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U.K. Shedenov,
Dr.Sci.(Econ.), professor
G.A. Askarov,
PhD Student
Al-Farabi Kazakh National University,
Almaty

Methods to improve the efficiency of road freight transport

Introduction

The efficiency of transport logistics is the result of performing such tasks as provision of proper quality of transport services, increasing the work efficiency, reducing the time of delivery, ensuring the regularity of departure and arrival of goods regardless of weather and climate conditions, maximizing the safety. The effectiveness of transport logistics is inevitably associated with a reduction in total costs for the transportation process, as well as with a reduction in the relative weight of transportation costs in the total logistics costs. Improving the efficiency of transportation is inevitably associated with the maximizing the feasible capacity of the rolling stock as well as with the standardization of the packaging.

Let's consider additional economic indicators of work of motor transport in details. With the growth of freight volumes, the growth rates of incomes of transport companies are higher than the operating costs, the increase in the volume of transportation allows to increase the technological efficiency of the transportation process control, and only variable expenses vary in proportion to the volumes of freight transportation. With the growth of transportation volumes, the cost price is relatively reduced, which, taking into account the growth in revenues, leads the company to an increase in profits and growth of competitiveness.

The assessment of the efficiency of transportations is a basic step for logistics and other related fields. Through the assessment of the efficiency of transport, logistics companies can optimize the process and improve economic benefits.

Analysis of existing indicators of the efficiency of road freight transport

Many researchers paid an attention on the problem of choosing the proper indicator of the efficiency of motor transport. In works Geronimus B. L. [1], Efremov A.V. [2], Kojin A. P. [3] the efficiency of road freight transport, the minimum average state of transportation and the minimum zero mileage are chosen as the indicators. Authors in the literature Bobarikin V. A., Prudovski B. D., Trofimova G. I. [4] also used such indicators as the minimum gross carrying capacity of motor vehicles, the average load factor and the downtime.

The following indicators were identified in the literature Vasiliev N. M. [5]:

– intersectoral order, taking into account the level of coordination, for example, productivity and lead time;

– productivity and time costs;

– quality of transportation, for example, timeliness of the performance of transportation, safety of cargo.

In the article Aristov V. M. [6], the key indicators of logistics efficiency include flexibility of logistic service, delivery time and interval time, safety of cargo, security of providing logistics services, serving the logistics system and time of order processing.

The author of the following paper, Ivut R. B. [7] considers the importance of the possibility of logistics to properly develop a transportation plan, taking into account the balance of the carrying capacity of the enterprise. For this purpose, motor transport enterprises need to determine the size and structure of rolling stock and calculate the production program for the operation of cars.

According to the author Kristopher M. [8], logistics can be estimated by the quality of service, response time and total costs.

In the source Efremov A.V. [2] there are several indices, such as ton-kilometers, the mileage factor, income, profit, location and distance.

The desire to achieve as complete evaluation of the motor transport process as possible lead to the area of economic indicators: productivity, profit, net profit, transportation costs, etc.

In the literature Sabden O. [9] author considers that the effectiveness of logistics needs to be assessed for speed and continuity.

A lot of researchers have worked on the issue of assessing the effectiveness transportation, however there is no single definition of efficiency.

Evaluation of the efficiency of transportation can be considered from the point of view of two participants in the transportation process, firstly, participants that offer their services and customers who receive services. From the point of view of participant, the higher the tariff, the higher the profit and, correspondingly, the higher the efficiency. The revenue of a participant consists of the costs of a client, so for customers efficiency is higher when the cost of transportation is cheaper.

To assess the efficiency of transportation, not only the degree of economy and technological efficiency is important, but the quality of transport services is also important.

In the source Kurganov V.M. [10], efficiency, quality and reliability are key concepts of logistic management, since it is with their help that the goals set by the participants in the transport process are specified. Author believes these three factors are related to each other: quality is a component of the performance evaluation system, and reliability is a component of the quality system.

The evaluation of the efficiency of logistics is complex and very sophisticated task for the company. Efficiency occurs when transport costs are reduced. Significant savings may be achieved by solving transport problems, optimizing routes, reducing idle runs.

Also, the factors influencing the efficiency of transportation can be divided into external and internal (table 1).

Table 1 - **The main factors affecting the auto carrier**

External	Internal
Legislation Taxes Transport and logistics infrastructures Fuel prices Political conditions Other	Car pool Staff (management and workers) Technical base Capital Other

Internal factors are factors that improve the organization of industrial processes, technical and operational indicators, characterizing the organization. Internal factors are organizational and management decisions aimed at reducing the total cost of transportation in the short and medium term. The implementation of such organizational and management solutions can help the company to improve its economic performance.

