Analysis of the market structure of operator companies: methods and evaluation

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Abstract. Analysis of the role of operator companies in the rail freight market in terms of competition and multi-agency is carried out in this article. It emphasizes the importance of choosing competitive strategies and identifying dominance and monopolization of markets. The methods of SWOT-analysis and Porter’s analysis are used to assess the competition of operator companies. In addition, the Lind, Herfindahl-Hirschman and market concentration indices are important indicators of competition. Indices were calculated for each segment of the rolling stock. An assessment is given to the rolling stock operating market. Competition assessment results help operators identify their competitive strengths and weaknesses, and take the necessary steps to strengthen their market position.

1 Introduction

Operator companies are key players in the rail freight market, providing wagon leasing, freight forwarding, industrial logistics, freight forwarding and other commercial services. In a market where there is competition between different participants, operator companies must constantly improve their position in order to attract new customers and retain existing ones.

From a competitive point of view, operators must develop and implement strategies that will enable them to benefit from the market and increase their market share. To do this, they need to analyze their competitors, evaluate their strengths and weaknesses, and identify their own strengths and weaknesses.

Railroad rolling stock operating companies are responsible for the operation, maintenance and management of the rolling stock. These companies need to be competitive in the rail industry in order to provide high quality services to their customers.

Railway rolling stock operators represent an important link in the logistics chain, providing transportation of goods, as well as wagon rental, industrial logistics, freight forwarding and other commercial services, can use a number of methods and indicators to select competitive positions and identify facts of market dominance and monopolization.

Currently, many research in the field of transport use various methods and approaches to analyze the competitive environment and identify measures to strengthen the position in the market [1-15].

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For example, in [1] the authors use a stylized simulation model to study how open access competition affects tariffs, demand, supply, consumer surplus, and operator profits compared to a profit-maximizing monopoly and a situation where welfare.

In [2], the authors explore the methodology for predicting the future development of unregulated industries, especially in the transport sector, in particular, assess the development of competition in the field of freight rail transport in Finland, and analyze different views on rail transport policy using the Delphi questionnaire.

Some research use various indices [16], as well as the Lind and Herfindahl-Hirschman index (HHI), to measure the level of competition in the transport services market [17-20]. Porter’s analysis and SWOT-analysis are also widely used in transport research [21-24].

Thus, the above methods are widely used in transport research to analyze competition and determine competitive advantages. However, to achieve accurate results, it is necessary to take into account the characteristics of the market and the transport industry, as well as apply appropriate modifications and adaptations of these methods.

These research and many others highlight the relevance and importance of using competition analysis methods to develop effective strategies and strengthen market position in various sectors of the transport industry.

Overall, this Ishikawa diagram is a useful tool for identifying potential causes that could be addressed to increase the competitiveness of a railway rolling stock operator company (Fig. 1). Thus, there is a dependence of the structure of the organization of the port transport and technological system on the structure of the market of operator companies, the dynamics of the cargo base and the system for organizing wagon flows.

**Fig. 1. Directions for increasing the customer focus and competitiveness of the operating company.**

Compiled by the authors.

The above diagram depicts a few possible causes that could contribute to the effectiveness of solutions for increasing the competitiveness of a railway rolling stock operator company.

**2 Materials and methods**

Competitiveness is a key aspect for business entities that allows them to survive and thrive in the market. In order to be competitive, companies must have a clear understanding of their position in the market and the ability to determine the facts of market dominance and monopolization. For this, methods and indicators for selecting competitive positions are used.
Methods for selecting competitive positions may be different. For example, the use of SWOT-analysis (analysis of strengths, weaknesses, opportunities and threats) [21-23], which allows you to evaluate internal and external factors that affect the company's positioning in the market and determine its competitive advantages. Portfolio analysis methods are also used, which allow assessing the positioning of the company's products in the market and choosing the best strategies.

The metrics that are used to select competitive positions include market share, sales volume, profitability, average selling price, customer loyalty, company image, and so on. Market share measures a company's market share relative to its competitors. Sales volume allows you to assess the scale of the business. The average selling price allows you to assess the pricing of the company in the market, and the level of consumer loyalty - to assess the level of consumer satisfaction with the company's products. The image of the company is also important, as it can influence its positioning in the market.

Also, to identify the facts of dominance and monopolization of markets, methods of competition analysis are used, such as analysis of the activities of competitors, analysis of their strategies, analysis of pricing policy, etc. These methods allow you to assess the strengths and weaknesses of competitors, identify potential threats and opportunities for the company in the market.

One of the main indicators for assessing the competitive position of the operator company is the market share. Market share is the share of a company in the rail transportation market, or in some part of a segment. It is calculated by dividing a company's traffic by the total traffic in the market. The higher the company's market share, the higher its competitiveness and share in total traffic volumes.

The market share can be calculated by the number of transported goods, by the number of rented wagons or by turnover. A railway rolling stock operator can use this indicator to assess its competitiveness and make decisions about its development strategy.

