

# Impact of alternative individual means of transport development on decisions of urban residents among travel planning

JEL: R41 DOI: 10.24136/atest.2019.257

Data zgłoszenia: 29.01.2020 Data akceptacji: 10.02.2020

*The article discusses the problem of choosing individual means of transport by urban residents when planning trips. Types and benefits of using alternative means of individual transport in cities were demonstrated. Then the decision-making process of users as well as motivations and transport needs of the population were presented. The aim of the research article was to analyze the preferences of residents in the field of choices for alternative, environmentally friendly means of transport.*

**Słowa kluczowe:** travel planning, alternative modes of transport, transport preferences and needs.

## Introduction

Urban mobility plays a strategic role in the transformation process towards smart cities, able to face environmental challenges and adapt to new circumstances. These measures should adequately take into account the need to maintain a balance between social, economic and environmental, which constitute the three pillars of sustainable development. Meanwhile, urban areas constituting the living environment for the vast majority of the population are generating increasing economic and environmental losses [8].

The communication factor is an important element with a huge impact on the sustainable development of the city. The challenges facing urban areas in achieving sustainable development goals for transport are extremely difficult. On the one hand, they are conditioned by progressing urbanization processes, on the other, by changes in the volume of transport services carried out and the branch structure of transport.

The development of cities and the evolving needs of their inhabitants led to an increase in demand for individual means of transport. The consequence of this transformation is the growing interference and congestion in the road network. Congestion in cities has a negative not only economic and social dimension, but also has a negative impact on the health of residents and violates the natural environment. It is therefore important to strive to build a trend and fashion among urban residents to develop alternative modes of transport that contribute to greater protection of the environment.

## 1. Benefits of using alternative means of individual transport

Among the pro-ecological means of transport, apart from collective transport, there are also possibilities of walking or using a bicycle [11]. New technologies with regard to alternative fuels have created the possibility of expanding the range of transport means by several more options, including a bicycle, scooter or electric car.

The increased demand for transport services in urban areas and suburbs, as well as transport-sharing services, quickly attracted the attention of many people. The reason why these services have become so popular is the ability to travel by specific means of transport, without having to purchase it. Services based on the idea of shared transport include services such as car-sharing, bike-sharing and scooter-sharing. It is assumed that the development of electro-

mobility created in the idea of sharing economy will contribute to reducing the amount of investment in individual transport.

In Poland, transport services are provided by a total of twenty-one companies, among which we can distinguish such companies as: Nextbike, BikeU, Arcus Romet, Blinkcity, Tauron, Hive, Lime, One Ślad, Trafficar, Greengoo, 4mobility, Vozilla, Bird, Hop. City, LOGO Sharing, Panek Carsharing, Omni and other [3], [4].

At the end of December 2018, the total number of vehicles created for transport-sharing services in the largest urban centers was a total of 18.3 thousand. These centers include the Tri-City, Warsaw, Cracow, Łódź, Upper Silesian Agglomeration, Wrocław and Poznań. At present, the highest vehicle density occurs in Warsaw and amounts to 16.4 vehicle / km<sup>2</sup>, and 0.5 vehicle / km<sup>2</sup> in other urban centers. Incentives for potential users of alternative means of individual transport are determined at national and local level. In the case of incentives used globally in selected countries, the most common are: 100 inhabitants. The largest part of shared vehicles are muscle-powered vehicles, i.e. city bikes. Their total number in the above-mentioned urban centers is a total of 11.9 thousand [2].

Incentives for potential users of alternative personal transport are defined at national and local level. In the case of incentives used globally in selected countries, the most common are:

- co-financing of a part of the vehicle purchase costs,
- tax discounts,
- discounts for charging during the first years of operation, or even a free boost in the initial period of operation,
- lower vehicle insurance rates (surcharges),
- the possibility of using separate lanes for HOVs (high-occupancy vehicles) or for buses,
- discounts in fees for paid road sections.

Considering the benefits proposed on the side of cities, it is most often the possibility of free parking of electric cars in paid zones or the possibility of free entry to restricted traffic zones.

