



Model of a Sustainable Transport System on the Example of Olsztyn

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Abstract: The main aim of the article is to present a theoretical model of a sustainable urban transport system and to indicate the need for changes in the approach to it. The issues of sustainable development and functioning of the municipal transport system in Olsztyn discussed in the article evoke vivid social and political interests of the city's inhabitants. This is mainly due to the impact of transport operation on quality of life, the correlation of its development with the economic development of the city, and the strong impact of transport on the natural environment. Today, it is already known that a coherent and modern transport system is an indispensable element of a competitive city. Connecting the city into a functional system, it presents it as a system of interdependencies between its elements.

Keywords: urban transport, sustainable transport, transport model

1. Introduction

The ongoing urbanization processes in the world, the increase in the share of the urban population in relation to the total population, the formation of agglomerations of great importance for economic and social life, places more and more demands on urban transport systems (Kłós et al. 2020) and transport safety (Woźniak et al. 2018). It is related to the increasing number of trips (Zochowska 2012), limitations of land that can be used for transport purposes, problems related to the impact on the natural environment, as well as congestion and inefficiency of the urban transport system. Of course, the invention of a mass-produced and increasingly accessible car had a huge impact on this.

Currently, passenger cars are the second type of ubiquitous objects after buildings, and only the lack of space means that there are not more of them. Moreover, there is an increasingly visible contradiction between the desire to have a car by the inhabitants and the technical possibilities of using it in densely built-up streets and neighborhoods (Burniewicz 2005). In this situation, it becomes necessary to rationally plan the transport system in which urban transport would be treated as a priority and the possibilities to own and use a passenger car would be



limited. However, this is a difficult measurement and requires considerable time and financial resources. It is also important to identify problems and dysfunctions in urban transport, which can significantly contribute to increasing its functionality (Tundys 2008). Generally, it can be said that these are problems with social, economic and ecological implications (Szołtysek 2008).

Consequently, it should be added that the period in which buses were the only available means of transport for urban travel has definitely passed. City transport has irretrievably lost a huge number of passengers traveling from home to work every day. In this sense, the urban transport market has not only been affected by the outflow of passengers, but also by the loss of state patronage, which has not been replaced by anything. The state has completely withdrawn from the care of public transport and the self-government in charge of it has not received adequate resources for the new tasks. We did not have to wait long for the effects of this state of affairs: ticket prices increased, there were not enough financial resources for the replacement of rolling stock and the development of infrastructure. This largely contributed to the decline in the attractiveness of urban transport. Also congestion and increased individual motorisation have contributed to the deterioration of transport conditions (Igliński 2008, Altshuler 1979, Zomkowska 2008, Ciesielski & Szudrowicz 2001, Kosacka-Olejnik 2021).

This hard-to-stop urban transport degradation process bears the hallmarks of a downward spiral. The decreasing number of passengers traveling by bus leads to an increase in ticket costs and a lower frequency of their rate, which entails a further decrease in the number of passengers transported. In such situation, the number of passenger cars in the city is increasing. Traffic, noise, and emissions are increasing. As a long-term effect, urban space and the natural environment are degraded and the quality of life of inhabitants decreases (Rudnicki & Starowicz 2007).

The main aim of this article is to present the theoretical model of a sustainable urban transport system and to indicate the need to change the approach to it. In particular, this concerns the ways of analysing and diagnosing its problems, regardless of whether we are dealing with a transport system in a metropolitan area or a small town. The aspect of mobility in urban areas is also important (Chamier-Gliszczyński & Bohdal 2016, Chamier-Gliszczyński & Bohdal 2016a).

However, the premises for taking up the topic should be found in the fact that modern cities are subject to constant processes of evolution. Thus, urban transport systems, which are the pillars of their functioning, are not free from change. However, it is important that the necessity of these changes is recognized at the right time and subjected to a proper analysis, which will result in a modified approach to the programming of sustainable development not only of the urban transport system, mobility (Chamier-Gliszczyński 2015), but also of the entire

city. Rationality and urban sustainability can be achieved by using effective instruments to reduce the intensity of urban transport, as well as by stimulating technological and organizational changes in urban transport that reduce its intensity of resources, intensity of energy, nuisance to the environment (Jacyna et al. 2021) and existing traffic conditions (Prasolenko et al. 2019).

