Reasons of university students' susceptibility to intelligent mobility and the use of mobility-as-a-service schemes

Mikhail Leontev[1*]

[1]National Research Moscow State University of Civil Engineering, 26, Yaroslavskoye shosse, 129337 Moscow, Russia

Abstract. The transition from the current transportation system to intelligent mobility and the MaaS concept, through the introduction of Big Data analytics and digital innovation, is underway. Perceptions, attitudes and other internal factors often have a significant impact on the choice of human behavior in transportation. This paper discussed the characteristics of vehicle choice by type and depending on the goal of the trip. Private car drivers noted that they choose a car mainly because of accessibility, flexibility of use, safety and comfort. For public transportation passengers, safety and cost of travel were determining factors in their choice of public transportation. The main differences between trips with different goals were found for the indicators "time of a trip", "company trip", and "prestige". The results show that there is a positive perception of intellectual mobility among student youth, a tendency to switch from owning vehicles to other ways of using them and participating in MaaS schemes. It can be concluded that MaaS is positively perceived by the young generation of students. Based on the data obtained, proposals for the directions of sustainable development of urban public transport are made. Keywords: public transport, intelligent mobility, Mobility-as-a-Service, mobility software, trip characteristics

1 Introduction

Today's megacities face a number of global challenges that affect the quality of transportation services and urban life in general. Private cars have met the growing need of car owners for individual lifestyle, independence and flexibility, and in the last century they have become the dominant mode of transport worldwide. However, private cars are also an important source of environmental pollution, both regionally and locally [1].

Transport mobility is one of the key areas of economic development in many countries. Urban mobility is decreasing due to the rapid increase in the number of vehicles on the roads. Traffic congestion, high concentration of cars, environmental pollution from car emissions and traffic noise lead to significant economic losses and have a negative impact on the lifestyle and health of the population. Alternatively, the implementation of cleaner

* Corresponding author: miillen@rambler.ru

transportation systems and shared mobility leads to a decrease in dependence on personal motor vehicles and, as a consequence, its negative impact on the environment [2].

The introduction of digital innovations greatly simplifies the implementation of modern social-and-psychological and technological methods of managing traffic flows, in particular involve tools for analyzing Big Data and the formation of individual offers for each user and the situation, which formed the basis of the concept of "mobility as a service" (MaaS). Currently, there is a transition from the existing transport system based on ownership of vehicles to the concept of "mobility as a service" (MaaS) [3]. By focusing on the needs of passengers, MaaS aims to offer customized, integrated mobility solutions based on user requirements. However, this concept and its implementation process are, on the one hand, surrounded by ambiguities and uncertainties. Moreover, in most cases MaaS are concentrated in developed countries with efficient transportation systems [3]. On the other hand, we believe that the MaaS concept is modular, adaptable, and applicable to several realities. In this sense, the possible user of MaaS (in any specific context) should perceive its level of value as superior to owning a car or any other personal mode of transportation [4].

It is expected that the first users of MaaS will be represented by the younger generations (Zoomers, Homeland Generation and Millennials), as they demonstrate the flexibility of travel schedule, often combining different modes of transport to make short trips and travel [5]. They are mostly students of universities and colleges.

To increase transport mobility and the practical implementation of the principles of sustainability around the world, transport is beginning to be seen as a united system. There is a transition to intellectual mobility, which is defined as the use of technology and data to create connections between people, areas of the city and goods via all modes of transportation [6].

Mobility-as-a-Service (MaaS) is now considered the first stage in the development of intelligent mobility. MaaS has developed the most within the ecosystem of smart city standards. MaaS can be perceived as the best way for organizing movement around the city, and it can change citizens' attitudes toward transportation in general. The MaaS system assumes that a person can use different modes of transportation while traveling. Using smartphones as a united identifier for moving on different modes of transport in the city seems to be the most appropriate option. The use of a single account to pay for all transportation services can be considered one of the key success factors of MaaS, because the user does not need to purchase multiple transportation cards, use multiple accounts or payment systems [7].

The concept of intelligent mobility and the MaaS concept are based on Big Data analytics. The ability to create added value through the use of Big Data makes urban transportation a comfortable, safe and efficient alternative to the personal car and, as a consequence, increases the number of passengers on public transport by managing the transport behavior of residents in the megalopolis. The key issue for creating MaaS-class applications is the availability of digital information from different areas of urban economy. Integrated fare payment systems allow users to pay in advance for the combination of services they require (by time of use or by distance of travel) and receive a discount [8].