External factors are factors that do not depend on the enterprise and its operating activities. These are factors such as state regulation and tax policy, broader macroeconomic trends, market development dynamics and emerging achievements in the field of high-tech. The political situation in the region and the degree of transport and logistics infrastructures. External factors also affect all key variables of freight traffic. Fuel prices carry the greatest burden on

the total cost of transportation. In the literature Bachurin A.A. [11], external factors are divided into three levels: interstate, intrasocial and market-sectoral.

Indicators assessing the effectiveness of the auto carrier can be divided into three major groups:

Economical:
- tariffs;
- net price;
- profit;
- profitability.

Industrial:
- number of processed orders;
- turnoff size;
- number of races;
- total mileage;
- lead time.

Qualitative:
- delivery time;
- timeliness of transportations;
- cargo safety;
- driver reliability.

Analyzing, we can come to a conclusion that the rational use of automatic telephone exchanges, reducing the cost of transportation and improving the quality of transportation are the main indicators for assessing the effectiveness of auto carrier.

Cost of transportation as the main indicator of the efficiency

The cost of transportation is an important element of transportation. Like any market category, the cost of transportation does not have a hard definition and depends on a combination of many factors.

The cost of transport services in monetary terms is called the tariff.

$$T = P + S. \quad (1)$$

where P is profit of the company and S is the net price.

On the road transport, the following types of tariffs are used to determine the cost of transportation:

- tariffs for the transportation;
- tariffs for auto ton-hours;
- tariffs for the temporal use of trucks;
- tariffs for the distance;
- Contractual tariffs.

The size of the tariff is determined by the distance of transportation, cargo weight, volumetric weight of cargo. These factors characterize the possibility of using the truck, carrying capacity of the truck, total mileage, exploitation time, type of car, the area in which the transportation is carried out. Specific tariff for the transport of goods by road does not take into account the entire set of factors, but only some of them, the most significant in the conditions of a specific transport. For example, to calculate the cost of transportation at a piece rate, it is necessary to take into account the transportation distance, the weight of the cargo and its class, which characterizes the degree of use of the vehicle's carrying capacity. At calculations under the tariff for time usage and the load-carrying capacity of the truck. Time of its use and the general mileage are also taken into account. In all cases, the amount of payment for the use of the car is affected by the area in which the transportation is carried out. This is due to the stable differences in the cost of transportation of goods by area Sabden O. [9].

The cost of transportation is the cost of the auto carrier for the performance of transportation. The total costs contain the operating costs calculated per unit of transport products. The level of the cost of transportation is greatly influenced by many performance indicators of the auto carrier, which can be divided into three groups.

1. Indicators of the production capacity of the car fleet, which determine its carrying capacity and carrying capacity of the rolling stock.

2. Technical and operational indicators of the use of rolling stock. The ratio of production of cars per line, the time of drivers, the technical speed of traffic, idle time for loading and unloading operations, the distance of transportation, the mileage and utilization factor of cars.

3. Technical and economic indicators, such as raising the technical level, improving the organization of labor and vehicle operation, improving management, reducing costs and other indicators.

Reducing the cost of transportation entails reducing tariffs and attracting additional customers.

The main methods of cost reduction are:

– increasing the productivity of the logistics by setting the additional amount of cargo for one run;

– reduction of unproductive idle times and idle runs;

– increase the speed of transportation;

– fuel economy;

– use of more advanced logistical systems;

– reduction of the overhead costs.

In the competitive struggle, when there are a lot of trucking companies on the market and other types of transportation, the most important goal of ATP is "survival". The best way to survive is the cost reduction and technical improvement, especially focused on speed of the car, it can be understood that the higher the speed of delivery, the higher the turnover and the ability to use the car for the next order.

Reduction of the cost price by increasing the speed of the vehicle.

In order to evaluate the effectiveness, a study was carried out, according to the method of literature Garmash O.V., Kozykenova A.A., Thess D. [12], as the cost parameters of the transportation of goods vary depending on the change in average speed and time. We set the following conditions for the task. Firstly, goods of different weight categories located in the city of Karaganda are brought and shipped to the city of Almaty. Secondly, the total volume of cargo is 200 tons. This operation continues periodically. We must determine the cost price of the cargo and the price dynamics. The distance between the cities is 946 km. The average speed is 77 km / h.

The data was obtained from a transport company engaged in road transport in Kazakhstan and from the processing of statistical data from official sources (table 2).

