you need to add a road map and other help on the way.

According to the planned production plan of the mobile phone assembly repair program, the information contained in the original production plan is:

- real estate located in the city center;
- characteristics of the production base;
- technical usage meter characteristics.

In the case of road transport, the load is taken into account in tons and ton-kilometers. Currently, three indicators are being analyzed in the industry:

- cargo volume in tons;
- cargo turnover in tonne-kilometers;
- total mileage in kilometers (Chiou, et. al., 2015).

Methods for calculating the efficiency of vehicles:

1. Method based on daily performance of one vehicle:

- calculation of daily power (capacity);
- extrapolation per year taking into account the fleet utilization rate and days of operation;
- Summarizes the characteristics to evaluate by company, region, or country.

2. Method based on the performance of one midlist autotone:

- calculation of annual productivity of one autotone in tons and ton-kilometers;
- multiplication by the carrying capacity of the average number of cars to obtain an annual plan.

The first two indicators are indicative, but this does not mean that they should not be economically justified.

These characteristics of the mobile reservoir extraction study can be calculated using two methods (annual averages):

- based on the daily work plan of the car;
- annual performance plan based on automatic averaging.

Methods of performance evaluation. First, calculate the daily power (that is, it has been an annual function, and the daily productivity of the car has doubled: the number of days of use has increased the coefficient of use of parking spaces. Then summarize the annual performance of individual cars and determine the entire operation process of the automatic transmission group. This method is the most convenient.

By analyzing the company's operations and efficiency, the scope of this method can also be expanded by selecting objects from different car parks such as cities, regions, and countries.

Another way. First, it is necessary to calculate the average annual productivity of automobiles in tons and ton kilometers. Then by multiplying the average annual vehicle productivity index by the average number of cars in Georgia, the annual plan is determined on the basis of appropriate indicators (Hyde, et. al., 2017).

Taking into account individual operators, it can be seen from the example of company analysis that each method is used to calculate the characteristics of a company's production plan with an active mobile configuration, and then scale to the size of the company.

Applied methods:

- economic analysis: assessment of traffic volume and substantiation of indicators;
- Planning and scaling: Create long-term plans and KPIs for fleets at company, city, or country levels.

The study was conducted taking into account the following main provisions:

- the development of freight transportation, taking into account the main trends in the current cargo turnover;
- determining the effectiveness of a vehicle depending on its technical characteristics;
- modeling the process of delivering goods to consumers and the impact of vehicle serviceability on delivery time.

Parameter's year of manufacture, mileage and carrying capacity directly affect the efficiency, reliability, efficiency and safety of cargo transportation. Their analysis allows you to optimally select transport for specific tasks, minimize risks and increase the profitability of transportation. An example of a formula:

$$N_{c.r.} = \frac{L_{tot}}{L_{a.m.}} \quad (1)$$

where:

$N_{c.r.}$ – the number of major repairs;

L_{tot} – total mileage (by brand) for the planned period;

$L_{a.m.}$ – average daily mileage, length.

$$N_{t.s.-2} = \frac{L_{tot}}{L_1 - N_{c.r.}} \quad (2)$$

where:

$N_{t.s.-2}$ – number of technical services №2 and №1 for the planned period;

L_{tot} – total mileage (by brand) for the planned period;

L_1 – the mileage rate between TS-2, TS-1;

$N_{c.r.}$ – the number of major repairs.

$$N_{t.s.-1} = \frac{L_{tot}}{L_2} - (N_{c.r.} + N_{t.s} - 2) \quad (3)$$

where:

$N_{t.s.-1}$ – number of technical services №2 and №1 for the planned period;

$N_{t.s.}$ – technical maintenance;

L_{tot} – total mileage (by brand) for the planned period;

L_2 – the mileage rate between TS-2, TS-1;

$N_{c.r.}$ – the number of major repairs.

