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Implemented sustainable public transport solutions and social expectations for the city transport system of Szczecin

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Abstract

The issues discussed in this article concern the basic assumptions for the sustainable development of public transport in cities. We discussed the need and direction of changes that occur in public transport that were referred to both users and transport organizers in cities. To this end, we characterized the activities which encourage urban residents to use forms of urban transport and the limitations of commuting via individual transport. The purpose of this article was to determine the main directions and areas of development of public transport in Szczecin. In addition, we also presented the solutions applied in the city transport system aimed at making it sustainable. In addition, an attempt was made to determine the impact of selected solutions on residents' transport behaviors. The survey research method was used to examine societal opinions and expectations regarding public transport. We also approximated the basic investments that have been implemented to make transport more sustainable and the activities for the development of electromobility. Future research directions on the sustainability of transport in the city, and especially on limiting vehicular traffic, were also discussed.

Introduction

Sustainable transport is necessary for the development of every urban space and is the basis for the mobility of its dwellers. It allows for the creation of optimal conditions for residents in terms of access to various functional areas of a city, including jobs, science, and culture. Investments to improve mobility in a given urban area improve its competitiveness and thus its economic growth. This was highlighted in the transport policy of the European Union, including the Transport Policy White Papers, which emphasized the need to ensure growth in the transport sector and to support urban mobility. They also assumed that urban development must be accompanied by a simultaneous reduction in greenhouse gas emissions (White Paper on Transport, 2010, p. 4). In accordance with this priority, solutions have been implemented to reduce the share of individual motorization in cities, and thus the congestion. Detailed recommendations and guidelines for the introduction of sustainable transport in cities were presented in the European Commission communication entitled "Together towards competitive and resource-efficient urban mobility" which introduced the concept of Sustainable Urban Mobility Plans (COM, 2013). Accordingly, urban public transport is necessary to meet the basic needs of urban mobility and provide residents with adequate living and development conditions. Therefore, it is important to identify and implement solutions in a city's public transport system that will improve the sustainability of public transport.

The basic assumptions for the sustainable development of public transport in cities

The contemporary approach to the issue of public transport has focused on conducting large-scale

activities that encourage passengers to use the offered forms of urban transport and limit commuting by car (Budi et al., 2019). The result of this approach are investments in public transport to make it environmentally friendly and competitive with individual transport, which is necessary for cities to develop further and provide residents with an adequate quality of life. To achieve this goal, it is necessary to pursue an appropriate urban development policy in conjunction with a policy for developing sustainable public transport. The direction adopted for activities by most cities in Poland (included in their development strategies) is to reduce the level of individual road transport (Barceló, 2019). These activities are multifaceted and include changes in:

- infrastructure,
- the offered public transport services,
- access to parking spaces (P&R),
- access to environmentally-friendly modes of transport (city bikes, electric scooters, etc.),
- the mindset of transport users.

The subject literature includes several approaches to the concept of *sustainable transport.* One of the most frequently cited is the definition provided in 2004 by the European Conference of Ministers of Transport and the Centre for Sustainable Transportation. According to this definition, sustainable transport is one that:

- enables a society to fulfill its basic need to have access to it,
- is safe and consistent with the needs of human health and ecosystems,
- meets the development requirements of the respective generation and ensures the development of future ones,
- is affordable,
- operates efficiently and offers a selection of various forms and modes of transport,
- supports economic development.

This approach to sustainable transport is preferred by many experts, including the Transportation Research Board's Sustainable Transportation Indicators Subcommittee, as well as the European Council of Ministers of Transport, and the Canadian Centre for Sustainable Transportation **(**Bąk & Gajda, 2009).

Sustainable public transport and social expectations

Sustainable public transport should be a safe, reliable, and low-emission public transport system whose task is to ensure the long-term ecological and economic stability of transport in a respective urban or agglomeration location (Richardson, 2005; Litman, 2007). The assumptions of sustainable public transport refer to efficient transport that meets the expectations of society and most importantly minimizes the negative impacts of public transport on the natural environment, economy, and human health (Nowak, 2015; Gatta et al., 2018). Actions to balance transport mainly relate to the control of emissions of harmful compounds in exhaust gases, as well as the systematic replacement of transport modes in form of conventional vehicles with those driven by alternative energy sources (Farzaneh et al., 2019). Particular emphasis is placed on renewable energy and electric motors. Sustainable public transport also strives to reduce the terrain intensity index and the level of individual car transport, which increases urban sprawl (EC, 2000). The basic impulse for the intensive growth of this phenomenon is the emergence of increasingly effective modes of transport in urban agglomerations, as well as the means of transport themselves (Wicher, 2012, p. 135). Individual means of transport meet the expectations and needs of their users not only in terms of the comfort of travel, but mainly in terms of travel time, which is usually shorter than that of travel by public transport. Therefore, city dwellers, when faced with a choice between individual means of transport and public transport, often opt for a car (Skrobacki, 2011; Gadziński, 2013).

