



Politechnika Śląska  
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## PRACA DOKTORSKA

Temat pracy:

*Opracowanie metody wyznaczania efektywności przedsiębiorstw  
komunikacji miejskiej świadczących publiczne usługi transportu  
zbiorowego*

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## **ABSTRACT**

### **Developing a Method for Determining the Efficiency of Public Transport Companies Providing Public Mass Transport Services**

The subject matter of the paper concerns an important and topical problem, closely related to production engineering, which is the determination and evaluation of the efficiency of public transportation companies providing public mass transportation services. Its relevance stems from the great role and importance of public urban transportation for the development of modern and smart cities, considering the economy of sustainable development and the related policy of sustainable mobility.

With regard to the multidimensionality of the subject matter and its great importance for an urbanizing society, a new and original research methodology was developed. Its purpose was to create a new multidimensional approach to the study of the efficiency of public transportation service companies. The basis of this methodology was the identification of areas (dimensions) of the activities of enterprises in this industry that should be considered when determining their efficiency. In addition to these dimensions, a very important stage of the study was also the selection of sub-indices that characterize the identified dimensions of this activity. In this process, it was necessary to take into account the possibility of obtaining sufficient quality and quantity of data to determine the values of these indicators. As a result, eight dimensions of the activities of public transportation companies were identified and 36 sub-indices were included in the study. The identified dimensions involved the use of rolling stock and personnel resources, the way in which the rolling stock is operated, the safety and comfort of the services provided, their impact on the environment, as well as the economic aspects of the business and the employment structure.

The multidimensional approach to studying this issue also determined the choice of methods that were used in the process. A multidimensional approach based on multi-criteria decision-making methods (MCDM) and the Laplace's criterion was used to determine efficiency. The TOPSIS, WASPAS and GRA methods were utilized to determine the integrated efficiency indices of each dimension of the company's activities and the integrated index of its total efficiency. On the other hand, CRITIC, equal weights, standard deviation and Entropy methods and survey results were used to determine the weights of sub-indices and dimensional efficiency indices. The research process included two variants, the first considered the values of the weights determined only from the results obtained from the analytical methods, and the second additionally also from the surveys. This approach was practically applied to the study of the efficiency of one of the public transport companies in Poland. The results obtained, together with the conclusions, are included in the paper.

The research conducted in accordance with the presented methodology made it possible to achieve the established scientific objective, which includes the development of methodology for determining and evaluating the efficiency of a public transport company providing public mass transport services, taking into account a multi-criteria approach. The knowledge gained from the implementation of the scientific part of the study made it possible to develop guidelines for the practical application of the results, in order to improve the efficiency of the process, which also made it possible to achieve the utilitarian purpose of the study. The

universality and flexibility of the developed methodology should also be emphasized, which makes it possible to adapt it to the specifics of the studied enterprises and gives the possibility of applying it also to the study of multi-criteria problems in enterprises from other industries.

With regard to the huge role and importance of public transportation in the sustainable development of modern cities, as well as the functions that public transportation companies play in this process, it can be concluded that the subject matter undertaken is timely and important from both a scientific and utilitarian point of view and fits into the field of production engineering within the scientific discipline of mechanical engineering.