ANALYSIS OF THE TRAVEL MODES OF THE RESIDENTS OF THE CITY OF PETROSANI

SORIN MIHĂILESCU[1]

Abstract: The mobility of residents is one of the necessary conditions for ensuring a functional urban area. People's actions are always accompanied by multiple reasons. The main purpose of this article is to identify and analyze the preferred mode of travel of the residents of Petroșani. The research was conducted using the analysis of specialized literature and the case study. The research material was collected following a face-to-face and telephone opinion poll. Compared to car use, pro-environmental motivation certainly has a significant and positive role in promoting the choices of ecological travel modes (walking, cycling and using public transport). The effects of gender, age, income, vehicle ownership, travel distance and government instruments show significant differences between the choices of travel modes. The research results increase the level of knowledge regarding the needs of residents regarding urban mobility and the development of the public transport system in Petroșani. They can be used in rational actions of local authorities aimed at improving the quality of life of residents in the context of sustainable development of urban transport.

Keywords: Choice of mode of travel, urban residents, mobility

4. INTRODUCTION

Determining the preferences of residents regarding the mode of travel in the city is an important element in the development of urban transport systems. [1] The European Union's transport policy emphasizes the need to support urban mobility. The White Paper on Transport Policy also considers that urban development should be accompanied by a simultaneous reduction of greenhouse gas emissions [2]. The transport sector is responsible for 28% of primary energy consumption worldwide [3], making it one of the main and most energy-intensive sectors of the economy. The European Commission has presented detailed recommendations on sustainable transport, with a focus on meeting urban mobility needs that will provide adequate living and development conditions [4].

[1] *Assoc. Prof. Ph.D. Eng., University of Petroşani, mihailescus@gmail.com, sorinmihailescu@upet.ro*

The European Commission, in its Green Paper [5], identified the main challenges in the development of urban transport:

- improving traffic flow in cities by optimizing the use of private cars, promoting active mobility (walking, cycling), sustainable commercial transport;
- improving accessibility and integration of urban transport, including sustainable spatial planning;
- increasing the use of Intelligent Transport Systems (ITS) services in urban transport;
- reducing the negative impact of transport on the environment by using modern technologies and alternative energy sources, promoting eco-driving and limiting car traffic;
- improving the safety and reliability of urban transport;
- changing transport behaviour and the way it is perceived by urban communities.

The report of the Organization for Economic Cooperation and Development on urban traffic congestion management highlights the need to support public transport and non-motorized modes of transport (walking, cycling) [6].

2. MODES OF TRANSPORTATION IN THE CITY

n the context of the continuous growth of urban population, mobility management has become a central issue for local authorities and citizens. Urban travel involves multiple options, each with specific advantages and disadvantages [7]. The choice of transport mode depends on factors such as distance, cost, time, convenience and environmental impact. People's decision to travel in a certain way is determined by factors such as season, weather, social environment, time perspective, health, income, market competition, preferences, quality of services, etc. The reasons why people travel are varied: going to work, school, shopping, doctor, visiting relatives, business trips, pleasure trips, etc. [8, 9, 10, 11]. The factors influencing transport demand are highlighted in the following relationship:

$$Q_t = f(P_S, P_C, V, P_a, P_r, D_S) \quad (1)$$

- Q_t [passenger km] is the performance or volume of transport;
- P_s is the cost of transport;
- P_c is the cost of related services;
- V is the related revenue;
- P_a is the anticipated price of the goods transported;
- P_r represents consumer preferences;
- D_s is the spatial distribution of customers.

By comparing these transport solutions, we can identify optimal models for organizing sustainable urban mobility.

Walking (Figure 1) is the oldest and most basic form of mobility [12]. It can also

be said that it is the healthiest way to travel in cities. In well-planned European cities, such as Copenhagen or Amsterdam, this mode of transport accounts for over 30% of all trips [13]. The main advantages include:

- notable benefits for public health;
- total accessibility;
- negligible environmental impact.

However, its effective implementation requires adequate pedestrian infrastructure (wide sidewalks, underpasses) and increased safety (public lighting, protected crossing areas) [14, 15].