If you take into account the number of renewals, then don't forget to maintain and replace consumables. The problem may also be that there may be no spare parts. Truck drivers often buy second-hand parts, which is due to the fact that it was in freight vehicles until 2000. There is no New Year at all. Donors use spare parts for old and new machines. This can also affect transportation delays during maintenance, which has a negative impact on time. Therefore, it is recommended to use and purchase parts at the same time as transportation.

The data in relation to the number of services per day and the days of operation will be calculated.

Table 1 – The planned amount of daily car maintenance

	Total mileage	Frequency TS – 2	Frequency TS – 1	Planned number of major repairs	By car – working days in the planned year
ZIL – 555	69600 thous.	11000 км	2200 км	2	274
KAMAZ	96100 thous.	11000 км	2200 км	4	548
UAZ- 452	95400 thous.	11000 км	2200 км	2	274
Note – compiled by the author based on sources (kolesa.kz, 2024)					

Table 2 – The outcome of the data in relation to the number of services per day and the days of operation

Name	ZIL – 555	KAMAZ	UAZ – 452
Quantity TS – 2	69600/11000-2 = 4	96100/11000 -4 =5	95400/11000-2 = 7
Quantity TS – 1	69600/2200 – (4+4) = 24	96100/2200 – (4+5) = 35	95400/2200 – (2+2) = 34
The number of daily maintenance, by car-days	274	548	274
Note – compiled by the author based on sources (kolesa.kz, 2024)			

The bill stipulates that the daily planned maintenance of the car is equal to the planned indicators of vehicle activities during the day. As the second step in studying the efficiency of car use, consider planning maintenance and repairs during downtime, which will reduce the efficiency of any car park. It is necessary to calculate the days when the car stops for repair (precautions):

duration of the maintenance break;

maintenance downtime (Zhang, et. al., 2019).

Other types of services are provided between shifts when the car is not in use and are therefore excluded. They are completely ignored. During maintenance and repair, the downtime of rolling components can be calculated according to the formula:

$$ST_r = \frac{N_c * D_c + L_{tot}}{1000 + I_{t.s.}} \quad (4)$$

where:

ST_r – stoppage time;

N_c – number of capital repairs;

D_c – duration of major repairs, calendar days;

L_{tot} – total mileage of cars, km;

$I_{t.s.}$ – the duration of vehicle downtime during maintenance and current repairs, days per 1000 km of mileage.

Based on this, it is possible to obtain standards for downtime of transport during major repairs and the time taken by transport during maintenance, starting from oil change in the engine and ending with the replacement of pipes, wires from the electrical component. Maintenance plays an important role in the operation of transport, since the frequency coefficient of the stay of transport under major repairs directly depends on it:

Table 3 – Transport downtime standards for capital and maintenance

The brand of the car	Total mileage	The rate of downtime during major repairs	The downtime rate for TM – 2 per 1000 km.
ZIL – 555	69600км.	0,7 day	0,1 day
KAMAZ	96100 км.	1 day	0,2 day
UAZ – 452	95400 км.	0,6 day	0,1 day
Note – compiled by the author based on sources (Kolesa.kz, 2024)			

As part of the study, other car brands can be evaluated, but these variations were chosen due to the fact that their characteristics are more accessible, since they are the most relevant and exploited on the scale of urban transport, therefore. The procedure and method of drawing up a production program for the operation of rolling stock for cars operating on piece-rate payment, consider the example of a car farm (see Table 4).

Table 4 – Data from the production program of the motor transport industry for the operation of rolling stock for the planned year