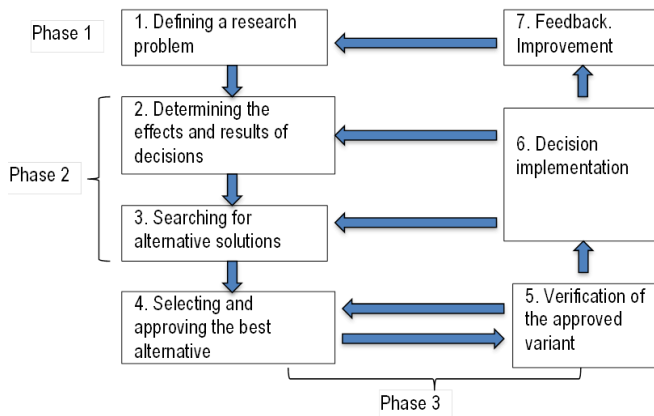
## 2. Travel planning decisions

The increased mobility of citizens and the accompanying development of individual automotive industry is an important causative agent of change in cultural and consumer standards. Decisions on planning of urban residents travel mode choice and preferences in the field of public transport is one of the most important elements of an efficient city logistics, aimed at meeting the needs of the people.

The term decision comes from the Latin word "decisio" and means resolution, resolution or resolution. It is important to understand that deciding means a series of actions leading to changes in the current state, and the decision is the ultimate goal of this action. From the point of view of the issues considered in this publication, it can be assumed that the decision is to choose one of the possible alternatives in a given situation. That is why it is so important to consider decisions individually, the analysis of which requires separate measures, test methods or information [13].

The decision-making process is the actions that the decision-maker takes from the moment of realizing the need to change to the final moment, which is to indicate the selected decision. It covers

three phases in turn: recognition, creation of a full decision model and choice of decisions, presented in Figure 1.



**Fig. 1.** Stages of the decision making process  
Source: own elaboration based on [12].

Some decisions are routine and relate to relatively simple matters that do not require reflection and special impact analysis, but not all. Some of the decisions are an expression of a deeper analysis, resulting, for example, from the system of values or the philosophy of life. The decision problem to be considered should be well recognized and the decision maker should recognize the complexity of the situation, determine the constraints on choice and know the potential effects of decisions [6]. An important factor in making decisions regarding the choice of individual transport when planning a city trip are the needs that translate into transport motivations.

Identifying key motivations and transport needs is a primary and initial role when optimizing transport, and when forecasting future movements of residents of developing cities. We can distinguish motivations such as:

- travel to and from work, school, college,
- business trips,
- travel for recreational or tourist purposes,
- travel related to visits (family, social, etc.),
- traveling for shopping purposes,
- travels for health purposes related to medical visits [9], [14].

These needs are often simplified into seven motivational groups such as: home-study, home-work, home-work, home-work, home-other, other-home, and non-home travel. Needs show a different intensity depending on the time of day or day of the week. Basic travel related to study and work, are more intense on weekdays during peak hours. These trips are the main reason for periodic road congestion in the city center and on its outskirts, due to increased traffic of passenger cars of working people and students [10].

Some needs give traveling a modal character through the need to travel to places such as: train station, airport, bus station, which are a place of changing the way people move in both small and large cities. This phenomenon is referred to as the modal division of movement. Determining the areas in which the way of moving takes place is an important aspect when planning development and spatial development of the city, in terms of infrastructure and information structure [15].

The assessment of activities in the field of the use of technological, organizational solutions and behavioral changes shows that large savings potential lies in behavioral activities with travel planning activities. Based on the literature review, a wide range of

transport activities have been identified that can contribute to climate change mitigation, which may also include the use of alternative means of transport for passenger cars. An overview of selected behavioral changes along with an assessment of these changes in the reduction of CO<sub>2</sub> emissions is presented in Table 1.

**Tab. 1.** Behavioral mobility CO<sub>2</sub> reduction measures

Activity	CO <sub>2</sub> reduction [%]			
	relation	min	max	
Buying and using smaller cars	%pkm	17	21	
Buying and using plug-in hybrids		25	40	
Buying and using electric cars		15	62	
Applying a fuel efficient driving style		6	10	
Increasing the occupancy rate of the car (incl. car pooling)		2	31	
Sharing a car		1	n/a	
Extending the life time of the car (12.5- 15 years)		1	n/a	
Travel by train instead of by car		1	9	
Travel by local public transport instead of by car		1	2	
Travel by bicycle instead of by car		1	3	
Travel by foot instead of by car		2	3	
Teleworking		reduction of total CO <sub>2</sub> emissions from passenger transport	6	8
Apply visual meetings		6	9	
Make (more) use of e-commerce		2	12	

Source: own elaboration based on [5].

The measures presented in the table to reduce CO<sub>2</sub> emissions from individual transport can be grouped into the following four groups of activities:

- a) using more fuel efficient cars,
- b) making use of the car in a more efficient way,
- c) using more sustainable modes of transport,
- d) reducing travel distance.

### 3. Survey research analysis

To check the impact of the development of alternative means of transport on the decisions of urban residents regarding transport behavior, a diagnostic survey using the Internet was used because it was mainly targeted at young residents of the city of Katowice.