Alternative urban transport, such as bicycles and electric scooters (Figure 2), have marked a real revolution in this field [16, 17, 18]. For example, a survey showed that 18% of Bucharest residents would choose the bicycle as a means of transport if there were adequate infrastructure [19]. Key advantages are the following:

- optimal speed-cost ratio for medium distances;
- flexibility in avoiding traffic jams;
- integration with other forms of transport (bike-sharing systems).

Highlighted problems: lack of a coherent network of cycle paths; risk of accidents due to lack of road education.

Fig. 1. Walking [12]

Fig. 2. Alternative urban transport [16]

The personal car (Figure 3), although a symbol of mobility independence, generates a series of complex problems such as [20]:

- contribution to urban pollution (according to official data from the European Commission, personal cars are responsible for approximately 16% of total CO_2 in the EU) [21];
- takes up a lot of public space (globally, approximately 51% of commutes are made by car) [22];
- hidden costs such as maintenance, insurance or parking.

To solve these problems, we can implement the following solutions:

- car-sharing systems;
- promotion of electric vehicles;
- charging for traffic in congested areas.

Public transport systems (Figure 4) represent the most viable solution for large cities. Analyzing the experience of Bucharest, we note that, for example, the metro

transports 20% of all passengers [23, 24]. As advantages we can mention accessibility (low subscription price), reduces traffic and pollution. It is ideal for long distances or frequented routes. As disadvantages we have congestion, delays and outdated infrastructure (in some cities).

Fig. 3. Personal car

Fig. 4. Public transport systems

Traditional taxi and ride-sharing services (Bolt, Uber, Free Now) (Figure 5) have undergone a radical transformation in the last decade, becoming a pillar of modern urban mobility [25, 26, 27]. In Romania, the market has grown, with 56,000 monthly active users on ride-sharing platforms (2023) [28]. A good example is the fact that in Bucharest, a traditional taxi trip costs on average more than a ride-sharing one [29]. The advantages include:

- reduction in the number of personal cars, i.e. 21% of users use ride-sharing instead of using their car [30];
- flexibility such as various options (Bolt, Uber Green for electric cars);
- in certain scenarios, the ride-pooling system can reduce road traffic during peak hours [31].

Disadvantages include:

- traffic jams resulting from the increase in the number of ride-sharing cars in city centers (e.g. a study conducted by MIT in 2021 found that the introduction of ride-sharing led to a 1% increase in traffic and a 4.5% increase in traffic jam times in large cities [32].
- regulatory problems, i.e. entering into conflicts with traditional taxis, which resulted in protests in several European cities [32].

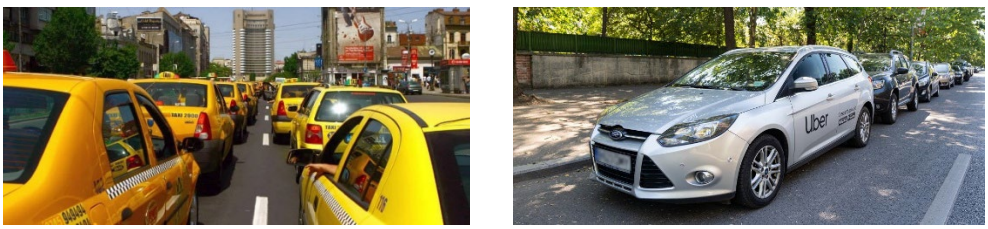

Fig. 5. Traditional taxi services and ride-sharing [25, 26]

In conclusion, each mode of urban transport has its role, and their optimized

combination (e.g. bicycle + metro) can reduce dependence on the personal car. Investments in green infrastructure and efficient public transport are the key to less polluted and safer cities.

3. URBAN MOBILITY

Urban transport is an essential aspect of daily life, directly influencing the quality of life of city residents. In the context of Petroșani, the analysis of residents' transport preferences becomes an interesting topic, given the limited options available and their impact on the environment and urban infrastructure.

