Managing the performance of transport organizations

Vladimir Chernov

Lobachevsky State University of Nizhny Novgorod, Institute of Economics and Entrepreneurship (IEE), Russia

E-mail: Chernovva@rambler.ru

Abstract. The article considers the types of costs and their efficiency indicators, most related to the distance and capacity of cargo transportation. The calculation of the efficiency of transportation use depending on the change in the size of the cargo, as well as the calculation of planned revenue from sales depending on the distance of transportation are proposed. Next, the costs that are most dependent on distance and most dynamically affect the cost of transportation are highlighted. The method of factor analysis of material consumption with consideration of fuel consumption as an energy source for road transport is considered. This method will allow the transport organization to calculate the impact of factors, identify and use reserves to reduce the material intensity of transport and improve their efficiency. Based on the results of the factor analysis, measures are proposed to use the reserves identified in the factor analysis.

1. Introduction

The transport industry is playing an increasing role in the global economy. Transport services are particularly relevant for Russia and other countries, where long distances between economic entities make transport crucial in the implementation of economic relations. The transition to the digital economy leads to the creation of new organizational relationships between market participants in remote mode using telecommunications systems. And this primarily concerns the issues of organization, object and technology management, design planning, financing, accounting and control using the Internet of things (IoT). However, goods, raw materials and materials in production and sales cannot be delivered without extensive transport networks and are closely related to them in a dynamic cause-and-effect relationship (Nannan 2018).

The consequences of the COVID-19 pandemic led to the suspension of production, and this contributed to a decrease in transport activity. But these same conditions have led to the activation of interaction of market participants via the Internet, to the development of Internet trade, which in the future will lead to an increase in transported goods (Pavlova 2020:100-1020). Therefore, if increasing the efficiency of production and management functions, excluding transportation, will be achieved by the introduction, dissemination and improvement of automated intelligent systems of digital technologies, then in transport issues, achieving efficiency will require the use of other approaches and tools.

2. Efficiency of cargo delivery and sales
Speaking about the efficiency of the transport system in Russia, it should be noted that thanks to this system, trade is able to achieve a reduction in prices for long-distance cargo transportation. For example, certain bookstores sell books at the manufacturer’s price. In Nizhny Novgorod, in large shopping and entertainment centers («Fantastic», «Mega»), as well as small sellers on the market, some types of products from the Moscow perfume factory «Novaja zarja» can be purchased cheaper than branded stores «Novaja zarja». And another example, in the Markets of In the summer of Nizhny Novgorod, the main types of southern fruits do not differ significantly or approach the prices of southern regions, the climate of which is suitable for their cultivation.

Such paradoxical phenomena occur due to the efficient operation of the transport network. For example, many manufacturers offer a discount to wholesale customers if they buy goods in large quantities up to a significant reduction in price relative to the manufacturer’s price. This allows wholesale organizations to sell the product cheaper. But the purchase of goods in large quantities is possible only if the transport network is highly efficient. Transport deliveries of southern agricultural crops from different countries make their supply on the market more complete and stable, which ensures not only the profit of the transport industry, but also solves the country’s food problems. Long-distance transport also becomes more efficient when heavy-duty vehicles are loaded at maximum.

Thus, the efficiency of the transport system is achieved not only in the internal direction (efficiency of transport organizations), but also in the external (extra-transport effect of transport activities). Non-transport effects are benefits (associated effects) obtained in various spheres of social and economic life of society as a result of the use of transport and various transport technologies, but not reflected in the financial performance of transport enterprises (Pankratova 2020: 60).

Let’s turn to the issues of achieving efficiency by transport companies, which are determined by indicators of resource efficiency, turnover, and return on capital of transport organizations.

Since the main task of transport organizations is to transport goods, the most important indicator of efficiency in transport is the indicator of the return (turnover) of the quantity of goods transported (cargo return). It is determined by the ratio of the proceeds from the sale of the transport service for the delivery of this cargo to the amount of cargo carried, which can be expressed in tons or in the volume of meters square occupied by the cargo on the vehicle. The more goods transported per vehicle run, the more efficient the transport and the higher cargo return. In order to measure the growth of such efficiency, the shipping factor must be multiplied by the load intensity factor in tons, which is determined by the ratio of the mass in the vehicle carried to the mass carried in the vehicle with the lowest load capacity used in the organization. As a result, we get the expression:

\[
TE = \frac{R}{W_0} \cdot \left(1 + \frac{W_1}{W_0}\right),
\]

where \(TE\) – cargo return, den. unit/ 1 t;
\(R\) – revenue from the provision of transportation services by this vehicle, den. units.
\(W_1\) – the mass of the cargo carried on this vehicle, t;
\(W_0\) – the mass of the cargo carried on the vehicle with the lowest load capacity, t.