To assess the situation in the market for operating rolling stock on the N-range of the railway for the T-period, the most important operating companies were selected and their role (share) in the segment of such types of rolling stock as: tank wagons, covered wagons and gondola wagons was determined (Table 1).

<table>
<thead>
<tr>
<th>Type of rolling stock</th>
<th>Operator name</th>
<th>Company share, %</th>
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</thead>
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<td></td>
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<td>SG-trans OA</td>
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<td>OTECO CJSC</td>
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<tr>
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<td>1.86</td>
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<td>7.14</td>
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Concentration index (CR) can be used to identify facts of dominance and monopolization of markets. The concentration Index is a numerical indicator that allows you to assess the degree of market concentration in a particular industry. For the railway industry, you can also use the HHI, the Lind index (L) [17-20].

CR - an indicator that characterizes what market share falls on a given number of the largest players.

Since the concept of a «set amount» looks rather vague, a number is added after the letters CR, which shows how many of the largest market players are in question.

CR is defined as the sum of the market shares of the $n$ largest companies:

$$CR_n = \sum_{i=1}^{n} S_i$$  \hspace{1cm} (1)

where

$S_i$ - share of each specific market participant;

$n$ - total number of entrepreneurial firms in a given market sector.

This method allows to assess the degree of concentration of products or services in the market, as well as to identify the market share that is controlled by the largest players. For the railway rolling stock operator company, this method allows assessing the competitive situation in the market and making a decision on the most effective development strategy.

Usually this indicator is calculated mainly for $3$ (CR 3), $4$ (CR 4), $6$ (CR 6), $8$ (CR 8) largest companies.

To identify the facts of dominance and monopolization of markets, various indices are used, for example, the HHI, which allows you to assess the concentration of the market. The HHI index is calculated by square summing the shares of each company's market share in the market. The higher the value of the HHI index, the greater the concentration of the market and the greater the likelihood of dominance and monopolization of the market.

$$HHI = \sum_{i=1}^{n} S_i^2$$  \hspace{1cm} (2)

$S_i$ - share of each specific market participant;

$n$ - total number of entrepreneurial firms in a given market sector.

The Lind index can be useful in the analysis of competition in the market of rail transportation and services provided by railway rolling stock operator companies. For example, if an operator company's Lind index is high, this may indicate that it has significant monopoly power in the rail transport and services market, which can lead to reduced competition and higher prices for consumers.

On the other hand, if the Lind index is low, this may indicate a more competitive market environment, which may be beneficial for consumers, as well as operator companies, which can use more competitive prices and conditions to attract new customers.

Thus, the Lind index is another tool for analyzing competition in the market, which can be useful for railway rolling stock operators in choosing competitive positions and identifying facts of market dominance and monopolization.

The Lind index measures the degree of inequality between market-leading sellers of a product:
\[ L = \frac{1}{k(k-1)} \cdot \sum_{i=1}^{k} Q_i \]  

(3)

where

\( k \) – number of big sellers (from 2 to \( N \));

\( Q_i \) – the ratio between the average market share of \( i \) sellers and the share of \( k - i \) sellers;

\( i \) - number of top sellers among \( k \) big sellers.

\[ Q_i = \frac{A_i}{A_k - A_i} \]  

(4)

where

\( A_i \) – total market share of \( i \) sellers;

\( A_k \) – market share attributable to \( k \) large sellers.

The Lind index is used as a determinant of the «boundary» of the oligopoly in the following way: it is calculated \( L \) for \( k = 2, k = 3 \) and so on until \( Lk + 1 > Lk \), that is, the first discontinuity of the indicator is obtained \( L \). «Boundary» is considered to be set when the value \( Lk \) of the minimum value is reached in comparison with \( Lk + 1 \).

The Lind index and the concentration index is calculated only for a few of the largest firms and, therefore, also does not take into account the situation on the «outskirts» of the market. However, unlike it, the Lind index is focused on accounting for differences in the «core» of the market.

From the theory of oligopoly [25], it is known that if 2–3 companies dominate the market, this is a «hard» oligopoly, if 6–7 companies dominate 70–80 % of the market, this is a «vague» oligopoly.

### 4 Results

The results of calculating the concentration index for the corresponding types of rolling stock (Table 1) according to formula (1) are presented in Table 2.

**Table 2. Values of the concentration index (CR).**

<table>
<thead>
<tr>
<th>Concentration index</th>
<th>Type of rolling stock</th>
<th>tank wagons</th>
<th>covered wagons</th>
<th>gondola wagons</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR4</td>
<td>60.42</td>
<td>71.86</td>
<td>52.37</td>
<td></td>
</tr>
<tr>
<td>CR6</td>
<td>70.5</td>
<td>92.28</td>
<td>64.27</td>
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<td>CR8</td>
<td>78.42</td>
<td>97</td>
<td>71.41</td>
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</tbody>
</table>

Since the concentration index is an arithmetic sum, it actually ignores the structure of the distribution of market shares among the companies that are included in the index calculation.

Thus, the concentration index should be used as a kind of addition to other economic indicators, or the number (\( n \)) of companies should be selected in such a way as to objectively correspond to the structure of the distribution of forces in the market.