In the MaaS system, the passenger has the opportunity to make multimodal intracity trips, using different modes of urban transport (car, scooter, bicycle), paying for the trip by purchasing a subscription. To implement and operate MaaS, the following conditions must be in place and met: 1) not a few types of urban public transport; 2) most transport operators open their data to third parties, including them in real time; 3) most transport operators allow third parties to sell their services and maintain an electronic payment system to access their services [9].

In the future, the private car may lose its popularity for travel, especially within large cities. The increasing contribution of MaaS to transport mobility may lead to car owners abandoning their personal cars in the fairly foreseeable future [10].

Payment bank cards and related mobile applications are currently the most common types of integrated payment systems in transport in Russia. Further development of such mechanisms and expansion of their application is possible. The development of interaction between transport operators and banks in the future will help form a common basis for the interaction of subjects in the payment system, then it will become possible to create a unified payment system in the megalopolis, region [9]. These processes are reflected in the regulatory document "On the Transport Strategy of the Russian Federation until 2030 with a forecast for the period up to 2035" [10].

Modern city payment systems in Russia in most cases are not integrated, and their functioning is limited only to certain segments, with the exception of the cities of Moscow and St. Petersburg. At the same time, the transition to MaaS is facilitated by the fact that different types of travel tickets for one or more types of public transport have always been widely used in Russian cities, especially when they are combined with various mechanisms of reduced fare [11].

Software related to MaaS schemes is already actively used in some European cities. In Finland, the Whim app (the MaaS scheme in Helsinki) works and allows you to plan and pay for multimodal trips around the city. The UK's ArrivaClick service provides a flexible bus service that responds to passenger demand and the routes of their choice. Some cities in China have implemented a traffic control system based on artificial intelligence. This has made it possible to optimize road traffic [12].

Even when MaaS is widely implemented in the pan-European and global market, it may face strong competitors that already have global services. Examples include Uber, cab app: eCab, Lyft, Gett, Cabify. The willingness of other companies to integrate their platforms with MaaS depends largely on whether MaaS becomes the main travel application. MaaS is currently working on an open, standard system architecture [12].

P. Jittrapirom et al. express concerns about the possibility of a centralized MaaS effect. If MaaS does move from a niche to the mainstream, consideration should be given to whether and how framework conditions should be established to ensure that MaaS' impact on mobility is aligned with higher-level goals for sustainability, equity, and responsible innovation [13]. K. Pangbourne et al. emphasize the possibilities of MaaS by adapting the provision of services to the needs of each user, which leads to an increase in private requirements for the transport infrastructure, if the levels of use and occupancy of vehicles are not improved [14].

Researchers have found that perceptions, attitudes, sets, psychological and other internal causes often have a significant impact on the choice of behavior of a person in transport. Currie, Graham et al. showed that feelings of anxiety and discomfort associated with traveling with strangers was the most influential factor in causing negative feelings of personal safety on public transportation [15].

S. Hernandez, A. Monzón stressed that it is necessary to combine several modes of transport or transport services at urban interchanges before reaching the final destination. The identified functional aspects contribute to facilitate moving around the city and reduce waiting times, while psychological factors make users stay more comfortable at interchanges, they can be used as meeting places within cities, as important elements for the future development of cities [16].

Researchers have found that certain indicators, such as flexibility of transport use, comfort, environmental friendliness, convenience and safety, will be taken into account by passengers when choosing a mode of transport, influencing their preferences for cars, trains and buses. [17,18]. J.M. Roos et al. revealed the reasons for driving a private car and the

reasons for using public transport. Among the latter, there is a low degree of openness, a high degree of benevolence, and a developed ecological consciousness [18].

It is assumed that there are latent variables that influence the choice of mode of transportation. These subjective and perceptual factors cannot be observed directly [17]. A number of studies have identified latent variables (such as convenience, reliability, comfort, safety, etc.) and looked at their impact on passenger satisfaction from using different modes of transportation [15, 17, 18, 19]. The studies considered demographic and social-economic characteristics of drivers and passengers: gender, age, monthly income, education level, availability of own car (scooter, bicycle), the flexibility of their use.