Table 2 - **Data for calculating the cost of transportation of goods**

		Value
1	Driver's salary	1 000,00 €/м
2	Certificate	0,000731 €/kg
3	Repairs	0,002000 €/kg
4	Price of the vehicle	125 000 €
5	The price of a wagon superstructure	14 000 €
6	The price of personal service and qualification courses	500 €
7	Extra costs	500 €
8	Distance between warehouses	946 km
9	Fuel consumption	35 l/100 km
10	Depreciation period	5 years
11	Load capacity	20 000 kg
12	Average domestic speed	77 km/h
13	The price of fuel	0,40 €/l
14	Turnover	200 000 kg

From the given data, we calculated the specific weight of each component and obtained the cost of 1 ton of cargo in transportation. All calculations were made in MS Excel. The following formulas are used:

Specific fuel consumption by vehicle was calculated by the following formula:

$$B_l = Z * K_{1/2} / 100 * B * P_D / Q. \qquad (2)$$

where Z is the number of races per day; $K_{1/2}$ is the average distance between hub and regional warehouses; B is the fuel consumption (liter/100 km); P_D is the fuel price (€/liter); Q is the gross wright of cargo (kg).

$$Z = (T_c + T_{пр} + T_{опер} / T_c) / (Q \qquad (3)$$

where $T_{общ}$ is total delivery time (minutes); T_c is delivery time per day; $T_{пр}$ is a mileage; $T_{опер}$ – handling time; W is total capacity (kg).

$$T_{пр} = 2 * K_{1/2} * L / V * 60 \quad (4)$$

where L is the number of races; V is the speed of the vehile.

$$B = ((T_c + (2*K_{1/2} *L/V*60) + T_{опер}/T_c)| /(Q/W))* K_{1/2} / 100 * B * P_D / Q. \quad (5)$$

Unit costs for driver's salary was calculated by the following formula:

$$Z_p = N * P_z/24 / Q. \quad (6)$$

where N is number of vehicles, P_z is driver's salary, €/м;

The unit cost for repair and depreciation was calculated by the following formula:

$$I = P_r / Q. \quad (7)$$

where P_r - expenses for repairs and depreciation, €;

Unit cost for depreciation charges was calculated by the following formula:

$$P_A = P_c * N / T_{0a} / 365 / Q. \quad (8)$$

where P_c is the vehicle price, €; T_{0a} is the tenure of depreciation;

Specific expenses for certificates, insurance, taxes and other organizational needs were calculated using the following formula:

$$P_D = P_p / Q. \quad (9)$$

where P_p is accumulated expenses (insurance, fees, certificates, etc.)

The prime cost of 1 kg of cargo is calculated by summing all the costs. The received sum should determine the prime cost of the general cargo in the rolling stock.

$$C = B_l + Z_p + Z_p + I + P_A + P_D. \quad (10)$$

In our case, the following indicators were obtained (table 3).

Table 3 - **Unit transportation expenses**

Types of expenses	Unit cost per 1 kg of cargo	Unit cost per 20 tons of cargo	Percentage
Fuel expenses	0,007395 €	148 €	42,9
Salary expenses	0,002500 €	50 €	14,5
Repairs	0,002000 €	40 €	11,6
Depreciation	0,004603 €	92 €	26,7
Expenses for certificates	0,000731 €	15 €	4,2
Total	0,017229 €	345 €	100,0

Let's illustrate the data of Table 3(figure 1).

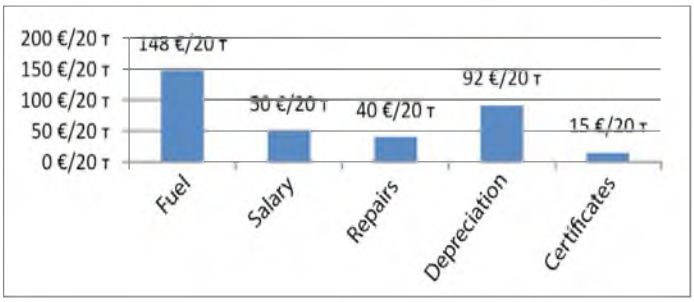

Figure 1 – **The share of each expense per 20 tons of cargo**

In this regard, increasing the speed of traffic, we increase productivity and reduce the cost of transportation. Table 4 shows how speeds and transportation expenses vary.

Table 4 – **Cost of transportation depending on speed**

Speed	25 km/h	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h	110 km/h	120 km/h
Costs	133 €	67 €	58 €	50 €	42 €/	42 €	42 €	42 €	42 €

The data in Table 4 is illustrated in order to get the dynamics of the value varying depending on speed (figure 2).

