Processing methods of expert assessment in determining the performance of road transport system

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ABSTRACT: In road transportation system, the competitive essence has two aspects: first, competition among motor transport enterprises, and then competition between customers. The fact that the competition has two aspects leads to a large number of species. Different Automobile Transport Companies (ATCs) and their transport services have different operational characteristics. Due to the research objectives, automobile transport has been taken into account that inter-enterprise competition arises in accordance with their exploitation characteristics and that these qualities have a decisive impact on the clients. In their activities, motor transport companies use different forms and methods of competition and their different exploitative qualities. This article shows the evaluation methods of expert assessment to determine the performance of vehicles. The use of a structured approach has allowed to systematize the factors identified by the source of inputs, quality and price components. The concept of exploitative quality also applies to road transport vehicles other than the automobile transport company, which can be grouped according to the influencing factors. In analytical systems of exploitative attributes, relative value is determined using the methods of calculation. The following are most commonly used such as differential, complex, and combined styles.

KEYWORDS: Road transport, International cargo, Quality of performance, Integral indicators, Expert evaluation, Discounting

I.INTRODUCTION

In road transportation system, the competitive environment in the activity of the International Cargo Transport Enterprise (CTE) is one of the main sources of development. However, many competitors, including large transport companies with substantial resources, do not have the capability to meet all the needs of their customers, while they spend most of their time on their activities., the competitive essence has two aspects: first, competition among motor transport enterprises, and then competition between customers. The fact that the competition has two aspects leads to a large number of species. Different automobile transport companies (ATCs) and their transport services have different operational characteristics. Due to the research objectives, automobile transport has been taken into account that inter-enterprise competition arises in accordance with their exploitation characteristics and that these qualities have a decisive impact on the clients. In their activities, motor transport companies use different forms and methods of competition and their different exploitative qualities (refer to figure 1-2).

Figure-1: Factors that determine the exploitative characteristics of automobile transport companies.
Competitiveness is a complex concept, and it is described in various scientific sources [1, 2]. The quality of ATC competitiveness is practically determined by their exploitation characteristics. It is therefore desirable to disclose this concept. It is necessary to define the concept of exploitation characteristics of the motor transport enterprise. The exploitation characteristics of the vehicle transport company are the ability to maintain a leading position among other transport companies for a long time in the market of transport services. Quality and exploitation quality of carriage services is a combination of technical and technological features, guarantee system, compensation and benefits that reflect customer satisfaction and the level of traffic, the level of its purchasing, at a specific time of the Market of Transport Service (MTS) within a specific segment of competitiveness. Based on the aforementioned, we can say that external and internal factors influence the ATC competitiveness.

II. METHODOLOGY AND DATA ANALYSIS

The use of a structured approach has allowed to systematize the factors identified by the source of inputs, quality and price components (Table 1). The concept of exploitative quality also applies to road transport vehicles other than the ATC, which can be grouped according to Figure 1. In analytical systems of exploitative attributes, relative value is determined using the methods of calculation. The following are most commonly used: differential, complex, and combined styles.

Relative values of exploitative characteristics are defined in the differential equation:

$$ q_i' = \frac{P_i}{P_{ib}}, \quad (i = 1, \ldots, n) \quad (1) $$

where:
- $P_i$ is the value of the $i$;
- $P_{ib}$ - base value of indicator;
- $n$ - quantity of indicators.

Table 1: - Factors influencing the exploitation characteristics of motor vehicles

<table>
<thead>
<tr>
<th>Factor initiator</th>
<th>Factors influencing the quality of transport products</th>
<th>Factors affecting exploitation characteristics of transport services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car traffic management system</td>
<td>Normative documents, appearance of new varieties of enterprises in motor transport</td>
<td>Change of ownership and business structure in motor transport</td>
</tr>
<tr>
<td>Government</td>
<td>Environmental policy, normative documents</td>
<td>Economic, credit-monetary, fiscal, customs policy, political factors, economic, political and social stability</td>
</tr>
<tr>
<td>Customers</td>
<td>Customer needs</td>
<td>Demand law, price elasticity of demand, segmentation</td>
</tr>
<tr>
<td>Competitors</td>
<td>Quality of competitive transport products</td>
<td>Price Strategies, Competitive Transport Costs</td>
</tr>
<tr>
<td>Partners</td>
<td>Strategic potential of partner companies</td>
<td>Partner behavior</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Investors</td>
<td>Investment Terms</td>
<td>Interest rates on loan, debt repayment</td>
</tr>
<tr>
<td>Working Resources</td>
<td>Quality of human resources</td>
<td>Workforce Cost</td>
</tr>
<tr>
<td>Environment</td>
<td>Climate, road conditions</td>
<td>Climate, road conditions</td>
</tr>
<tr>
<td>Freight Suppliers</td>
<td>Quality of material resources, availability of resources</td>
<td>Level of material resources prices</td>
</tr>
<tr>
<td>Non-budgetary funds</td>
<td>Funding policy</td>
<td>Interest rates and conditions</td>
</tr>
<tr>
<td>Illegal environment</td>
<td>Racer, theft, the sharp deterioration of the situation</td>
<td>Racer, theft, the sharp deterioration of the situation</td>
</tr>
<tr>
<td>Casualty</td>
<td>force-major cases</td>
<td>force-major cases</td>
</tr>
<tr>
<td>ATC environment</td>
<td>Efficiency, corporate governance structure, business strategy of enterprise strategic capacity</td>
<td>Organizational business strategy, organizational structure and market strategies management, type of transport</td>
</tr>
<tr>
<td>Car transport system</td>
<td>Advances in scientific and technical development of the motor transport</td>
<td>ITT achievements in motor transport, trends in the economy, level of development of demand for goods</td>
</tr>
</tbody>
</table>