Transport behavior also depends on characteristics directly related to a trip: the purpose of the trip, the distance traveled, the travel time, the distance from home to work or other destinations, the role in trips (driver or passenger), the frequency of trips, the acceptable waiting time for public transport, etc. It is also necessary to consider the degree of passenger satisfaction with the level of service in public transport, which is determined by several parameters: safety, convenience, economy. It turned out that passengers were more sensitive to the time costs during trips on public transport than when using private transport [19]. It was found that when analyzing individual characteristics: electronic fare application, integration of different modes of transport, monthly fare tickets, a positive probability of switching to another mode of transport was found for both drivers and passengers of private cars and other modes of transport. Thus, the daily distance traveled is a variable that has a greater impact on passengers than the cost of travel [20].

Considering the above, the following questions were formulated for this study: 1. Is there a trend toward transition to MaaS schemes among university students? 2. Are there differences among university students between passengers of public or other transportation and drivers of private cars and other vehicles with respect to MaaS? 3. How do university students' travel purposes affect their preference for modes of transportation? 4. What are the most significant travel purposes that affect the satisfaction of MaaS users?

The purpose of this study is to examine students' transportation preferences and predispositions to use MaaS, and to understand differences in perceptions of mobility between drivers and passengers of different vehicles. We also need to analyze the subjectively perceived parameters that influence the choice of mode of transportation. This will help identify ways to improve public transportation from the consumer's perspective.

2 Methods

To study transport preferences and perceptions of transport mobility, a questionnaire was developed and a survey was conducted. Students from technical universities in Moscow participated in the survey. Data were collected from 126 students, 62% of the total sample was male. Respondents aged 19-26 years old were 76% of the total sample, respondents aged 26-35 years old were 20%, and respondents over 35 years old were about 4% of the total sample.

Participants took part in the study voluntarily and without pay. Data were securely stored and responses were kept confidential. The questionnaire used for data collection mainly used a 5-point Likert scale. The questionnaire included items on demographic and social-economic characteristics: gender, age, monthly income, preferred type and mode of vehicle use. In addition to demographic characteristics, the motives for choosing one or another modes of transportation and the respondent's predisposition to sharing different modes of transportation were also studied. Respondents were asked to evaluate individual characteristics that influence their preference for different modes of transportation and their overall satisfaction with the use of different modes of transportation.

Travel items included travel time, distance traveled (or number of public transport stops), availability of alternative modes of transportation, role in travel (driver or passenger), frequency of transport trips, acceptable passenger waiting time, and choice of travel mode in case of public transport delays.

To measure the latent variables, relevant observation indicators were used, including: 1) safety (availability of safety equipment, safety of person and property); 2) comfort (cleanliness and interior load level, comfort of the seats and environment); 3) accessibility (i.e. distance between home (destination) and transport stop, frequency of departures); 4) flexibility of transport use (degree of freedom that the respondent has or perceives in terms of choosing direction and speed in transport, as well as in implementing personal goals of a driver when driving.

The respondents were also asked to correlate different characteristics of the trip depending on its purpose: 1) business: to work, to study, 2) personal, related to household maintenance, shopping, etc., c) recreational, leisure trips within and outside the city. The questionnaire included items to assess the satisfaction of drivers and passengers.

3 Results

Table 1 assesses the characteristics perceived by users when choosing a mode of transportation (table columns) and the independent variables (table rows). Such characteristics were analyzed on a five-point scale (from 1 to 5: from least important to most important) for each mode of transportation.

Table 1. Evaluation the characteristics of a trip by preferred mode of transportation.

	Preferred mode of transportation									
	Public transportation		**Private car driver**		**Car passenger**		**Motorcycle**		**Scooter, bike**	
Characteristic	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Flexibility of transport use	3.67	1.36	4.83	0.46	4.29	0.90	4.76	0.57	4.00	0.82
Accessibility of the vehicle	3.77	1.31	4.73	0.62	3.97	1.21	4.66	0.80	4.00	0.82
Comfort	3.52	1.52	4.05	1.13	3.72	1.38	3.47	1.43	3.25	0.70
Cost of a trip	4.13	1.04	3.38	1.35	3.16	1.18	3.53	1.38	3.58	0.63
Travel time	3.67	1.14	3.27	1.31	3.09	1.17	3.12	1.28	3.36	0.65
Parking difficulties	--	--	3.80	1.28	2.86	1.69	1.37	1.15	3.75	0.96
Safety	4.08	1.15	4.60	0.76	4.22	1.24	3.66	1.27	2.75	0.50
Prestige	1.62	1.12	1.47	0.89	1.36	0.83	2.65	1.25	2.00	0.15
Reliability	3.72	1.25	2.78	1.44	3.19	1.49	3.13	1.55	4.00	0.82
Traffic	3.28	1.40	3.70	1.03	3.36	1.22	3.10	1.28	4.00	0.82
Company trip	1.66	1.12	2.77	1.09	1.06	0.81	1.82	1.19	1.48	0.86

Further, the results regarding trip purpose showed that trip purpose may not be as important reason affecting the characteristics of the use of transportation as previously thought. Table 2 assesses the characteristics associated with the trip purpose (table columns) and the independent variables (table rows). Such variables were analyzed on a five-point scale (1 to 5: less important to most important) for each travel purpose.