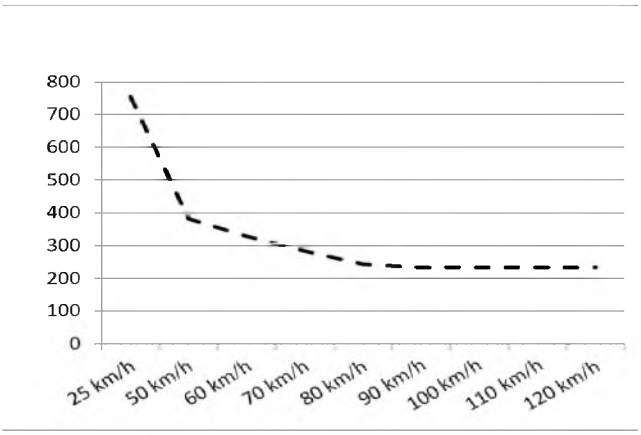

Figure 2 –**The cost of transportation, depending on the speed**

Conclusion

As a result of the conducted research, we achieved research aims and came to the following conclusions:

1. In order to evaluate the efficiency of enterprises involved in road transport, the key indicators may be set. Firstly, the rational use of the fleet of vehicles. Secondly, the reduction in costs of transportation. Finally, the improvement of the quality of transportation.

2. Increasing the speed of traffic, we achieve a decrease in the cost of transportation and improve the productivity of each car. But this method can be used if and only if there is a constant cargo pool and road infrastructure is in good condition.

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Түйін

Автокөлік, әр түрлі саладағы өндірістік кәсіпорындардың, өндірушіден тұтынушыға жүктерді тасымалдауды жүзеге асырып, логистика деп танылатын тауар қозғалысы жүйесінің құрамына кіреді. Кәсіпорындар логистикалық тәсілдерге және шаруашылық байланыстарға ере отырып, клиенттерге қызмет көрсету кезінде аз шығынмен өнімді жеткізу сапасын арттыруда бір бірімен бәсекелеседі.

Көліктік кәсіпорындарға логистиканың тиімділігін арттыру, біріншіден, автомобильмен жүк тасымалдау нарығында бәсекелестік көп және екіншіден, көліктік шығындар логистиканың жалпы құнының 35 тен 50 пайызға дейін құрайтынымен анықталады. Сондықтан, автокөліктік кәсіпорындарға көлік шығындарын үнемдеу өте маңызды. Зерттеулер мен публикацияларды талдау барысында, тиімділік көрсеткіштерін таңдау мәселесімен көптеген ізденушілердің айналысқандары анықталды. Автомобиль көлігінің логистикалық қызметін бағалау бағытында көптеген шетелдік және отандық ізденушілердің зерттеулері логистикалық тәсілдерді пайдаланып автокөлік кәсіпорындарының тиімділігін арттырудың маңыздылығы мен өзектілігін көрсетті. Мақаланың мақсаты – автомобильмен жүк тасымалдаудың тиімділігін бағалау көрсеткіштерін талдау және тасымалдау өзіндік құнына жылдамдықтың әсер ету деңгейін анықтау. Мақсатқа жету үшін, автомобиль көлігімен тасымалдаудың тиімділігін бағалау мәселесіне арналған ғалымдардың еңбектері талданды. Жылдамдықтың тасымалдау өзіндік құнына әсерін профессор Д. Тестің анықтаған алгоритмімен, MS Excel бағдарламасы көмегімен анықталды.

Түйін сөздер: автомобильмен тасымалдау тиімділігі, логистика, тариф, өзіндік құн, жылдамдық.

Аннотация

Автотранспорт, осуществляющий перевозки грузов для производственных предприятий разных отраслей, от производителя к потребителю, входит в состав системы товародвижения, которая понимается как логистика. Следуя логистическим подходам и развитию хозяйственных связей, предприятия при обслуживании клиентов конкурируют друг с другом в сфере повышения качества доставки продукции с наименьшими затратами.

Повышение эффективности логистики для транспортных предприятий подтверждается тем, что, во-первых, на рынке автомобильных грузовых перевозок высокая конкуренция и, во-вторых, транспортные расходы составляют от 35 до 50% от общей стоимости логистики. В связи с этим для автотранспортных предприятий очень важно экономить транспортные расходы. Анализ исследований и публикаций показал, что к проблеме выбора показателя эффективности обращались многие исследователи. Тематические исследования в направлении оценки логистической деятельности автомобильного транспорта были проведены многими зарубежными и отечественными исследователями, которые показали важность и актуальность повышения эффективности автотранспортного предприятия с применением логистического подхода. Цель настоящей статьи – провести анализ показателей оценки эффективности грузовых автомобильных перевозок и определить степень влияния скорости на себестоимость перевозки. Для достижения поставленной цели были проанализированы научные труды, посвященные проблемам оценки эффективности перевозки автомобильным транспортом. Влияние скорости на себестоимость перевозки было определено с помощью программы MS Excel, алгоритм расчета разработан профессором Д. Тессом.

Ключевые слова: эффективность автомобильной перевозки, логистика, тариф, себестоимость, скорость.