Equation (1) is selected from the formula and then used in which the increase in motion will lead to an increase in the operational characteristics of the moving vehicles. The differential estimation method does not necessarily help to find the best, exploitative model simultaneously.

In this case, it is accepted to apply a comprehensive approach to evaluate the competitiveness of vehicles. Quantitative assessments of this method are elaborated in scientific sources [4] and are:

\[
K_{d,p} = \frac{E_{d,c}}{E_{d,c}}
\]

where:
- $K_{d,p}$ - Unit model, which analyzes the model of the vehicle, showing the exploitative quality of the market;
- $E_{d,c}$ - the effectiveness of the model of the action vehicle being analyzed in a particular market;
- $E_{d,c}$ - The best of the kind used in the particular market, i.e., the efficiency of the exploitative model.

The average arithmetic ($U$) can be calculated by the following formula for the complex value of exploitative qualitative:

\[
U = \sum_{j=1}^{n} m_j \times Q_{ja}
\]

(3)

Where:
- $m_j$ - is the weight indices of the j-th group;
- $Q_{ja}$ - total indicator of group i of indicators;
- $n$ - The number of indicators grouped for evaluation of exploitation characteristics.

Comprehensive index of group $Q_{ja}$ is calculated according to the formula:

\[
Q_{ja} = \sum_{i=1}^{n_j} m_j \times q_{ij}
\]

(4)

where:
- $m_j$ - the weight ratio of the i-th group of the j-th group;
- $n_j$ - number of indicators in the j-th group;
- $q_{ij}$ - relative to the base analogue of the action tool's exploitative characteristics. Equation (4) is expressed in the $m_i$ points given in the formula.
Figure: -3 Objectives of the evaluation of the operational quality of vehicles for international road transport

In the composite set of indicators commonly used, an integral indicator of exploitative quality can be determined which can be determined by the sum of the sum of the action of the tool of action, in relation to the total cost of its creation and operation:

\[ K_1 = \frac{P_S}{X_{Y_A} + X_E}, \]  

(5)

where:
\( P_S \) - the sum of the effects of the tool operation;
\( X_{Y_A} \) - sum of cost of creating the tool;
\( X_E \) - the sum of exploitation costs.

In the various sources [3], the use of exploitative quality assurance methods is based on the conventional assessment of the results of expert evaluations. The drawback of this approach is that attracting experts can lead to such a situation in which it is impossible to guarantee that some of the values of the indicators reflect the objective situation. Therefore, this research has suggested a methodology for re-evaluating expert assessments. The following list of quality indices can be developed using this technique in the scope of research of exploitation characteristics of vehicles.

Transportation and logistics systems (LTS) are not limited to the transportation process. They do not depend on the type of transport used by carriers or passengers, but by taking into account the required dimensions, duration and quality characteristics. Thus, he uses the principle of constructing a multitude of logistics modeling systems that allows the management of logistics systems on a single basis. Evaluation of factors influencing the exploitation quality characteristics of motor transport enterprises is carried out in several stages.

If experts have been forced to give the same or average color to several factors in the process of color separation, then in this case, the Co-ordination Coefficient can be determined using the following formula:

\[ W = \frac{5}{2m^2(K^2-K)+m}\sum_j t_j, \]  

(6)

\[ \sum_j t_j = \frac{1}{m^2}\sum_i (t_i^2 - t_i) \]  

(7)

where \( m \)-the number of identical colors in \( t_{i,j} \)-colors. The coefficient of conversion varies between 0 < \( W < 1 \). When \( W \) is greater than 0, the opinions of the expert are so compatible. The significance of the coefficient of the coefficient is estimated by the Xi-square (Pyrrhic Conformity):

\[ X^2 = \frac{125}{mK(K+1)} \]  

(8)

If it is determined by formula 6, then

\[ X^2 = \frac{5}{2m(K^2-K)+m}\sum_j (t_j^2) - t_j \]  

(9)
With the formula calculated, detecting the table value of \( X_i \) is 95% probability for practical matters. If \( X^2 \)-critical (0.05; \( k \) ) < \( X^2 \)-calculated, it is possible to estimate 95% probability of the experts' opinions. Let's go back to the question now. Experts assessments are based on the matrix of color-based distribution factors (Table 3).