The choice of a transport mode is one of the most essential aspects of urban transport planning and policy, as it impacts the overall efficiency with which residents can move around urban areas. The transport mode share or modal split is defined as the proportion of people using a particular transport mode and is usually presented as a percentage of each transport mode. This can be based on a variety of factors, such as the proportion of passengers using a particular transport mode, the percentage of trips made, or the distance traveled using a particular transport mode [33]. In selecting a transit mode, most passengers consider travel time to be the most important factor. Thus, people may be discouraged from using public transport if the time between departures is excessive. Speed and delay are service characteristics that relate to travel time. [34].

Exploring the complex interplay of demographic and socio-economic factors on transport mode choice, several studies have highlighted the role of variables such as age, gender, income and education [7, 34].

In addition to demographic and socio-economic factors, trip-specific factors such as distance and time have been found to significantly influence transport mode choice. For essential trips such as work or school, public transport is preferred due to its economic benefits. In situations such as the coronavirus disease 2019 (COVID-19) pandemic, health implications may drive a shift from public transport to private cars. Researchers have found that the accessibility and availability of public transport can attract passengers. Higher incomes and education levels tend to be associated with higher use of private cars, while lower incomes and education levels correspond to a greater reliance on public transport and adapted transport modes. Factors such as gender, residential selection, household size, presence of children, income, travel distances, and employment status influence car use and ownership. Vehicle ownership increases with increasing income, employment, and education (Figure 6, Figure 7). In addition, there is a negative correlation between age and stop frequency, which refers to the number of stops or destinations a traveler visits during a given trip or excursion. Mode choice in developing countries, especially for work and school trips, depends on an interaction of socio-demographic factors, the availability and accessibility of transport modes, and the specifics of the trip. Recognizing these relationships is crucial in shaping equitable and efficient transport policies [34, 35, 36].

To ensure the representativeness of the study, a survey was conducted on 160 households with 398 people, with households selected using systematic random

sampling. This sampling strategy was designed to capture a representative sample of the population of Petroșani from various socio-economic strata and geographical locations, providing a balanced picture of the modal share of transport for trips in the city. During the data collection phase, household heads were contacted and asked to participate in the survey. The number of households contacted was determined by the number of households present in Petroșani.

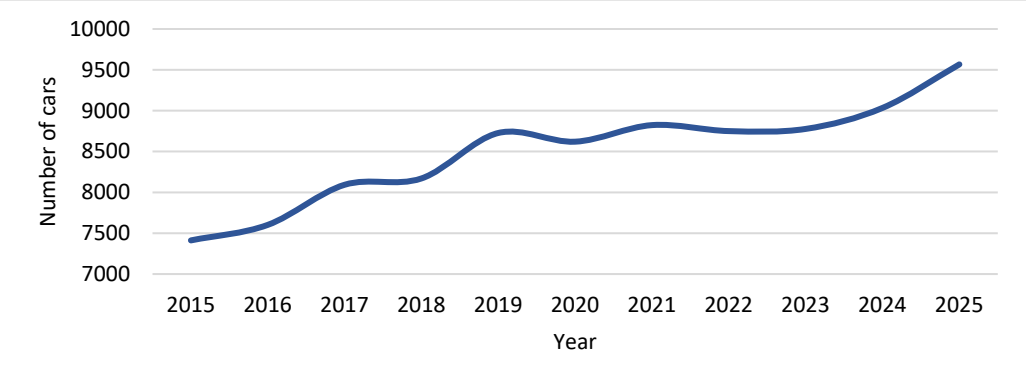

Fig. 6. Evolution of the number of personal cars in Petroșani

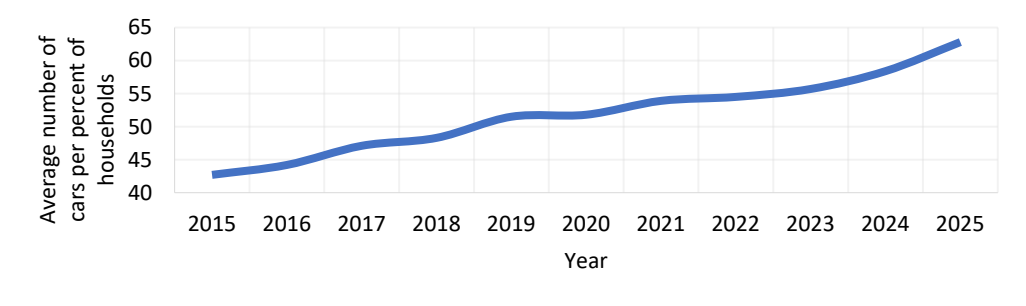

Fig. 7. Average number of cars per percentage of households

The survey was structured as follows:

- information on the user's personal and household details, as well as recent travel;
- information on the individual's travel behavior and habits, including the use of ride-hailing services, factors affecting the choice of transport mode and the main challenges they face;
- demographic information, including employment, education, age, gender, family size, income, driver's license status, and automobile accessibility.

To gain insight into the data and identify patterns, trends, or anomalies, a comprehensive descriptive analysis was conducted.

The results obtained in the first part of the day (Figure 8), indicate a predominance of pedestrian mobility, with almost half of the respondents choosing to

travel on foot. This aspect may reflect a compact urban configuration, with short distances between home and frequent destinations. The use of personal cars (35%) however suggests a significant dependence on individual motorized transport, which may have implications for traffic and local pollution.

In the second part of the day (Figure 9), an increase in pedestrian mobility compared to the morning (+5%), which can be explained by the relaxation of time constraints and a possible preference for light physical activity after work, is observed. The use of personal cars remains constant, which suggests a stable dependence on individual transport.

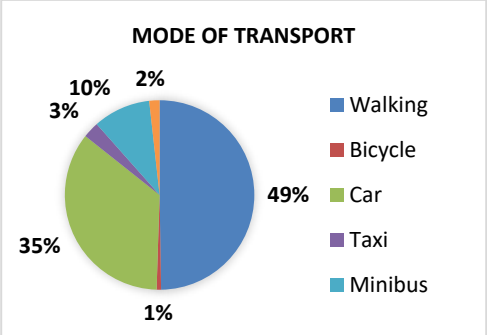

Fig. 8. Travel 1

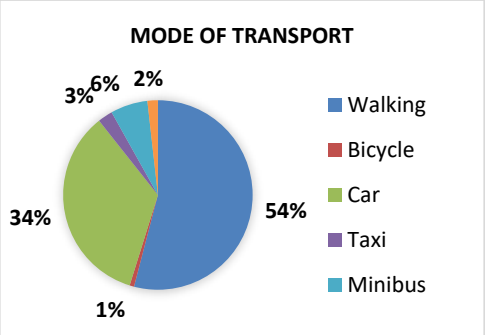

Fig. 9. Travel 2

Correlating the two data sets, it can be seen that pedestrian mobility is likely associated with trips to work or education, which suggests good urban accessibility. At the same time, the low use of public transport (minibus – 10%, service bus – 2%) may signal an insufficient offer or a negative perception of its quality. The decrease in minibus use may indicate a reduction in the frequency of trips or a preference for other means of transport outside peak hours. Compared to the morning, a transition from functional to personal and recreational mobility is observed. The increase in walking and trips for shopping or recreation indicates a relaxation of the urban rhythm and a possible preference for activities carried out in the proximity of the home. Also, the stability of car use suggests that road infrastructure and parking remain important factors in the mobility decision.

4. CONCLUSIONS

The conclusions drawn from this study are consistent with other studies [37, 38, 39]. Integrated information on sustainable travel will be a more effective measure for and education. Thus, local and national administrations can develop policies adapted to the heterogeneity of the population in the future.

The residents of Petroșani use a combination of urban and interurban means of transport, adapted to the specific needs of the region:

- urban mobility is essential for the efficient functioning of the city of Petroșani, and understanding how residents prefer to travel contributes to the development of public policies better adapted to their needs.
- the study, based on surveys and specialized analysis, provides valuable information that can support local authorities in improving public transport and, implicitly, the quality of life, in accordance with the principles of sustainable development.
- the data highlight a mixed urban mobility, with a significant share of walking, but also a considerable use of personal cars;
- gender, age, income, vehicle ownership, distance traveled and local government instruments present differences in their effects on different choices of travel modes;
- afternoon mobility behavior in Petroșani is characterized by:
  - a majority orientation towards returning home;
  - an increase in pedestrian mobility;
  - diversification of travel purposes, with an emphasis on personal activities.