Based on the aforesaid, public transport that is focused on meeting social expectations should be distinguished by several features, the most important of which are:

- availability and reliability of services rendered,
- regularity and punctuality of transport,
- high quality of service and comfort of travelling,
- the wide availability of stops and interchanges,
- affordability,
- proper information systems,
- safety of travel.

In addition, and in-line with social expectations, a sustainable public transport system must also ensure that other objectives are met. Among these, the most important are:

- social development – providing all residents with an efficient and affordable commuting system as the basis for social development;
- functionality – enabling efficient and time-efficient transport compared with individual transport, and urban mobility;
- environmental friendliness – enabling the use of public transport as an alternative to less-ecologically friendly individual transport.

This means that sustainable public transport, in addition to the implementation of the basic postulates, should also meet those that are formulated based on the general opinion of the public. This applies not only to expectations with regards to the quality of transport but also to other needs, resulting from environmental awareness.

Study of opinions and social expectations regarding public transport in Szczecin

An analysis of the subject literature and general involvement of cities in achieving the goals of sustainable public transport indicates the need to investigate the opinions and expectations of the public (Ghorbanzadeh et al., 2018). They are related to existing solutions in urban transport systems, as well as those to be implemented in the future. For this purpose, we conducted a survey aimed at gathering the opinions of potential urban transport users in Szczecin. The research was conducted at the turn of October and November 2019 and included 438 people (197 men and 241 women) whose average age was 36 years. A significant proportion of respondents (37%) declared they lived on the right bank of Szczecin, which mainly includes residential areas: Dąbie, Płonia, Kijewo, Załom, Wielgowo, etc. A large group of respondents was comprised of people commuting from Stargard (16%), which were assumed to commute to their jobs or schools by car. We also surveyed people driving to the offices as customers. Parking lots located at the two Szczecin universities and the municipal office were selected as the study locations. For this reason, the questionnaire was simplified and contained 15 questions, including two open-ended ones. The limited number of questions allowed for an efficient study, i.e. giving a short response time to the respondents, who were usually in a hurry.

The study was designed to answer the following questions:

1. What is the level of awareness of individual transport users regarding the idea of sustainable transport development?
2. What are the expectations of members of the public regarding the functionality of solutions implemented in public transport?
3. What are the social expectations regarding future directions for the development of public transport services and electromobility?

The study concerned various issues of sustainable transport development, and the questions that were specifically meant to reflect the studied problem were questions about:

- knowledge of priority directions for the development of sustainable transport in the city;
- assessment of the impact of existing solutions (ITS, P&R parking, city bikes, electric scooters, scooters, etc.) on sustainable transport;
- an opinion of the impact of the constructed Szczecin Metropolitan Railway on sustainable transport in the region;
- expectations of the public regarding the scope of on-demand urban transport services;
- expectations of the public regarding the future and planned solutions for expanding the fast tram network;
- public expectations for the development of a municipal electric vehicle rental system.

The survey included a question that examined the knowledge of the idea of sustainable transport and electromobility alone. The distribution reflecting the answers to this question is presented in Figure 1.

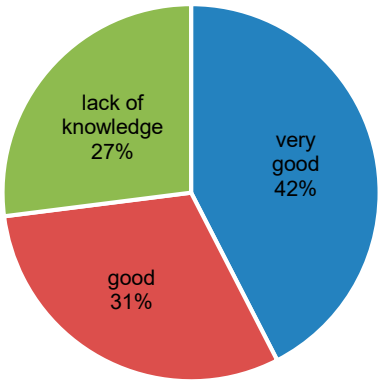

Figure 1. Knowledge of the assumptions of the idea of sustainable transport development and electromobility among people commuting by individual transport

The distribution of answers to this question made it possible to draw the conclusion that people commuting to their places of work or education using their car know and understand the need for actions in the field of sustainable public transport and the development of electromobility. This answer was given by almost 66% of those surveyed, including over 38% of those stating that they knew the assumptions of the idea very well. Unfortunately, these declarations did not translate into the everyday transport behaviors of city dwellers, and a significant proportion of respondents (57%) used a car in their daily commute to school. The reasons for this behavior were analyzed in the subsequent questions which were aimed at determining the reasons for their infrequent public transport use, even though it is characterized (as indicated by the respondents)

by a high frequency of runs and a direct or integrated connection to their destination. The respondents' answers allowed us to understand the motivations of those who predominantly use individual transport to commute to work (Figure 2).