If the transport efficiency is measured relative to the volume of the cargo expressed in square meters, then instead of the mass indicator \(W_1 - W_0\), use the corresponding indicator of the volume of the cargo expressed in square meters.

It should be noted that, all other things being equal, the greater the distance of cargo transportation, the higher cargo return will be when the vehicle is sufficiently loaded. This indicator can be used in planning revenue from a given trip, depending on the distance. This requires the following conversion of the load return formula (1):
3. Factor analysis of cost effectiveness

Achieving efficiency is not possible without saving costs. The main items peculiar to transport organizations include expenses for drivers’ labor, fuel, lubricants, spare parts, maintenance and repair of rolling stock, repair and wear of tires, etc. material costs, depreciation, General economic costs that are formed in connection with the maintenance of production and management, etc.

In the closest relationship with the use of transport are material costs. Therefore, their effectiveness requires careful analysis. Long distances are a feature of Russian and especially international transport. Therefore, the analysis should highlight the costs that are most dependent on distance. The most significant and dynamic in the composition of material costs are for spending on fuel, since fuel is a source of energy for road transport.

Research and empirical data from China have shown that the expected benefits of energy efficiency are achieved by increasing energy consumption as a result of lower prices. As a result of a 10% increase in efficiency in the transport sector, an 89% effect was identified in the form of savings from total energy consumption. Moreover, such energy efficiency leads to an increase in economic activity and an increase in the rate of production growth in many sectors of the economy (Yuldashev 2019: 135-149). From the above, it becomes obvious how important fuel and energy costs and their cost in the transport industry are for the country's economy as a whole.

Fuel costs are most dependent on the distance of transportation. Therefore, the cost intensity of transport services is primarily affected by the cost intensity of fuel and the ratio of all material costs to fuel costs. The lower the organization's total material costs relative to fuel costs, the more efficient the transport system is, minimizing material costs. Let's look at the methodology for analyzing these ratios using an example.

Example. According to table 1, calculate the impact of changes in the material intensity of products for fuel costs and changes in the ratio of all material costs and fuel costs for changes in material intensity.
Table 1. Use of material resources in transport.

| Indicators | Designation | According to plan | Actually | Deviation, col.3–col.2 |
|------------|-------------|------------------|----------|-----------------------|
|            | A           | B     | 2     | 3     | 4                    |
| 1. Revenue from the sale of transport services, den. units | R | 3918 | 4152 | 234 |
| 2. Material costs, den. units. | M | 1025 | 1020 | -5 |
| 3. of these, fuel costs, den. units. | Mf | 970 | 971 | 1 |
| 4. Material intensity total (line.2/line.1) | EM | 0.262 | 0.246 | -0.016 |
| 5. Material intensity of transport by fuel consumption (line.3/line.1) | EMf | 0.248 | 0.234 | -0.014 |
| 6. Ratio of all material costs to fuel costs (line.2/line.3) | KM | 1.057 | 1.050 | -0.007 |
| 7. Profit from sales, den. units. | P | 893 | 932 | 39 |

The relationship between factors and result indicator can be derived from the material intensity formula:

\[ E^M \frac{M}{R} = E^{Mf} \frac{Mf}{R} = E^{Mf} \cdot K^M \]

The symbols in the formula are disclosed in column B of Table 1.

Using the data of table. 1, let's calculate influence of factors by a method of chain substitutions in table. 2, where the estimated material intensity \( E^M \) is determined by multiplying the planning of material intensity in fuel costs (fuel intensity) \( E^{Mf}_{pl} \) on the actual ratio of material costs and fuel costs \( K^M_{act} \), that is

\[ E^M = E^{Mf}_{pl} \cdot K^M_{act} = 0.248 \cdot 1.050 = 0.26 \]

Data are recording in Table 2.

