



APPLICATION OF DEA METHOD IN RAILWAY TRANSPORT

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Abstract – The railway is a complex, dynamic system that constitutes the unity of railway infrastructure, vehicles, and personnel and has its function or goal. The main characteristics of rail transport are high speed, low cost, mass, and inelasticity. The main advantage of railways is their ability to transport large quantities of goods and people over long distances. From the moment of loading the goods or boarding passengers, the railway enables high-capacity transport at high speeds. One of the basic, but still insufficiently researched, performances is efficiency. In modern market operations, efficiency is a key factor in market success.

Measuring efficiency is an important task of management to look at the previous operation of the unit and plan its future development. Considering the analysis model, the advantages of calculating the efficiency of the traffic solution can be applied in many other branches of the economy, such as education, various economic segments of city and state management, etc.

Efficiency can be defined as the ability to achieve desired goals with minimal utilization of available resources. Information about efficiency is relative to the analyzed data. So, different data give different efficiency, which, however, is only valid when applying the same model. On the one hand, the data obtained from practice (empirical data) are variable (daily, monthly, and annual unevenness is known) and can be influenced (accidentally or planned). On the other hand, from the point of view of mathematics, it is known that two opposite models give the same result, namely: smaller input and the same output (input model) or the same input and larger output (output model).

This research presents the application of the DEA (Data Envelopment Analysis) method for measuring the efficiency of rail freight transport in the Republic of Serbia from 2015 to 2021. In developing the DEA analysis model, the number of DMU decision units, or more precisely, variant solutions, is first determined, and each unit represents a specific year. The number of DMU decision units should equal or exceed the number of input-output parameters. The following parameters were used as input parameters: the number of employees in traffic and transport, the consumption of liquid fuels in traffic (in thousands of tons), the consumption of electricity in traffic (in thousands of MWh), the number of railway transport assets in the freight car fleet, and the tons of load capacity of railway transport assets expressed in thousands. As output parameters, the following were used: transported goods expressed in thousands of tons and transported goods in tons per kilometer. After certain DMU units, the number and sizes of input-output parameters have been determined, and the DEA model is set. The calculation was made based on the CCR model.

For 2017, 2018, 2019, and 2021, maximum efficiency was achieved. For the other observed years, 2015, 2016, and 2020, the percentage values for decreasing input and increasing output parameters are given.

Keywords – rail freight transport, efficiency, data envelopment analysis.

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