The summary information in Table 2 shows that the relative importance of the characteristics depending on the trip purpose differs slightly. Most of the characteristics showed higher scores for business trips to work (study) and leisure trips than for personal trips and household needs.

Table 2. Evaluating the characteristics of a trip according to the trip purpose.

	Trip purpose					
	Business (to work, to study)		**Personal, household maintenance, shopping**		**Recreational, leisure within and outside the city**	
Characteristic	Mean	SD	Mean	SD	Mean	SD
Safety	4.51	0.51	4.21	1.19	4.36	0.75
Reliability	4.08	1.04	--		--	
Travel time	4.03	0.95	3.12	1.17	3.16	1.25
Cost of a trip	3.46	1.45	3.32	1.28	3.44	1.49
Flexibility of transport use	3.29	1.37	2.98	0.84	3.19	1.18
Traffic	3.11	1.15	2.74	0.81	2.97	1.06
Accessibility of the vehicle	2.77	1.11	2.71	1.03	2.95	0.92
Company trip	2.05	1.38	2.84	1.23	3.76	1.06
Prestige	---		2.06	1.39	2.33	1.14
Comfort	---		3.51	1.35	3.58	1.27
Parking difficulties	---		---		3.89	1.43

4 Discussion

According to the results (see Table 1), for public transport passengers, the safety and cost of a trip were the determining factors in their choice of public transport (4.08 and 4.13). It should also be noted that public transport' passengers place greater importance on getting to their destination in the shortest time and travel the shortest distance compared to private car and other vehicle users.

Compared to other modes of transportation, personal car drivers indicated that they choose a car primarily because of flexibility of use (4.83), accessibility (4.73), safety (4.60), and comfort (4.05); these results are consistent with those obtained by other researchers [17, 18, 19, 21]. Car drivers pay less attention to the cost per trip than owners of other modes of transportation (3.38). This is consistent with the data obtained by G. Lyons et al, and may be caused by the fact that in general car owners tend to consider only current fuel costs in the survey and do not consider periodic and additional car maintenance costs, such as technical inspections, repairs, insurance, taxes, depreciation. Thus, it makes difficult to attract car owners to participate in MaaS schemes [21].

At the same time, car drivers do not perceive car prestige (1.47) and company travel (2.77) as significant parameters. Such results can be explained by the composition of the sample (university students belong either to the Millennials or Zoomers), with their attitudes towards moving by transport, which was noted by D. Lois, M. López-Sáez [22]. Their motives for driving are instrumental, individualistic and pragmatic rather than affective or related to social status and the desire to impress.

On the other hand, the highest average indicator describing prestige was for motorcycle drivers (2.65), which may be due to the fact that motorcycles can be an attribute of belonging to informal groups (bikers), currently associated with a sporty lifestyle, which may affect the perception of status. Confirming this, Smith G. et al. [23] argued that the popularization of active motorcycle travel can play an important role in promoting this mode of transportation towards MaaS. The lack of parking spaces associated with high building density in urban areas may be another reason to promote MaaS [24]. According to the data obtained, drivers of private cars were more concerned about parking difficulties than drivers of other vehicles (3.80).

Car passengers presented average scores that were similar to those of public transport passengers. The greatest differences were observed in the parameters of "flexibility of transport use", which is more valued by car passengers: 4.29 versus 3.67, and "cost of a trip," which is more significant for public transport' passengers: 4.13 versus 3.16. Therefore, it is possible to shift from the use of public transport to other modes, thus facilitating the transition to MaaS in any city.

It has been observed that the cost of a trip is not a dominant factor for different groups of transport users, except for public transport passengers. When asked about increased comfort combined with increased cost of a trip on public transportation, there were low levels of approval. Respondents were not willing to reduce transport flexibility, comfort and accessibility (even if this would lead to a reduction in the cost), and the level of agreement was low for all categories of respondents. Thus, it can be stated that flexibility of use, accessibility and comfort are characteristics important not only for car drivers and passengers, but also for users of other modes of transportation, which is consistent with the findings of other studies [25].