2. The idea of sustainable development and its specification in transport

In its basic interpretation, the concept, or rather the feature of the state of development referred to as sustainability, reflects a concern with the consequences arising from various indirect and long term effects and impacts (Borys 2005). In short, sustainability is a fundamental human aspiration to protect and improve the quality of life. Without going into detail, sustainability is an intuitively understandable concept, but as Litman and Burwell point out, it is a category fraught with many complex implications (Litman & Burwell 2003). The general outline of the concept of sustainable development forms the basis of assumptions made in sectoral applications (Borys 2005, Nicolas et al. 2003). Of course, there are some difficulties in distinguishing between the concepts of sustainable transport and sustainable transport development. Sustainable transport is considered in a broad and narrow sense. Sustainable transport, strictly speaking, raises three issues. Firstly, it only refers to environmental aspects related to rational human activity (for example, minimizing the consumption of environmental components, minimizing the emission of pollutants, maximizing the use of waste products (Kryk 1993), therefore, it is called environmentally sustainable transport. Second, sustainable transport is considered in terms of two factors: resource scarcity and climate change. In this sense, sustainable planning is a specialised enterprise. Thirdly, sustainable transport is environmentally sustainable mobility (Chamier-Gliszczyński 2012), which includes changes in behaviour and an unusual approach in all sectors of the economy. On the other hand, sustainable transport in the broad sense is not limited only to the environmental dimension, but to the whole triad of aspects. In general, it is a system that reduces the negative effects of any transport activity, is characterized by features such as mobility and accessibility and, above all, is beneficial for the economy and the user.

Although there is no uniform definition and uniform perception of the content, form and meaning of this concept, most definitions refer to the concept of sustainable transport, which from generation to generation can fully function, carrying out the processes of moving people and cargo without including materials, energy, and other environmental resources due to each next generation (OECD 1991). This approach to the problem is presented in the classic definition adopted in 2004 by the European Conference of Transport Ministers and in 2005 by the Centre for Sustainable Transport. This is the classic definition adopted by

the European Conference of Ministers of Transport in 2004 and by the Centre for Sustainable Transport in 2005. From this definition it follows that a sustainable transport system is one that (Borys 2005):

- it enables the basic need for access by individuals and society to be met in a safe and consistent manner with the needs of human health and ecosystems and meets the capital value requirements within a given generation and on an intergenerational scale;
- it is affordable, functions efficiently, offers a choice of means of transport, and supports a thriving economy;
- reduces emissions and waste, taking into account the absorption capacity of the planet, minimizes the use of nonrenewable resources, reduces the consumption of renewable resources to a sustainable level, recycles and reuses their components, minimizes land use, and reduces noise levels.

According to this definition, the sustainable transport system takes into account the criterion of accessibility to transport services in accordance with the requirement of health and environmental safety, taking into account the principle of intergenerational justice, then the criterion of economic efficiency and the criterion of limiting the environmental impact (Chamier-Gliszczyński 2011, Jacyna 2018) and use of space. This definition can be considered the most comprehensive and unambiguous and is preferred by many experts in the transport industry.

Today, the concept of sustainable transport is at the heart of many policies, strategies, and actions. However, despite four decades of discussion, it can be said that it still remains more of a debatable concept than a guideline for real action (Dobrzańska 2007). In order to make this concept real in urban transport, operational principles for sustainable transport have been identified. These are:

- The principle of adequate funding for infrastructure necessary to eliminate bottlenecks.
- The principle of political determination to implement the measures proposed in the White Paper.
- The principle of a new local authority approach to urban transport.
- The principle of meeting the needs of users, in return for increasing mobility costs, has the right to expect high-quality services.

Undoubtedly, the concept of sustainable transport under current social and economic conditions is an idea that is difficult to implement, as there is little chance that the transition from declared ecological values to specific actions will take place in a short time. This is because the positive attitude of society toward the issues of environmental protection often loses when confronted with the economic conditions of functioning. Hence, sustainable transport is still the future as too many transport needs are met with a private car. It will be possible to talk

about real sustainable urban transport when most of society will abandon cars in favour of urban transport, walking, or cycling. However, we should remember that only sustainable urban transport is the only one that can prove itself in our modern cities.