We calculate the \( HHI \) index for the 7 largest companies in the rolling stock operating market (tank wagons) using formula (2):

\[ HHI = 31,65^2 + 13,67^2 + 7,91^2 + 7,19^2 + 5,4^2 + 4,68^2 + 4,32^2 = 1372,58 \]

Similar calculations show:

For 5 companies – \( HHI = 1332,01 \);
For 6 companies – \( HHI = 1353.91 \);
For 8 companies – \( HHI = 1385.54 \);
For 9 companies – \( HHI = 1391.89 \);
For 10 companies – \( HHI = 1395.13 \).

In further calculations, the index does not change so significantly, so these results are sufficient to assess the situation on the rolling stock operating market in the tank wagons segment.

In the covered wagons operating segment, the results of the index calculation for 8 companies are sufficient:
4 companies – \( HHI = 2298.97 \);
5 companies – \( HHI = 2356.28 \);
6 companies – \( HHI = 2378.46 \);
7 companies – \( HHI = 2386.65 \);
8 companies – \( HHI = 2390.11 \).

In the gondola wagons operating segment, the \( HHI \) ceases to change significantly when it is calculated for 11 or more companies:
5 companies – \( HHI = 1059.81 \);
6 companies – \( HHI = 1082.47 \);
7 companies – \( HHI = 1105.13 \);
8 companies – \( HHI = 1110.79 \);
9 companies – \( HHI = 1116.45 \);
10 companies – \( HHI = 1122.12 \).

According to the values of \( CR \) and \( HHI \), there are three types of market:
– type I – highly concentrated markets (monopolistic markets): at \( 70\% < CR < 100\% \); \( 1800 < HHI < 10000 \);
– type II – moderately concentrated markets (oligopolistic markets): at \( 45\% < CR < 70\% \); \( 1000 < HHI < 1800 \);
– type III – low concentrated markets (competitive markets): with \( CR < 45\% \); \( HHI < 1000 \).

It can be seen from the results obtained that the rolling stock operating markets – tank wagons and gondola wagons are oligopolistic, and the rolling stock operating market – covered wagon - is monopolistic (Fig. 2).

![Fig. 2. Determining values of HHI and CR indices in the wagon operation market.](image-url)
To clarify the situation in the oligopolistic markets for operating rolling stock – tanks wagons and gondola wagons, we use the Lind index. Based on formulas (3), (4), we will calculate the Lind index to determine the oligopoly boundary in the gondola wagons operating segment.

The calculation results $L$ are summarized in Table 3.

<table>
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<tr>
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<th>2</th>
<th>3</th>
<th>4</th>
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Similarly, we will obtain results for the tank wagons operating market, which we summarize in Table 4.

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**5 Discussion**

Based on the calculations of the Lind index, the following conclusions can be drawn:

– in the segment of the rolling stock – tank wagons, the discontinuity of the index occurred at $k = 10$. Consequently, the oligopoly is formed by the first 9 economic entities. The nature of the oligopoly is «vague».

– in the rolling stock segment – gondola wagons, the discontinuity of the index occurred at $k = 8$. Consequently, the oligopoly is formed by the first 7 economic entities. The nature of the oligopoly is «vague».
The calculations of market assessment indicators for operating rolling stock, as well as changes in legislation (introduction of fees for the storage of rolling stock on the general-use railway tracks outside the transportation process, for providing tracks when delivering and removing wagons from non-public use tracks, the ban on extending the service life of wagons), and other related markets (wagon-building) indicate the near-term trends in the wagon operating market: a reduction in the wagon fleet, further consolidation of large operators, and a gap in the number of wagons between large operators and the remaining operators in the market.

6 Conclusions

Assessing competitive positions and identifying facts of market domination and monopolization are important aspects for successful business operations on the market. Research in this field shows that the use of SWOT analysis and Porter's analysis allows operator companies to determine their position in the market and choose an optimal competitive strategy. The Lind, $HHI$, and market concentration help assess the level of competition on the market and identify facts of market domination and monopolization.

In conclusion, it can be noted that operator companies play an important role in the market of railway freight transportation. To successfully compete in this market, it is necessary to use various methods and tools such as SWOT-analysis, Porter's analysis, Lind and $HHI$. These methods allow for the assessment of the competitive situation on the market and identify facts of market domination and monopolization, as well as determine the competitive advantages and weaknesses of operator companies.

Thus, the use of different methods and tools to assess competition in the railway freight transportation market allows operator companies to make the right decisions and strengthen their position in the market. However, it is important to consider that the competition in this market is high, and operator companies need to constantly analyze the situation and take effective measures to strengthen their positions.

References

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effective measures to strengthen their positions. However, it is important to consider that the competition in the transportation market allows operator companies to make the right decisions and strengthen their position in the market. These methods allow for the assessment of the competitive situation on the market and use various methods and tools such as SWOT analysis. To successfully compete in this market, it is necessary to identify facts of market domination and monopolization.

Research in this field shows that the use of SWOT analysis and Porter's analysis allows operator companies to determine their position in the market and choose an optimal strategy. Conclusions

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