REFERENCES

[1]. Burian, J.; Zajíčková, L.; Ivan, I.; Macků, K. *Attitudes and Motivation to Use Public or Individual Transport: A Case Study of Two Middle-Sized Cities*. Soc. Sci. 2018, 7, 83. https://doi.org/10.3390/socsci7060083

[2]. https://eur-lex.europa.eu/legal-content/RO/ALL/?uri=celex:52011DC0144

[3]. https://www.eea.europa.eu/publications/european-union-emission-inventory-report-1

[4]. https://eur-lex.europa.eu/legal-content/PL/TXT/HTML/?uri=CELEX:52013DC0913&from=EN

[5]. https://eur-lex.europa.eu/legal-content/RO/LSU/?uri=celex:52007DC0551

[6]. https://www.oecd.org/en/publications/managing-urban-traffic-congestion_9789282101506-en.html

[7]. Mihailescu, S. *Prospective Evaluation of the Public Transport System in the Petrosani Basin*. Sustainability 2023, 15, 16481. https://doi.org/10.3390/su152316481

[8]. Shin, J.; Tilahun, N. *The role of residential choice on the travel behavior of young adults*. Transp. Res. Part A Policy Pract. 2022, 158, 62–74, https://doi.org/10.1016/j.tra.2021.11.016,

[9]. Mouratidis, K.; Ettema, D.; Næss, P. *Urban form, travel behavior, and travel satisfaction*. Transp. Res. Part A Policy Pract. 2019, 129, 306-320, https://doi.org/10.1016/j.tra.2019.09.002,

[10]. Liao, C.; Huang, Y.; Zheng, Z.; Xu, Y. *Investigating the factors influencing urban residents' low-carbon travel intention: A comprehensive analysis based on the TPB model*. Transp. Res. Interdiscip. Perspect. 2023, 22, 100948, https://doi.org/10.1016/j.trip.2023.100948,

[11]. Ranjan, R.; Sinha, S. *A systematic review of mode choice behavior in urban transportation with emphasis on individual preferences and influencing factor.* Discover Cities, 2025, 2 (98). DOI: 10.1007/s44327-025-00138-3

[12]. https://www.wall-street.ro/articol/Turism/315875/top-20-orase-in-care-mersul-pe-jos-este-o-placere-aici-esti-cel-mai-fericit-ca-pieton.html