3. Towards a sustainable urban transport system

The road to sustainable urban transport has been outlined. The Lisbon Strategy set a new strategic goal for the European Union – to become the most dynamic and competitive economy in the world, capable of sustainable economic growth accompanied by qualitative and quantitative improvements in employment and greater social cohesion. The basic strategy for achieving it is the transition from the growth promotion model to a model in which environmental protection and rational management of natural resources will become components of development patterns (Kozłowski 1994). Urban transport has a significant role to play in this process. Every day it faces contradictions between the community demanding more mobility and the public criticizing the delays and congestion of transport modes. Reconciling them always seems to be a difficult, even impossible task. After all, no one has managed to reconcile the interests of all people or to satisfy everyone at once.

The new path to sustainable urban transport involves the need to break away from traditional and dominant patterns, taking into account the civilization and cultural megatrends (Stacewicz 1996) that shape the society of the future. Sustainable development is currently the only fully crystallized alternative development concept. It is a multifaceted concept that covers the basic aspects of development (Pyć 2006): social, economic, ecological, spatial and cultural.

In light of the above arguments, there is no doubt that the development of the transport system is a continuous process. There is no end state to which it aspires. Each condition achieved is a transitional state that forms the basis of the next stage of development. Development understood in this way makes it possible to achieve better conditions of functioning by making positive changes. Certainly, the process of developing sustainable transport systems must be a conscious, purposeful and prospective activity conducted in the interest of local communities. Only then, at least from a purely theoretical point of view, will the conditions of sustainable development be created, i. e. the development that will bring the maximum social effects, satisfying the participants of this development, appropriate and expected individual effects, and will proceed with the minimum risk of failure (Parysek 2001).

The above premises indicate that one of the main goals of each city should be to create conditions for efficient, safe, and effective movement of people while limiting the harmful impact on the natural environment. In this context,

adopting a sustainable approach to the city's transport system seems appropriate and satisfactory – Figure 1.

This is indicated by the opinions of the scientific community and the activities of local communities associated with various types of associations that promote the idea of sustainable development. What is missing are only specific, often drastic, and politically unpopular measures that could actually contribute to the simultaneous improvement of the quality of life of the inhabitants and the natural environment. Without it, the sustainable transport system can only become a fiction.

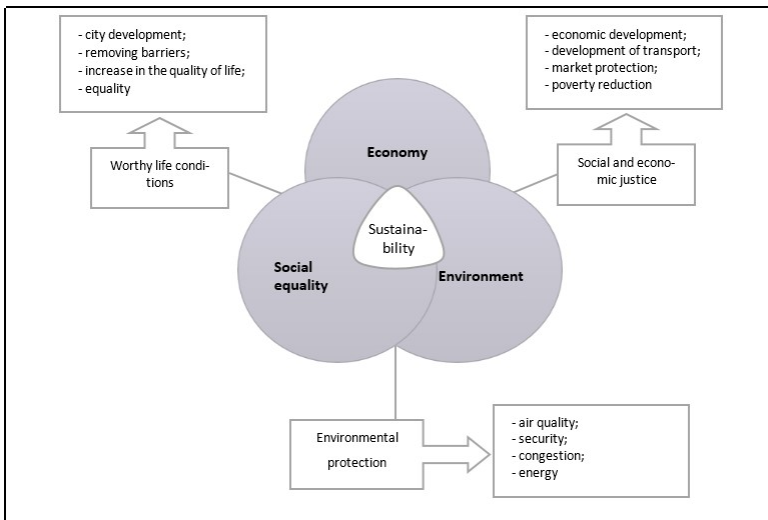


Fig. 1. Sustainable solutions in transport
Own study based on Urban Mobility in Developing Countries, UITP, Brussels 2007