Indicators	Total	including		
1	2	3	4	5
Average number of cars, units	4	1	2	1
The average length of stay of the car in the outfit, h	8	8	8	8
Car park utilization rate	0,75	0,75	0,75	0,75
Mileage utilization factor	0,9	0,9	0,85	0,9
Load capacity utilization factor	0,9	0,9	0,9	0,8
Technical speed, km/h	50	50	50	50
Downtime during loading and unloading per ride, h	0,8	0,8	1	0,65
Average distance of cargo transportation, km	60	50	80	50
Continued table 4				
Output per average tonne of load capacity:				
Thous. t	0,8	0,8	0,85	0,8
Thous. km	49,2	47,5	54,2	46,0
The load capacity of the car park, t	9	5,5	26	3
Transportation volume, thousand tons	9	5,2	18	3,1
Cargo turnover, thousand tkm	616	258	1436	154
Total mileage, thousand km.	95	70	144	72
Including mileage with cargo, thousand km	84	63	130	58
Note – compiled by author based on sources (Kolesa.kz, 2024)				

When planning, the first method first determines the indicators of the daily productivity of one car: the volume of traffic (in tons), cargo turnover (in tkm.) and the average daily mileage (in km.). Based on the data given in Table 3, we will calculate the daily productivity indicators. The average daily mileage can be determined by the formula:

$$L_{cc} = \frac{T_n + V_t + I_{car}}{t_i + 1_{car} * V_t * B} \quad (5)$$

where:

L_{cc} – average daily mileage, km;

T_n – the average duration of operation of the car in a shift, h;

V_t – speed, km/h;

I_{car} – average distance of a trip with cargo, km;

t_i – downtime during loading and unloading, h;

B – the coefficient of effective mileage of the car.

Substituting the values into the formula, then determine the average daily mileage:

Table 5 – Average daily mileage indicators

	ZIL – 555	KAMAZ	UAZ – 452
Calculation	Lcc = 8 * 50 * 50 / 50 +0,65 * 50 * 0,70 = 274,9	Lcc = 8 * 50 * 65 / 65 + 0,65 * 50 * 0,70 = 296,3	Lcc = 8 * 50 * 50 / 50 + 0,65 * 50 * 0,80 = 240,1
Note – compiled by the author based on sources (Kolesa.kz, 2024)			

Then the annual production program for all trucks is determined. The annual performance indicators of the plan are determined by the product of the productivity of one unit per day for days in operation. The formula has the following form:

$$A_e = P_u * 365 * K_{f.u.} \quad (6)$$

where:

A_e – annual efficiency;

P_u – the productivity of one unit per day;

$K_{f.u.}$ – car park utilization rate.

Table 6 shows the data when the transport was operating. And based on the results of the total mileage, we can identify the most productive car of the three compared.

Table 6 – Data defining the days of operation of the transport

	ZIL – 555	KAMAZ	UAZ – 452
Calculation	АДэ = 1 * 365 * 0,75 = 274	$АД_э$ = 2 * 365 * 0,75 = 548	АДэ = 1 * 365 * 0,75 = 274
Note – compiled by the author based on sources (Kolesa.kz, 2024)			

Table 7 – Average transportation distance

Indicator	ZIL – 555	KAMAZ	UAZ -452
Average full ride distance	60:0,9 = 66,7 км.	80:0,85 = 94 км.	50:0,9 = 55,6 км.
Driving time	66,7:50 = 1,3 h.	9:50 = 1,9 h.	55,6:50 = 1,1 h.
Number of rides	8:(1,3+0,8) = 3,81	8:(1,9+1) =2,8	8:(1,1+0,6) = 4,7
Daily traffic volume	5,5 x 0,9 x 3,81 =18,9 t.	13 x 0,9 x 2,8 = 32,8 t.	3 x 0,8 x 4,7 = 11,3 t.
Daily cargo turnover	18,9 x 50 = 943 tkm.	32,8 x 80 = 2620,8 tkm.	11,3 x 50 = 565 tkm.
Average daily mileage	66,7 x 3,81 = 254,1 км.	94 x 2,8 = 263,2 км.	55,6 x 4,7 = 261,3 km.
Note – compiled by the author based on sources (Kolesa.kz, 2024)			

Substituting the found values from the table into the formula, you can determine the days when the car was working.

The annual performance indicator of the plan is based on the first method. The calculation results are presented Table 8.