The whole questionnaire consisted of six sections dedicated to questions related to: the frequency of using individual means of transport, possession of means of transport, aspects of individual means of individual transport and factors that could influence the decision to use a given means of transport. The article presents only part of the research results, devoted to alternative means of transport, without their individual assessment. The research was carried out over a period of 5 weeks this fall. Over 3,000 people took part in the study. The respondents were dominated by people in the 15-25 age group (58%), mainly students and high school students, while the least interviewees were in the 46-55 year range (1%).

Among them, up to 44% people own a car, while 48% have a bicycle. The majority of respondents who own a bike (253) use the bike sporadically, e.g. for recreational purposes or in an emergency. Among the respondents, 89 people use the bike every day on business days, 82 people use the bike once a day, and only 14 people use the bike more than once a day. This may be due to leading a healthy lifestyle, and commuting to work, college or school, during the week and on weekends. The results are shown in Figure 2.

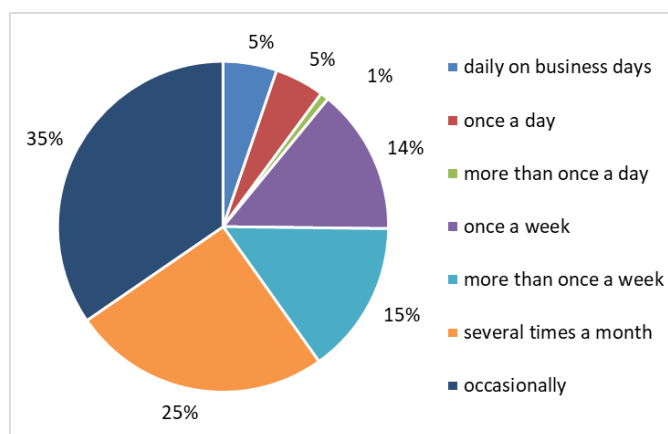


Fig. 2. Frequency of using the bike by respondents

The transport motivations of the respondents are dominated by such transport needs as commuting, school or university. These are absolutely mandatory needs characterized by the indispensable need for transport, both on business days and on weekends. Needs such as shopping (12%), visits (12%), recreation (6%), travel to other means of transport (12%) or business travel (7%) (Fig. 3). They obtained worse results due to the fact that they are relatively obligatory (shopping, business travel), and incidental or optional (access to other means of transport, recreation, visits, shopping, other) characterized by a lower frequency compared to mandatory absolute [7].

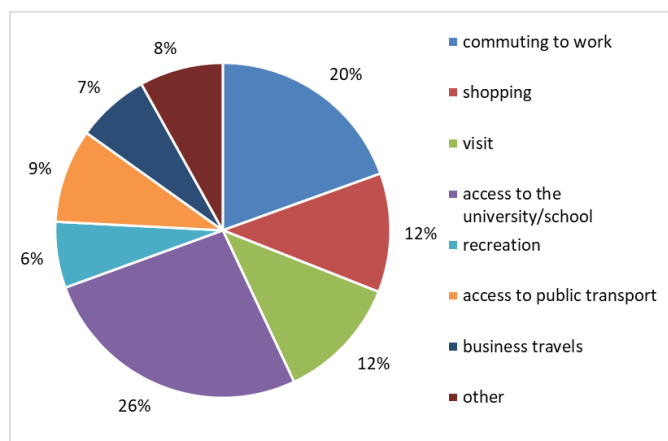


Fig. 3. Percentage of the most common transport motivations of the respondents

The next question, the respondents answered the question about the average distance traveled by car in one day, and the results are shown in Figure 4. As many as 791 of people travel from 0 to 5 km in one day, this is due to the lack of a car, and the need travel to work, school or college. Similar transport trends were shown by people traveling from 5 - 10 km (645), 10 - 20 km (510) and 20 - 30 km (465). These people probably live outside the city center, or outside the city, which they drive a greater number of kilometers than people living in the center and on its outskirts. Only 600 people surveyed cover a distance greater than 30 km. This result may be due to the large use of the car during daily travels, and the use of the car for business purposes as well as leisure travel or visits.