Continuing the thought, it is obvious that the development of the transport system should take place in an orderly manner, based on a mosaic of plans with a different spatial scale and a different time horizon. On the other hand, the vision of future sustainable transport should present its shape and features desired for the region and local communities, differing from its present state by a large set of implemented innovative solutions (Burnewicz 2005). Naturally, a vision is not a forecast, a plan, or a program, but only the starting ideas for its creation. It is a look at the future of transport through the lens of innovation trends around the world that can be transferred to it. Hence, on a strictly theoretical basis, it can be imagined that this is an optimistic vision, showing a sustainable urban transport system as:

- efficient, to be able to handle a huge number of passengers at the highest possible level;
- flexible, so that local communities can move according to their preferences and expectations, using various forms and means of transport;
- efficient, so that the financing of transport does not limit investment activity in new technologies and its development;
- integrated not only within the regional transport system itself, but also with urban and superregional transport;
- modern and ecological, so that it attracts crowds of stakeholders and is a positive element of the city's image, as well as ensuring sustainable development of the urban area.

The above list shows that the development of urban transport should stimulate economic development and spatial order, improve the image of the city, and reduce the differences in development and quality of life in individual areas of the city. What is referred to as 'quality of life' depends to a large extent on the transport solutions adopted. Not surprisingly, the choice of a particular transport option translates into issues such as pollution, noise levels, commuting times to work and school, etc. All this, in turn, contributes to the character of the city and how it is lived in - pleasant and nice or the opposite.

4. Determinants of a sustainable model of the Olsztyn urban transport system

Olsztyn's public transport, like similar systems in other Polish cities, is an integral part of the complex organism that is the city. Hence, it is subject to numerous limitations and development stimuli, appropriate for an urbanized area. A properly organized and efficient operating system is of key importance for the proper functioning of the city and the lives of its inhabitants. And its formation is closely related to the constant need to move around, which determines the possibility of satisfying human needs (Jacyna 2009). This thesis is still relevant today. What changes are the requirements and the means by which these challenges can be met.

This view supports a comprehensive view of transport in Olsztyn, so that, as in other Polish or European cities, the passenger can be transported in one travel chain upon presentation of one ticket. Therefore, it is necessary to organize urban transport in such a way that the competences and scope of action of all transport operators are strictly defined and delimited. By its very nature, this leads to the conclusion that an institution is needed to manage and coordinate the entire public transport system, which should set common transport goals for the city. In addition, it should cooperate with the authorities of neighboring communes in order to ensure the possibility of satisfying the basic mobility needs of individual

communities, limiting the sources of congestion, and ensuring environmental protection. In this context, under the circumstances of the existence of numerous operators on the local urban transport market, it is most appropriate for the public transport organiser to manage it on the basis of regulated competition, which is in line with European Union guidelines and Polish legislation.

And if so, improving the efficiency of urban transport operation requires structuring of the functions and competences of the participants in the transport process. The model presented in Figure 2 is characteristic of a market corresponding to the conditions of regulated competition. It assumes separation of the sphere of organisation from the realisation of transport. In addition, it takes into account the functioning of the public regulator and the operation of more than one entity in the field of transport with different forms of ownership. The designed model considers four levels of functionality:

- regulation of the market and transport policy;
- managing the transport offer;
- provision of transport services;
- consumption by consumers.

The model presented assumes that integration is a desirable state and a way to organize the urban transport system that should be pursued. It is recognized that the integration of urban transport will be both a factor determining the quality of life of local communities and influencing the development in the entire area of which it is part. As an efficient city transport system attracts new residents, tourists, and investors, it contributes to the economic growth of the area and contributes to its image.

Of course, fulfilling public service objectives does not necessarily mean that transport services will be available and consumed by all. The model assumes that the organization and financing of services of general interest will concern the part of services available on the market that meet certain criteria of general interest. Thus, the correct solution should be considered to directly link the volume of journeys made on the basis of free and concessionary travel entitlements with financial support for municipal transport from municipal budgets in the form of reimbursement of lost revenues on this account.

The proposed concept of the model aims to improve the functioning of public transport and change the current state of the transport system in the city. The project postulates based on the public transport system on two subsystems, tram and bus transport. At the same time, the designed tram line takes the form of a transport spine, supplemented by bus lines with assigned delivery functions. This results in the creation of a clear transport system, an increase in the quality standard of the provided services and, consequently, an increase in demand for public transport services.