Table 8 – The annual performance indicator of the plan is found by the first method

Indicator	ZIL – 555	KAMAZ	UAZ -452
The volume of traffic, thousand t.	18,9 * 274 = 5,2	32,8 * 548 = 18	11,3 * 274 = 3,1
Cargo turnover, thousand tkm	943 *274 = 258	2620,8 * 548 = 1436	565 * 274 = 154
Total mileage, km	254,1 *x 274 = 70	263,2 * 548 = 144	261,3 * 274 = 72
Note – compiled by the author based on sources (Kolesa.kz, 2024)			

The development of the program's production indicators began with the second method, used in the automotive industry with a large number of car brands, by determining annual performance from the average automatic performance of the car. The annual productivity of an average vehicle per ton-kilometer is equal to the product of average daily kilometers, mileage utilization factor, load capacity utilization factor, number of calendar days per year, car park utilization factor:

$$W_{tkm} = L_{cc} * B * y * 365 * K_{f.u.} \quad (7)$$

where:

L_{cc} – average daily mileage, km;

B – the coefficient of effective mileage of the car;

y – load capacity utilization factor;

$K_{f.u.}$ – car park utilization rate.

Table 9 – Calculation of the rolling stock production program according to Table 8

ZIL – 555	KAMAZ	UAZ – 452
Wtkm =274,9 * 0,9 * 0,9 * 365 * 0,75 = 61 thous. tkm.	Wtkm = 296,3 * 0,85* 0,9 * 365 * 365 * 0,75 = 62,1 thous. tkm.	Wtkm = 240,1 * 0,9 * 0,8 * 365 * 0,75 = 47,3 thous. tkm.
Note – compiled by the author based on sources (Kolesa.kz, 2024)		

Based on the results obtained, it is obvious which kind of transportation more involved in work that requires more frequent maintenance. Therefore, when organizing the use of road transport networks to transport the loads that are most suitable for this type of car, people should not look for alternatives, because Kamaz is 10% better than any other automatic means of transport.

Results and discussion

As part of the description, it should be noted that compliance with quality improvement and maintenance plans can not only reduce long-term maintenance costs, but also modernize the management system. The management system uses appropriate management efficiency to redesign the car park as part of a planned car park expansion project to improve road traffic. In order to determine the optimal maintenance rate for motorized traffic, a table has been developed for each vehicle, showing the number of steps performed before the start of operation each year, the planned weight and the distance traveled. Taking into account the processing conditions and flow parameters between repairs, it is necessary to introduce the following parameters.

Based on the data, the cars are divided into models to determine the most efficient cars. Then the table allows us to determine the total number of repairs for each car brand (Kochinov, et. al., 2014).

Based on this information, we can share brands and models to help us evaluate the most efficient cars on the highway. Transport models were chosen based on the popularity and quantity on the market of the Republic of Kazakhstan. In particular, the number of vehicles was calculated from information taken from the car sales website Kolesa.kz. The information was analyzed using the available built-in filters on the site. The choice of special vehicles was carried out according to such parameters as the year of production, mileage and carrying capacity. Thus, the first 20 cars were determined.

The choice of special vehicles for the transportation of goods was determined by the parameters of the year of production, mileage and carrying capacity due to the following reasons:

- year of manufacture: older cars require more maintenance and have a greater risk of breakdowns during transportation, which increases operating costs;
- mileage: Mileage shows the degree of wear on the car. The higher the mileage, the greater the risk of failure of components and assemblies. Timely delivery is critical for trucking. High-mileage vehicles can be less reliable and require unplanned repairs. High mileage is often associated with high fuel consumption and maintenance costs;
- load capacity: the right choice of load capacity allows you to minimize the number of trips and optimize fuel costs and time. Compliance with load capacity requirements is important to ensure safe movement and stability of the car.

The last step is performed by analyzing and simulating the process of calculating the power of the car. Based on these statistics, the anelogic program created a model that uses GIS mapping software to display the best possible measure of road traffic efficiency in real time.