As seen in the table, experts have estimated several factors. Therefore, we have to calculate the corresponding colors:

\[
\begin{align*}
T_1 &= 2^3 - 2 = 6; \quad T_3 = 2^3 - 2 = 6; \quad T_5 = 2^3 - 2 = 6; \quad T_6 = (2^3 - 2) + (2^3 - 2) = 6 + 6 = 12 \\
T_7 &= 2^3 - 2 = 6; \quad T_{10} = 2^3 - 2 = 6; \quad T_j = \frac{6 + 6 + 12 + 5 + 6}{12} = \frac{42}{12} = 3.5
\end{align*}
\]

The coefficient of the coincidence is:

\[
W = \frac{1}{\sum_{i=1}^{k} \frac{2612.5}{10(7+1)-i+1} - 3.5} = \frac{2612.5}{46.02 - 0.58} = \frac{2612.5}{45.44} = 56.8
\]

Calculate the sum of the square of \( x_i \):

\[
X^2 = \sum_{i=1}^{k} \frac{2612.5}{46.02 - 0.58} = \frac{2612.5}{46.02} = 56.8
\]

95% of the square value of \( X^2 \); with probability and \( X^2 \)-critical= (0.05 / 6) = 12.59.

12.59 << 56.8 So 95% of probability is that the opinions of the experts are compatible.

When selecting the factors affecting exploitative quality characteristics of the motor vehicle, the diagram of their color distribution is shown in the following table-3.

Table-2: Diagram of the colors by factors influencing the performance characteristics of road transport.

<table>
<thead>
<tr>
<th></th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14.5</td>
<td>16.5</td>
<td>35.5</td>
<td>42.2</td>
<td>43.5</td>
<td>59.1</td>
<td>68.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table-3: Matrix of distribution of experts' assessments of factors influencing the exploitation characteristics of transport services

<table>
<thead>
<tr>
<th>№</th>
<th>Factors</th>
<th>Conditional mark</th>
<th>Conditional number of the experiment</th>
<th>COLOR collection</th>
<th>An average deviation of the color combination</th>
<th>Heavy Quadrature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Delivery Guarantee</td>
<td>X₁</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td>16,5</td>
<td>-23,5</td>
<td>552,25</td>
</tr>
<tr>
<td>2</td>
<td>Delivery time</td>
<td>X₂</td>
<td>1 1 2 1 2 3 1 1 1 1</td>
<td>14,5</td>
<td>-25,5</td>
<td>650,25</td>
</tr>
<tr>
<td>3</td>
<td>Delivery to destination</td>
<td>X₃</td>
<td>6 5 4 5 4 3,5 4 4 4 3</td>
<td>42,5</td>
<td>2,5</td>
<td>6,25</td>
</tr>
<tr>
<td>4</td>
<td>Delivery of the required volume of cargo</td>
<td>X₄</td>
<td>3 4 5 3 5 3,5 2 3 3 4</td>
<td>35,5</td>
<td>-4,5</td>
<td>20,25</td>
</tr>
<tr>
<td>5</td>
<td>Full satisfaction of transportation needs</td>
<td>X₅</td>
<td>5 3 3 4 3 5 5 5 5 5</td>
<td>43,5</td>
<td>3,5</td>
<td>12,25</td>
</tr>
<tr>
<td>6</td>
<td>Providing the requested type of transport</td>
<td>X₆</td>
<td>4 6 6,5 6 6,5 6,5 6,5 6 6 6,5</td>
<td>59</td>
<td>19</td>
<td>361</td>
</tr>
<tr>
<td>7</td>
<td>Choosing the optimal shipping scheme</td>
<td>X₇</td>
<td>7 7 6,5 7 6,5 6,5 6,5 7 7 7</td>
<td>68,5</td>
<td>28,5</td>
<td>812,2</td>
</tr>
</tbody>
</table>

T=40

![Formula Image](image.png)

### III. CONCLUSION

It is important to note that the models of vehicles, which are almost identical to their technical specifications and exploitation costs, can be used for the promotion of ATC at the expense of indicators such as aesthetics, ergonomics, and so on. Indicators are of great importance. The purpose of this paper was to Process the methods of expert assessment in determining the performance of road transport system. From the results obtained in this research, it shows that the calculated chi-square was 56.8 and the critical value from the table with degree of freedom of 0.05 was found as 12.59. According to the data analysis, it concluded that the expected value with the matrix of color-based distribution factors was greater than the critical value, which meant 95% of probability was that the opinions of the experts are compatible.
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