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Sustainable urban transport – the concept of measurement in the field of city logistics

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Abstract

One of the most important areas of sustainable development is the transport sector. There are a lot of different examples of sustainable transport in many papers. The most commonly used definitions of sustainable transport include environmentally sustainable transport, sustainable transport system and process sustainability of the transport system. The differences between the cited concepts are generally minor, substantially greater difficulties arise, however, in measuring the characteristics of the sustainability of transport, not only in the base - by analyzing the indicators, but especially in a multidimensional system aimed at exploring the relationship between the characteristics chosen to describe sustainable transport. The aim of this paper is to identify and select indicators repeated in different strategic documents describing sustainable transport, then study the spatial coherence selected for the study of these indicators and conduct an analysis of relations between the identified areas of sustainable transport. In the available literature, the results of such analyses to date are based mainly on the analysis of sustainability of individual indicators. Much less attention has been devoted to the study of interactions between the indicated areas. In this paper, the vector calculus method is applied.

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1. Introduction

According to the definition of the World Commission for Environment and Development of 1987, sustainable development means development that meets the needs of the present generation, which are fulfilled without compromising the ability of future generations to meet their own needs. One of the most important areas of sustainable development is a transport sector. On the one hand its impact on the sustainable development is associated with social or economic benefits, but on the other hand it involves the need to minimize the adverse effects of the development.

The transport sector is in fact strongly conditioned socially, economically, legally and technologically. It is also highly integrated with other areas of the economy, and complementary with other activities associated with the transport sectors of neighboring countries.

Over the last two decades, the sector has been subjected to very intense changes, which is particularly evident in the case of the European Union countries. The pace and complexity of these changes are influenced by many factors including different areas such as:

- economic conditions including: economic situation, unemployment rates, changes in the level of inflation,
- social determinants including: demographic factors, changes in consumer purchasing behavior or affluence,
- technological conditions including: primarily changes in production processes and services, new technologies and technological solutions on both the means of transportation and logistics systems,
- legal and regulatory conditions including: changes in the European Union laws and guidelines, internal changes in legislation and regulations.

Particularly important areas for the further development of transport are the economic, social and technological spheres. In contrast, the most stable situation is that concerning the sphere of regulatory and legal framework. The changing socio-cultural, economic and technological conditions are a major challenge for sustainable transport in the area of modern cities. The dilemmas associated with the explanation of the meaning of the term “sustainable transport” are also important. First of all, it is difficult to define what is meant by this term.

There are a lot of different examples of sustainable transport in many papers (Anderson et al., 2005; Goldman and Gorham, 2006; Litman, 2008; Borys, 2009; Laconte, 2012; Limaa et al., 2014, May, 2015). The most frequently used definitions alongside sustainable transport are: environmentally sustainable transport, sustainable transport system, and in terms of process, sustainability or sustainability of the transport system. The differences between the cited concepts are generally minor; substantially greater difficulties arise, however, in measuring the characteristics of the sustainability of transport, not only in the base - by analyzing the indicators, but especially in a multidimensional system aimed at exploring the relationship between the chosen characteristics of study that describe sustainable transport. Selecting the indicators of sustainable transport itself is an extremely difficult task mainly due to the wide variety of indicators used in literature and the numerous strategic documents of both domestic and international organizations.

The aim of this paper is firstly the identification and selection of indicators repeated in different strategic documents describing sustainable transport, then the study of the spatial coherence selected for chosen indicators and an analysis of relations between the identified areas of sustainable transport.

Within the available literature, the results of such analyses are to date based mainly on the analysis of sustainability of individual indicators. Much less attention has been devoted to the study of interactions between the indicated areas. In the paper a study of the interrelationships that exist between chosen indicators and a method of multidimensional comparative analysis will be used.

The paper is organized as follows: the first section comprises of a general literature review of the concepts and theories of sustainable urban transport. The second part looks at contemporary research work and focuses on some indicators of sustainable transport in the European Union and Poland. In the last section, the authors present a proposal of measurement in the field of sustainable development of city logistics and formulate conclusions.

2. Features of a sustainable transport system

The transport system is an ordered system of interrelated components of the transport infrastructure. This system, structured in both functional, spatial and technical-technological systems consists of the following elements: railway, road, air, inland waterways and the sea with its port subsystem. Efficient management of this system is an important

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