In order to improve work efficiency, laboratory conditions must be observed (Myerson, 2012). By creating a traditional supply chain, one can consider an original picture showing how suppliers deliver goods to traditional consumer stores. The program also allows you to understand how the "sustainability" parameter affects the stable operation of the logistics chain (Morozova et. al., 2022).

Therefore, this parameter should be one of the basic requirements when using cargo transportation in logistics. In addition, you can also take into account the following parameters: depreciation, warranty, load capacity, novelty of the car and total mileage (if used).

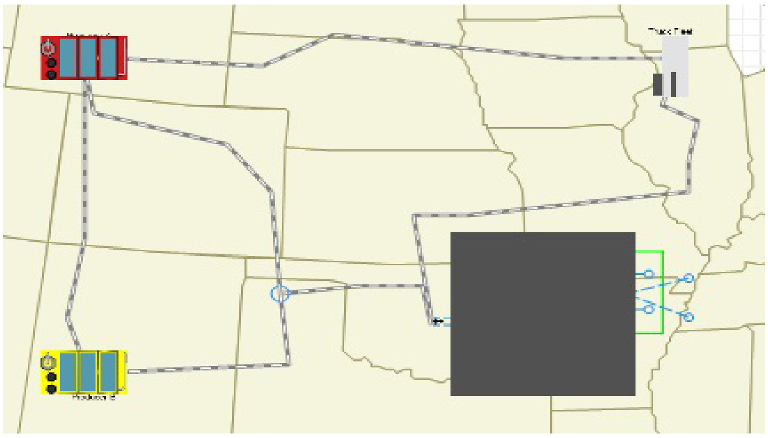

Figure 1 – The layout of the consumer store
Note – compiled by the author using the (AnyLogic program, 2024)

1 shows a simple structure with several components:
- car park;
- factory A (together with supplier A);
- factory B (together with supplier B);
- online store.

The buyer buys the product in the store. Each client gets a different number of resources A and B (for example, 1A and 3b or 3A and 0b). Commercial resources were exhausted, and the signal came to the caravan, it is necessary to purchase a certain amount of certain resources, which happened (Palagin, et. al., 2015).

At the same time, the parking lot keeps the car for a certain period of time, that is, when the car is driven, its power is exhausted. If the power of a national-level car is 0, the car will disappear with the resources it carries (simulating damage and load damage). In order to restore operational capacity, the car must be repaired in the fleet.

In order to increase the efficiency of a particular chain and increase the number of modes of transportation, it is necessary to maintain the car in the fleet for a certain period of time, and in order to minimize road damage, more efficient vehicles are needed.

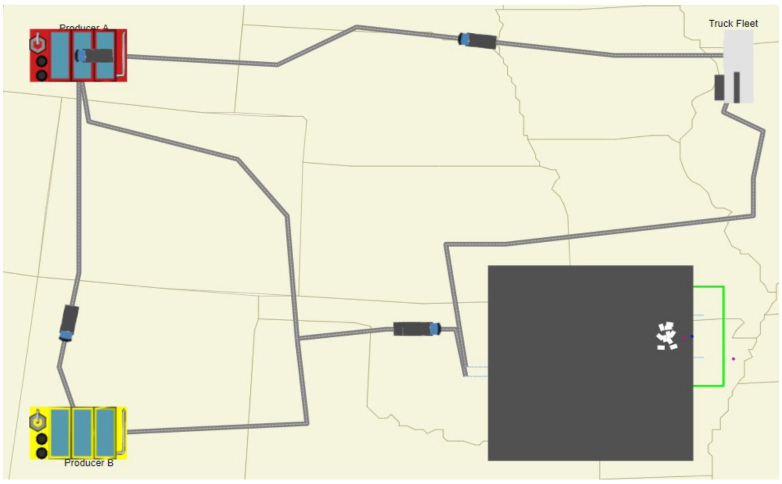

Figure 2 – A ready-made scheme with an imitation of sending goods from warehouses
Note – compiled by the author using the (Anylogic program, 2024)

In accordance with Figure 2, you can see how cars are in constant cyclical motion in the logistics chain. That is, interruptions should not occur, or at least should minimize any risk that may result in the downtime of the product and its delay. Calculating by the formula, it is possible to select them as "basic" by identifying durable cars that can withstand a heavy load. And leave less durable ones in reserve, which, in case of breakdown of strong ones, can immediately replace them. Thus, we reduce costs and keep up the pace. Of course, such schemes require good capital, which will be able to provide a large number of vehicles. But for logistics, first of all, all the rules of logistics should remain a priority.