Responses to the statements regarding vehicle sharing showed mixed results. The agreement was high with respect to the sharing of vehicles for passengers (86.3%), which is related to the desire to save money on travel. This may confirm the desire to take hitchhikers, which is a way to relieve the burden of public transportation. In addition, the willingness to change the use of transportation combined with a reduction in the fare is consistent with modal integration in the implementation of MaaS schemes.

According to the results (see Table 2), the most important characteristics for all trip purposes were: safety, cost of a trip, travel time, flexibility of transportation use, traffic, accessibility of the vehicle, company trip. Other characteristics: reliability, prestige, comfort, and parking difficulties appeared in one or two of the trip purposes.

According to the data obtained, the main differences between the characteristics according to the trip purpose were found for the indicators "travel time", "company trip", "prestige". Travel time was perceived as significantly more important for business trips than for other goals, and the ability to take family and traveling companions was much more important for out-of-town trips and leisure trips. Reliability was most important to respondents on business trips (work, study), probably reflecting the need to be there at certain times. Comfort was important for personal trips with domestic maintenance and for leisure, but not for business trips. Parking difficulties was the second most important characteristic for recreational travel, but it was not evident on trips for other purposes. Prestige was important for leisure trips, less important for personal trips for domestic purposes, but not for business trips.

Although there are absolute differences between the mean values of the characteristics for different travel purposes, the relative ratings of the characteristics for all trip purposes are similar. It can be considered unlikely that the impact of traffic and congestion will affect car ownership preferences in the foreseeable future. The parameter of accessibility of the vehicle is interesting because respondents are reluctant to acknowledge its influence on their trip decisions.

Differences in the perception of the importance of trip characteristics were found depending on the demographic characteristics of the respondents. The importance of flexibility in the use of vehicles increases in direct correlation with a person's level of education, his (her) monthly income, the number of vehicles in personal ownership. This is consistent with other studies [19, 21]. High flexibility of use was demonstrated by young people between the ages of 25 and 35 who work full-time, with above-average income in respective field of employment. On the other hand, the importance of reliability and travel time was higher for people with a lower average income in their respective occupation, those who do not have their own vehicle, and people of retirement age.

5 Conclusions

The results obtained in this study indicate that there is a demand and predisposition to participate in MaaS schemes among the student youth of Moscow. MaaS as a digital adaptable transportation service can be implemented in a number of schemes and contexts if consumers (drivers and passengers) understand its benefits [[11, 21, 23]. There is still not enough academic research and practical experience in the implementation of MaaS schemes, especially in countries and regions where the public transport network is underdeveloped. But all MaaS schemes have not yet been fully implemented in any country.

The results showed an overall level of commitment to MaaS of 73% among both drivers and passengers. We can conclude that MaaS is positively perceived by the younger generation, which confirms the data of the other researchers [5, 8, 25, 26].

Further research could focus on analyzing the integration of different MaaS operators and customer requests. MaaS, which provides more flexibility in transportation use, accessibility, and shorter trip times, could be an attractive choice for car drivers and passengers.

We should pay attention to such modes of transportation as motorcycle, scooter and bicycle. These modes of transport are important for the implementation of MaaS schemes as a means of getting the customer from home (work) to parking lots, stations, public transport stops to continue the trip, and back. However, there is still little research on these modes of transportation [24].

A number of proposals can be made for the sustainable development of urban public transportation with regard to safety, convenience, comfort, flexibility of use and cost-effectiveness. For example, the role of public transport in passenger transportation can be effectively increased through its good accessibility by creating comfortable traffic conditions, improving waiting conditions, transportation and road working environment, including the organization of dedicated lanes. We should increase the number of safety features in the cabin, optimize the rolling stock, integrate the fare ticket system, and increase the use of transport smart cards.