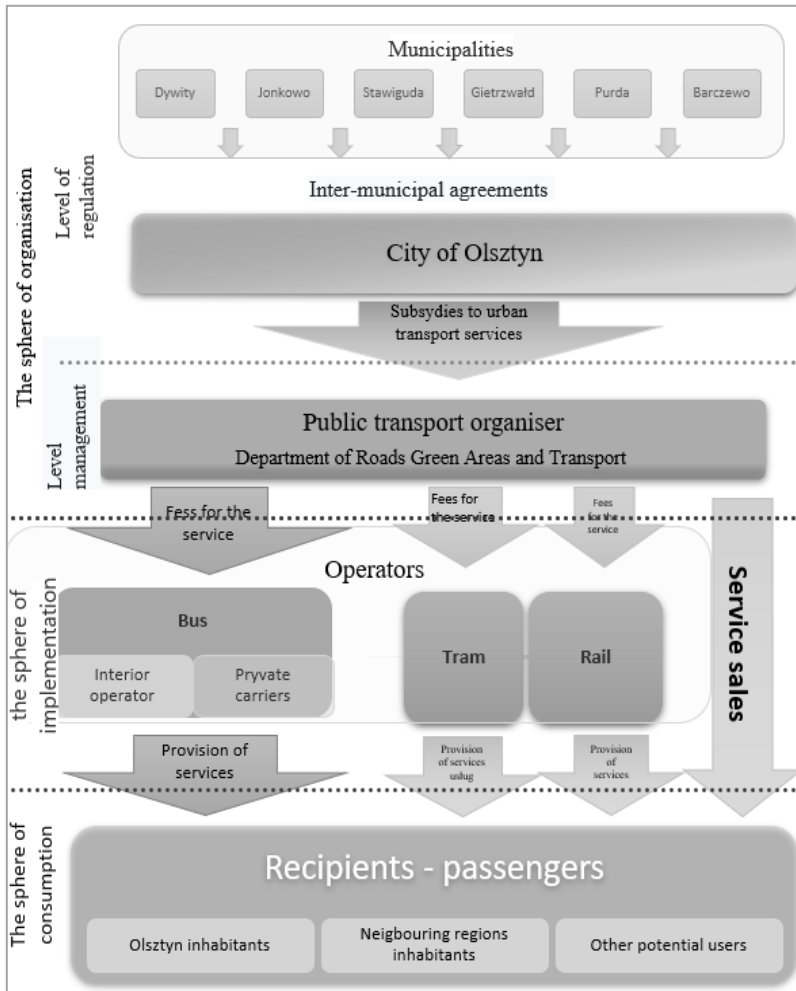


Fig. 2. Model of the urban transport system of Olsztyn

It should be emphasized that the presented model is also an attempt to synthesize the most important elements of the concept of sustainable transport development. In particular, strengthening the benefits and reducing the costs of transport, including its external costs. It is formulated to meet both the present and future needs of the inhabitants of Olsztyn. Therefore, it is not an utopian theory to say that Olsztyn can have a public transport system which would allow efficient travel in a spatially integrated and environmentally balanced way. It is enough that the current subjective barriers and prejudices of all its stakeholders will be eliminated.

5. Conclusions

1. The issues of the sustainable model of the urban transport system in Olsztyn evoke vivid social and political interests of the city's inhabitants. This is mainly due to the impact of the functioning of transport on the quality of life, the correlation of its development with the economic development of the city, and the strong impact of transport on the natural environment.
2. The condition for the efficient and effective functioning of public transport is the provision of appropriate organizational solutions. It turns out that the way of organization and management translates into appropriate quality and size of the transport offer.
3. Properly organized and managed urban transport, ensuring the implementation of transport demands at the appropriate level, is also a condition for rationalizing the costs of providing transport services and increasing its attractiveness.
4. A sustainable urban transport system is an essential element of a competitive city. It connects the area in a functional system and presents the city as a system of interdependencies between its elements.

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