Therefore, one of the most likely things to happen is that the country will cope with an increase in traffic, more investment in infrastructure, and the introduction of a large number of commodities.

Overload, changes in production and logistics practices, deviation from the busiest locations. Such a decision may be acceptable, but it is certainly far from economic optimism for two reasons.

First of all, some of the available power of the system is rarely used, for which users do not a price comparable to the cost and operators have no incentives to meet users' costs and preferences.

Second, there are obstacles to the effective distribution of investment, especially in the public sector. Government investment has largely offset its impact, because some high-yield projects have been approved, while others have been implemented through low-yield . If many companies do not manage the market in the best way and hinder competition, private sector investment may prove ineffective. It is possible to estimate possible future costs related to other direct consequences of delays and congestion, but it is also possible to estimate other costs of "normal operation" scenarios, such as land use and model distortion costs.

Regional development-difficult to detect or predict. Changes in public policy will enable the country to make better use of existing opportunities and make investment decisions that bring significant economic benefits compared to the current situation. In Kazakhstan, almost 98% of companies work in the transportation and warehousing sector,

They belong to the category of small businesses that hire less than 100 people. On average, companies with 101-250 employees accounted for 1.4%, and only 0.6% were large enterprises with more than 250 employees. It should be noted that the same proportion is found in other economic sectors, among which the number of small businesses is 97,7%, the average is 1,7%, and the upper limit is 0,6% (Tebekin, et. al., 2018).

94% of small warehouse companies are privately owned, and only 5.6% are created with foreign capital. Government agencies account for 9.8% of large companies. Other information 90% of freight is handled by 1-2 autonomous vehicles, and only 10% of the vehicles are owned by transportation companies.

Conclusion

Currently, most of the transportation is carried out by the centralized transportation method. This method consists in the fact that the entire responsibility for transportation is assumed by the transportation company. Transportation planning is a complex process that requires precision and speed in decision making. And therefore, logistics companies take full responsibility for themselves, starting from loading the goods, ending with its shipment and unloading. The system is easier to manage if you know all its subtleties.

Advantages of centralized transportation:

- freight forwarding services are carried in full;
- drawing up a contract for transportation;
- distribution of responsibilities between supply chains;
- the calculations are performed by the company 's side;
- usage of all transport for more optimal transportation;
- reducing the number of downtime;
- increasing the mileage utilization factor;
- reduction in the number of maintenance personnel;
- exclusion of freight forwarders from the chain, as drivers act instead of them (Bakshi, et. al., 2014).

Due to its simplicity and uniqueness, the central space is more popular today. Despite its advantages, some prefer the distributed mode of transportation, and customers require it because they are very reliable. This method is more convenient for small-distance transportation, because when shipping from abroad, customers are likely to encounter many problems in loading the goods into the documents.

Using a centralized method with simulation can significantly reduce processing and calculation time. Accurate numbers and the right route can reduce costs and risks. The application and application of the centralized transportation organization method are considered, and its location is optimized. Using a permanent driver instead of a freight forwarder can save prices because the route is known to the driver and the approximate road infrastructure, and for the company driver to become a reliable operator. The nuances here can be considered that the stability of the application of this method will last for a sufficient period of time. But just like any logistics company with all reputations based on work experience, this nuance can be considered an achievement.