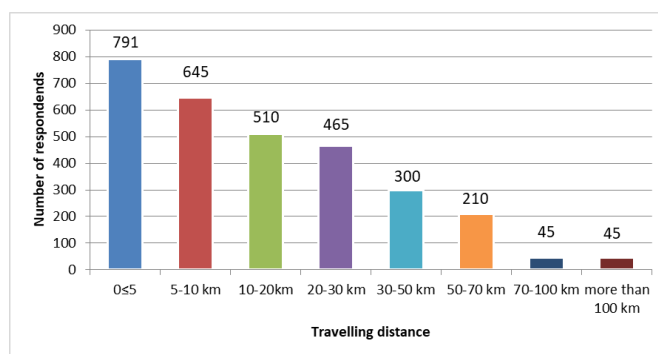


Fig. 4. Distance traveled by respondents in one day

Figure 5 presents alternative means of individual transport used by the respondents. Of the respondents, 1241 people did not use individual means of transport, but some of them expressed their willingness to use. City bikes are the most popular, as surveyed people rented a bike at least once. Cars and electric scooters are the least popular, as only 535 people have rented a scooter at least once, and an electric car only 315. This may be due to higher costs. The largest number of people most often uses city bikes (889), compared to other alternative means of individual transport, and the smallest number of electric cars (181). This result may be due to greater availability and lower costs of use, relative to other means of transport. Renting a bike does not require a driving license and has a positive effect on the health or condition of users.

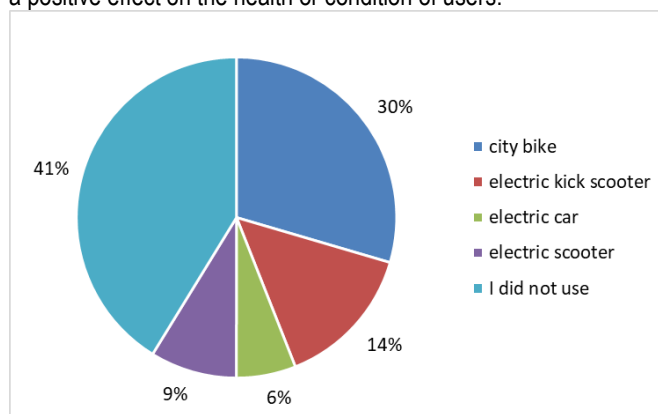


Fig. 5. Alternative means of individual transport used by the surveyed people

In the case of questions regarding the factors of choice of means of transport, the respondents could choose max. three factors that they think are the most important. According to respondents, the most important factors affecting the choice of means of transport are travel time, cost of travel, and availability of means of transport. The time of travel by individual means of transport consists of the time of reaching the means of transport, driving time and the time of reaching the means of transport from the means of transport, which in the case of alternative means of transport depends on the availability of means of transport. The most important of these was the safety of driving a given vehicle.

When choosing a mean of transport, the inhabitants of the city of Katowice most often take into account the travel time (1857 votes), the availability of the means of transport (1571 votes), the cost of travel (1616 votes), and the reason for this may be the saving of residents in terms of time and money.

Additional questions also appeared in the survey, referring to possible modifications to increase the popularity of given means of transport, and factors that could influence the decisions of persons who did not use any of the above-mentioned means of transport. The following factors can be distinguished:

- promotions for regular customers and students
- scooter availability in a larger area
- more electric cars
- lower price of the service
- a larger area of operation for scooters and electric scooters
- lack of necessity to connect a bank card to a user account.

## Conclusion

Companies that provide shared transport services should pay special attention to transport preferences of the inhabitants of the cities in which they operate. Research on the demand for transport services can provide a lot of information, based on the opinions of customers and potential who have not yet decided to use the service. Based on this data, operators can create their offer in many respects, such as the cost of the service, equipment of means of transport or their availability, so as to match the offer to the preferences of as many people as possible.

Many people, when planning their day and future, struggle with the very important problems of choosing how to move during everyday travels. Each inhabitant of the city has their own preferences, needs and requirements thanks to which they decide on the hierarchy of individual parameters of transport mode selection. The essence and purpose of research and analysis carried out by companies providing transport-sharing services is their characterization and definition of factors that determine them.

At the same time, a number of deficiencies and restrictions can be noticed that at the moment the use of alternative individual means of transport is not yet fully comfortable. The most common problems are adaptation of the transport infrastructure [1], organizational problems, availability of information for those using this means of transport, integration with other means of transport into travel chains, change of communication behavior, etc.

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### Wpływ rozwoju alternatywnych środków transportu indywidualnego na decyzje mieszkańców miast w zakresie planowania podróży

W artykule omówiony został problem wyboru środków transportu indywidualnego przez mieszkańców miast podczas planowania podróży. Wykazano rodzaje i korzyści wykorzystywania alternatywnych środków transportu indywidualnego w miastach. Następnie przedstawiono proces decyzyjny użytkowników oraz motywacji i potrzeb transportowych ludności. Celem badawczym artykułu była analiza preferencji mieszkańców w zakresie wyborów dotyczących alternatywnych, proekologicznych środków transportu.

**Słowa kluczowe:** planowanie podróży, alternatywne środki transportu, preferencje i potrzeby transportowe.

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