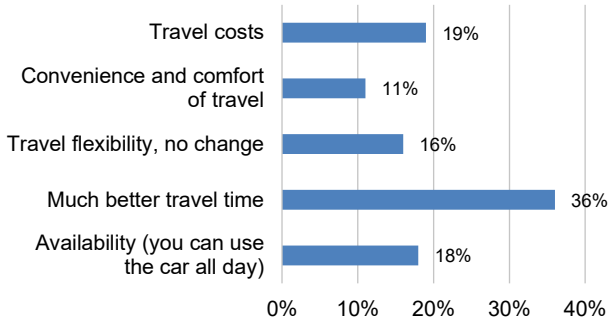

Figure 2. Reasons for using a car as the method of transport in daily commutes to work/study

The main reasons for using a car to commute to places of work and education were:

- significantly quicker travel time;
- travel costs;
- availability (you can use the car all day);
- travel flexibility, no interchanges;
- convenience and comfort of travel.

It should be concluded from the received research results that city dwellers use their own cars because public transport does not provide them with a favorable alternative. Among the factors that were particularly emphasized was the unfavorable duration of the journey. As frequently pointed out by the respondents, it can often take up to three times longer than travelling by car. As an example, we can indicate access to the city center from the distant, right-bank districts of Szczecin, e.g., Szczecin Płonia, Kijewo, Wielgowo, etc. The average distance to travel from these districts is 17 km, with a driving time of about 25 minutes. Covering this distance by public transport takes 60 minutes, which does not include the time needed to change the means of transport and reaching the bus stop, where the distance often exceeds 500 m. There is a direct connection by fast bus, but it is very limited due to the very low frequency of these buses, which run every 40 minutes on average. In addition, these buses only run in the mornings and afternoons, and there are no connections after 5 PM.

According to the respondents, the cost of travel is also important, which is lower when travelling by public transport, but only when one person is travelling. With two or more people, the cost is significantly lower and is often close to the price of (single) public transport tickets.

The research also obtained users' opinions regarding their expectations for future public transport and electromobility developments in Szczecin. The questions in the survey were related to both future transport projects and ongoing investments aimed at improving the mobility of city residents. The questions included:

- the construction and launch of the Szczecin Metropolitan Railway,
- the extension of existing tram and bus lines,
- completion of the construction of the Szczecin Fast Tram,
- expansion of the city bike system,
- expansion of the electric vehicle charging station network,
- creation of a municipal electric vehicle rental system.

According to the respondents, the priority actions that can balance public transport in the city and encourage them to give up cars in their daily commutes to work/study were: metropolitan rail and a completed fast tram line. The Szczecin Metropolitan Railway is a city rail project that connects the Szczecin residential area Prawobrzeże with the center of Szczecin and Police, Goleniów, Stargard, and Gryfino. This railway will provide, along with other forms of public transport (trams, buses) and individual transport (for which P&R and B&R car parks will be built), a system of connections ensuring fast and safe movement within the city, as well as connecting to adjacent towns. However, in the area of electromobility development, expanding the charging stations network, as well as the creation of a municipal vehicle rental system were also identified as important activities. The distribution of answers is presented in Figure 3.

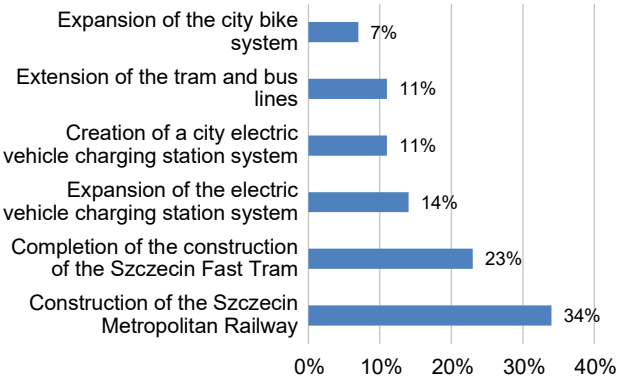

Figure 3. Priority actions for sustainable public transport in Szczecin

The distribution of responses indicates that transport users see the need for further development of