The second method is to unify the travel law. This organizational structure method can unify and strengthen the communication between the structure and the infrastructure. Brigade forms can be divided into categories: drivers, porters, warehouse workers, and operators. The form of brigade has its own functions and functions. When the entire supply chain of each crew member works in stages, risk can be reduced and productivity can be increased. At each stage, the relationship between the slides is maximized because the slides are known. All wages are evenly distributed, except for overtime or trips designed to exceed a fixed plan. In other words, all brigades are interested in the work they are doing. Due to the connection between the links, the entire chain is connected as much as possible.

The agreement between the brigades, no one may fire or add an employee without the consent of all other members of the brigade, should not be ignored. This reduces internal differences between workers, thereby increasing productivity relative to good relationships.

The third and most common mode of transportation is multimodal transportation. Today, its application is very timely, because most transportation services are carried out by rail.

Multimodal transport includes products and raw materials, which are transported in containers by various means of transport, such as container ships, semi-trailers and trains. This type of transportation involves grouping goods into cargo units (containers, movable baskets) to minimize loading and unloading operations and reduce the chance of loss, damage or theft. They also facilitate their transportation or overloading to various modes of transportation (automobile, railway, sea, etc.). Used when delivered to the final destination.

Containers designed for multimodal transport comply with the rules of the International Organization for Standardization, which allow goods to stay in one container between modes of transport instead of being transferred to a new container of another size. Multimodal transport should not be confused with multimodal transport (Sivakov, et. al., 2017).

In view of the above situation, it can be said that the introduction of systematic calculations, the use of information and mathematical formulas, their optimization and adaptation will contribute to the improvement of transportation.

Using new concepts to determine the quantity, intensity and time of transportation can increase productivity through data collection and statistical data input. Four types of data required for implementation

Transportation capacity analysis:

- information on national trends in freight volumes, freight volume, capital expenditures and cargo system performance;
- case studies of delivery and planning projects;
- interviews with industry representatives;
- cargo transportation;
- evaluation of the latest research on transport companies (Tebekin, et. al., 2018).

In the case the basic direction of political and economic conditions remains the same as in the past, then the cumulative development will give people an understanding of the development prospects of cargo transportation in the coming decades.

The study shows how institutional and management factors affect company's ability to respond to changing needs.

The development of commodities in the last century was characterized by increased efficiency and increased types and complexity of services provided, aiming to provide customers with significant benefits. The main sources of productivity growth change over time.

They include the combination of capital accumulation and the of further technological improvement, as well as cyclical major breakthroughs. Breakthroughs are revolutionary changes in technology (including vehicles, infrastructure, and information systems).

These trends show that the emergence of socio-political forces will have a new impact on the development of transportation vehicles in the coming decades. The increase in population density, urbanization and prosperity have led to

Disputes between freight and passenger transportation; disputes between freight, residential, recreational and other competitive land uses; increased requirements for pollution control. These factors usually increase the cost of capacity expansion and increase investment risk (Tebekin, et. al., 2018).

The study revealed key technical parameters affecting the efficiency of the operation of vehicles for cargo transportation. The main result of the work was the determination of a method that allows you to choose the most efficient vehicles based on their technical characteristics, such as range, carrying capacity, mileage and frequency of maintenance.

An important aspect of the study is maintenance accounting, which directly affects the performance of the fleet. Unplanned stops due to repairs reduce the efficiency of transportation and can lead to delays in delivery, which is especially critical for transport companies. The breakdown of vehicles by brand and model, as well as the analysis of intervals between repairs and overhaul, allow companies to more accurately plan the operation of vehicles and minimize downtime.

The practical significance of the study lies in the fact that its results can be applied by transport companies to optimize the fleet, which is especially important in the operating conditions of worn-out vehicles. The determination of the most efficient vehicles helps to increase the productivity of vehicles, reduce costs and, as a result, increase the profitability of companies.

Thus, this work is valuable both from a theoretical point of view and from an applied point of view, offering specific methods for improving the efficiency of road transport based on the technical characteristics of cars.

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