According to the rule of chain substitutions, the difference between the calculated and planned material intensity is equal to the effect of changing the ratio of all material and fuel costs on the total material intensity (col. 5 table 2). That is, as a result of reducing the ratio of all material costs and fuel costs by 0.007 in comparison with the planned value (col.4 line. 6 table 1) the total material consumption decreased by-0.002 (col.5 table 2).
Table 2. Calculation of the influence of factors on the material intensity of transportation.

| Indicators | Value of indicator | Deviation from the plan | including at the expense of: |
|------------|-------------------|-------------------------|-----------------------------|
|            | planned settlement actual | total | Material intensity of transport by fuel consumption col.2–col.1 | Ratio of all material costs to fuel costs col.3–col.2 |
| \( E^M \) Material intensity total | 0.262 | 0.26 | 0.246 | -0.016 | -0.002 | -0.014 |

The difference between the actual and calculated material intensity will reflect the impact of changes in the material intensity of products for fuel costs on the total material capacity (col.6 table 2). That is, a reduction in the material consumption of products for fuel costs in comparison with the planned value (line 5, col. 4 of table 1) led to a reduction in the total material intensity by 0.014 (col. 6 of table 2).

The sum of the influence of factors should be equal to the total deviation of the material capacity from the plan:

\[-0.002 - 0.014 = 0.246 - 0.262\]

\[-0.016 = -0.016.\]

The resulting equality confirms the accuracy of the calculations.

4. Conclusions and proposed measures

To reduce fuel costs as much as possible, organizations need to taking organizational, technical, and socio-economic measures.

Organizational measures include: elimination of irrational routes, increase of load factors, mileage, release to the line, implementation of dispatching guidance, etc.

Technical measures to reduce fuel costs include: improving the structure of the fleet, purchasing cars with a larger capacity, improving the design qualities of cars, introducing new computer programs for accounting, analysis and control of the activities of road transport enterprises, etc.

Socio-economic measures involve the introduction of new methods for calculating, accounting and analyzing fuel and lubricants consumption rates in the digital economy, which are disclosed in the publication (Chernov 2020: 283-297); of material incentives for employees using better forms of remuneration, discussed in the article (Chernov 2015: 12-39).

As external factors, measures of state support for producers, disclosed in the sources, are necessary (Chernov 2019: 154-162; Fasoula 2020: 21-39).

Based on making research, we have come to the conclusion that the transport sector has a decisive impact on the country's economy. In addition to commercial achievements of transport organisations transport system is the most important social factor shaping netransport effect in the form of benefits (conjugate effects) or losses obtained in the different areas of social and economic life of the community in the use of transport and various transport technologies, but does not affect the financial performance of transport enterprises. Empirical data from China has shown that lower prices for fuel and energy resources increase energy efficiency by increasing energy consumption. A ten percent increase in efficiency in the transport sector results in an 89 percent savings in total energy...
consumption. Moreover, such energy efficiency leads to an increase in economic activity and an increase in the rate of production growth in many sectors of the economy.

As a result of the research, a method for determining the cargo return and planned revenue from the sale of transport services, depending on the weight and volume of goods transported by a single vehicle, as well as a method for calculating the impact of fuel intensity and the ratio of all material costs and fuel costs on the total material intensity is proposed. This will allow the transport organization to calculate the impact of factors, identify and use reserves to reduce the material intensity of transport and improve their efficiency. Based on the results of the factor analysis, measures are proposed to use the reserves identified in the factor analysis.

References
[1] Nannan Yu, Bo Yu, Tao Hong, Martin de Jong 2018 International Journal of Transport Economics \textbf{XLV/2}
[2] Pavlova E 2020 Transport business in Russia \textbf{1} 100
[3] Pankratova E 2020 Transport business in Russia \textbf{1} 59
[4] Yuldashev O, Mirkomilov M, Eshchanov B 2019 Journal of Transport Economics and Policy (JTEP) \textbf{53(2)} 135
[5] Chernov V 2020 Economy of region \textbf{16(1)} 283 https://doi.org/10.17059/2020-1-21
[6] Chernov V 2015 Financial management \textbf{5} 12
[7] Chernov V 2019 Economics, taxes & law \textbf{12(3)} 154 DOI: 10.26794/1999-849X-2019-12-3-154-162
[8] Fasoula E, Schweikert K 2020 Journal of Transport Economics and Policy (JTEP) \textbf{54(1)} 21