the public transportation system, and they indicate investments that will improve the level of communication both within the city and with adjacent towns as priority developments. This mainly applies to areas that belong to the so-called Szczecin metropolitan area. Such expectations of public transport users demonstrate the need to further develop various forms of urban transport, in particular, those that can significantly increase the mobility of the population by providing direct connections with districts/towns far from the center of Szczecin. In addition, the respondents indicated that it is very important that these solutions alone will offer direct connections that are not susceptible to city traffic congestion.

Examples of solutions implemented in Szczecin for sustainable public transport

One of the main goals in every city's transport policy is to limit car traffic, which is why many cities have developed or expanded new public transport networks, such as tram and bus lines and city rail. In Szczecin, the tram network was expanded with a fast tram line. This is a very important investment, the completion of which has significantly improved the communication between the right and left banks of the city. Currently, a fast tram forms an important element of the public transport system in Szczecin. The route length of its first section is 4 km, and it has been in operation since 2015, and the construction of another 2.9 km-long section is planned for the coming years.

Another recently-implemented solution in Szczecin is so-called on-demand transport, which supports regular public transport. Its task is to facilitate access to public transport for the inhabitants in the peripheral parts of the city. In Szczecin, three bus lines operate on-demand. This form of transport is an element of the Szczecin public transport system, in which passenger transport is carried out in an irregular system.

It is noteworthy that concerning the Szczecin agglomeration, actions aimed at sustainable transport have focused on integrating all forms of transport. The integrative actions relate to both infrastructure and the urban transport management system and cover both motorized and non-motorized transport. These actions are implemented in numerous stages, and some of which are already completed while others are still being applied. The major investments under construction include the construction of the Szczecin Metropolitan Railway whose aim is to improve the quality of internal public transport connections within the Szczecin agglomeration (TRAKO, 2016). It is to become the main axis of public transport using existing railway lines and is to be integrated with bus lines serving the towns in individual municipalities adjacent to Szczecin. In terms of management system integration, the project involves a single metropolitan ticket system (Integrated Sustainable Mobility Plan for the Szczecin Metropolitan Area, 2016). In addition to the aforementioned activities, in the Szczecin public transport system, measures have been taken to reorganize road traffic to encourage and support walking, cycling, or the use of electric bicycles. To make the transport in the agglomeration more sustainable and increase the level of transport accessibility, a city bike system was launched a few years ago. Its introduction was preceded by the construction or tracing of 100 km of bicycle paths from the road lanes. It has also recently become possible to move around the city using electric scooters, which are rented for several minutes at a time. This solution not only improves mobility but also increases electromobility. Changes in this field have also occurred in the city transport system. As planned in 2020, 11 electric buses will appear in the city bus fleet. In addition, activities have been carried out under the municipal Electromobility Development Program, from which a fleet of 12 electric vehicles was purchased for local government units. Under this program, an investment was also launched which initiated the creation of an urban network of electric car charging stations. In the first stage of this investment in 2018, three electric vehicle charging stations were launched which are fast-charging stations with a peak power of 50 kW. According to the plans adopted in the Electromobility Development Program, by the end of 2020, about one hundred charging stations are to be commissioned by Szczecin (Motoryzacja Interia, 2019).

Conclusions

Sustainable transport is necessary for the development of every urban space and is the basis for the mobility of residents. A correctly-organized public transport system ensures optimal conditions for residents in terms of their access to important functional areas of the city, including jobs, education, and culture. The basis of effective public transport is the integration of all forms of transport, and integration activities must relate not only to infrastructure but also to the city transport management system.

Improving the functioning of public transport in a given urban area positively impacts not only the

quality of life of its inhabitants but also increases its competitiveness. City dwellers know the basic assumptions of sustainable transport and electromobility; however, urban transport offerings are not always an acceptable alternative to individual transport.

The research results confirmed that solutions that influence the sustainability and electromobility of public transport have been implemented in Szczecin's public transport. In addition, it was also shown that environmental awareness among transport users is growing. Still, further action and investments are required in the urban transport system to make public transport competitive with individual transport. Therefore, sustainable transport within the city must be further developed, which will enable the construction of a functional and environmentally-friendly public transport system.

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