[13]. https://en.wikipedia.org/wiki/Transport_in_Copenhagen
[14]. Fonseca, F.; Papageorgiou, G.; Conticelli, E.; Jabbari, M.; Ribeiro, P.J.G.; Tondelli, S.; Ramos, R. *Evaluating Attitudes and Preferences towards Walking in Two European Cities*. Future Transp. 2024, 4, 475-490. https://doi.org/10.3390/futuretransp4020023,
[15]. Mitran, G., Ilie, S., Igret, S. V., Mihăilescu, S., *Sustainable mobility as a result of peoples' awareness on environmental problems generated by transport activity*, IOP Conference Series: Materials Science and Engineering, Volume 568, conference 1, 2019, DOI: 10.1088/1757-899X/568/1/012025
[16]. https://greencommunity.ro/mobilitate-urbana-sustenabila-piste-biciclete-romania-bucuresti-cluj-timisoara-brasov-sibiu-iasi/
[17]. Herman, G.V.; Bucur, L.; Filimon, C.A.; Herman, M.L.; Nistor, S.; Tofan, G.-B.; Stupariu, M.; Bacter, R.V.; Caciora, T. *Exploring the Relationships Between Bicycle Paths and Urban Services in Oradea, Romania*. Urban Sci. 2025, 9, 373. https://doi.org/10.3390/urbansci9090373,
[18]. Gras Gentiletti, M.; Cahour, B.; Safin, S. *Abandoning the Car to Embrace the Bicycle in Urban France: A Model of Modal Shift for Daily Commuting Routines*. Sustainability 2025, 17, 448. https://doi.org/10.3390/su17020448
[19]. https://greencommunity.ro/harta-propusa-piste-biciclete-bucuresti-master-plan-velo/
[20]. von Behren, S.; Bönisch, L.; Niklas, U.; Chlond, B. *Revealing Motives for Car Use in Modern Cities—A Case Study from Berlin and San Francisco*. Sustainability 2020, 12, 5254. https://doi.org/10.3390/su12135254
[21]. https://climate.ec.europa.eu/eu-action/transport/road-transport-reducing-co2-emissions-vehicles/co2-emission-performance-standards-cars-and-vans_en
[22]. https://phys.org/news/2024-03-global-commutes-car.html
[23]. https://ro.wikipedia.org/wiki/Metroul_din_Bucure%C8%99ti,
[24]. Popescu, A.-F.; Matei, E.; Bădiceanu, A.; Balint, A.I.; Râpă, M.; Coman, G.; Predescu, C. *An Optimistic Vision for Public Transport in Bucharest City After the Bus Fleet Upgrades*. Environments 2025, 12, 242. https://doi.org/10.3390/environments12070242
[25]. https://www.facebook.com/p/Anti-Taximetristi-100081199793611/
[26]. https://startupcafe.ro/oras-romania-acces-aplicatie-ride-sharing-uber-89718
[27]. Anagnostopoulos, T.; Ramson, S.R.J. *A Vehicle Ride-Sharing Algorithm Assessing Passenger Satisfaction According to Spatial, Temporal, and Social Behavior Context Based on Real Data Sources*. Future Transp. 2025, 5, 56. https://doi.org/10.3390/futuretransp5020056
[28]. https://www.observatorulph.ro/economic/2750363-soferii-uber-si-bolt-in-atentia-anaf-cum-vor-fi-verificati
[29]. https://newsweek.ro/social/taximetristi-contra-uber-si-bolt-orasul-in-care-tarifele-sunt-mai-scumpe-decat-in-capitala
[30]. https://investigative-report.ro/taximetrie-in-romania/
[31]. https://news.mit.edu/2016/how-ride-sharing-can-improve-traffic-save-money-and-help-environment-0104
[32]. https://news.mit.edu/2021/ride-sharing-intensifies-urban-road-congestion-0423
[33]. https://www.bugetul.ro/suprematia-uber-si-bolt-s-a-incheiat-dupa-10-ani-de-proteste-si-de-sicane-din-partea-autor;itatilor-fiscale-taximetristii-redevin-preferatii-clientilor/
[34]. https://jtscm.co.za/index.php/jtscm/article/view/1005/1689
[35]. Mihăilescu, S., *Analysis of the Influence of Economic and Exploitation Factors on the Public Transport System in the Petroșani Basin,* Annals of the University of Petroșani, Mechanical Engineering, vol. 24, Petroșani, 2022, pp. 101-114, ISSN 1454-9166

[36]. Mihăilescu, S., *Public Transport - Analysis of Natural and Socio-Political Factors in the Petroșani Basin*, Annals of the University of Petroșani, Mechanical Engineering, vol. 24, Petroșani, 2022, pp. 115-124, ISSN 1454-9166

[37]. Prillwitz, J.; Barr, S. *Moving towards sustainability? Mobility styles, attitudes and individual travel behavior*. J. Transp. Geogr. 2011, 19, 1590–1600,

[38]. Geng, JC; Long, RY; Chen, H. *Impactul intervenției informaționale asupra alegerii modului de deplasare de către locuitorii urbani cu diferite cadre de obiective: Un studiu controlat în Xuzhou, China*. Transp. Res. Part A 2016, 91, 134–147,

[39]. Geng, J.; Long, R.; Chen, H.; Yue, T.; Li, W.; Li, Q. *Exploring Multiple Motivations on Urban Residents' Travel Mode Choices: An Empirical Study from Jiangsu Province in China*. Sustainability 2017, 9, 136. https://doi.org/10.3390/su9010136.