References

1. T. Jain, G. Rose, M. Johnson, Transportation **49**, 503–527 (2022) https://doi.org/10.1007/s11116-021-10184-6
2. Y.Z. Wong, D.A. Hensher, C. Mulley, Transportation Research Part A: Policy and Practice **131**, 5-19 (2020) https://doi.org/10.1016/j.tra.2019.09.030
3. S. Jang, V. Caiati, S. Rasouli, H. Timmermans, C. Keechoo, International Journal of Sustainable Transportation **15(5)**, 351-363 (2021) https://doi.org/10.1080/15568318.2020.1783726
4. Y. Crozet, G. Santos, J. Coldefy, *Shared mobility and MaaS: Regulatory challenges of urban mobility* (CERRE, 2019) https://halshs.archives-ouvertes.fr/halshs-03169805

5. S. Shaheen, A. Cohen, Journal of Public Transportation **21(1)**, 67-81 (2018) https://doi.org/10.5038/2375-0901.21.1.8
6. V. Kupriyanovsky, A. Akimov, O. Pokusaev et al, International Journal of Open Information Technologies **5(12)**, 77-122 (2017) http://injoit.org/index.php/j1/article/view/517
7. T. Casey, V. Valovirta, VTT Technology **255** (2016) https://www.vttresearch.com/sites/default/files/pdf/technology/2016/T255.pdf
8. T. Storme, C. Casier, H. Azadi, F. Witlox, Sustainability **13(6)**, 3074 (2021) https://doi.org/10.3390/su13063074
9. V. Tregubov, International Journal of Open Information Technologies **7(6)**, 73-80 (2019) http://www.injoit.org/index.php/j1/article/view/721
10. N.A. Asaul, Transport strategy of the Russian Federation for period up to 2030, with changes relevant to contemporary realities, Scientific Proceedings of the Free Economic Society of Russia **183**, 43-57 (2014)
11. T.N. Sakulyeva, The MaaS system and its problems, E-Management **2**, 30-37 (2018) https://doi.org/10.26425/2658-3445-2018-2-30-37
12. G. Smith, S. Sarasini, I.C.M. Karlsson et al, *Governing Mobility-as-a-Service: Insights from Sweden and Finland. The Governance of Smart Transportation Systems. The Urban Book Series* (Springer, Cham, 2019) https://doi.org/10.1007/978-3-319-96526-0_9
13. P. Jittrapirom, V. Caiati, A.-M. Feneri et al, Urban Planning **2(2)**, 13-25 (2017) https://doi.org/10.17645/up.v2i2.931
14. K. Pangbourne, D. Stead, M. Mladenovic, D. Milakis, Governance of the smart mobility transition. (Chapter 3), Emerald Points, 33–48 (2018) https://doi.org/10.1108/978-1-78754-317-120181003
15. G. Currie, A. Delbosc, S. Mahmoud, Journal of Public Transportation **16(1)**, 1-19 (2013) https://doi.org/10.5038/2375-0901.16.1.1
16. S. Hernandez, A. Monzón, Cities **50**, 158-167 (2016) https://doi.org/10.1016/j.cities.2015.09.009
17. J. Chen, S. Li, Mathematical Problems in Engineering **7861945** (2017) https://doi.org/10.1155/2017/7861945
18. J.M. Roos, F. Sprei, U. Holmberg, Applied Sciences **12(3)**, 1467 (2022) https://doi.org/10.3390/app12031467
19. P.P. Sarkar, C. Mallikarjuna, Travel Behaviour and Society **12**, 108-114 (2018) https://doi.org/10.1016/j.tbs.2017.04.003
20. D.A. Hensher, Transportation Research Part A: Policy and Practice **98**, 86–96 (2017) https://doi.org/10.1016/j.tra.2017.02.006
21. G. Lyons, P. Hammond, K. Mackay, Transportation Research Part A: Policy and Practice **121**, 22–36 (2019) https://doi.org/10.1016/j.tra.2018.12.010
22. D. Lois, M. López-Sáez, Transportation Research Part A: Policy and Practice **43(9-10)**, 790–799 (2009) https://doi.org/10.1016/j.tra.2009.07.008
23. G. Smith, J. Sochor, I.C.M. Karlsson, Travel Behaviour and Society **28**, 237-248 (2022) https://doi.org/10.1016/j.tbs.2022.04.001
24. R.L. Sanders, M. Branion-Calles, T. Nelson, Transportation Research Part A: Policy and Practice **139**, 217–227 (2020) https://doi.org/10.1016/j.tra.2020.07.009

25. D. van Lierop, M.G. Badami, A.M. El-Geneidy, Transport Reviews **38(1)**, 52–72 (2018) https://doi.org/10.1080/01441647.2017.1298683
26. D.A. Hensher, H. Xi, Transport Reviews **42(3)**, 269-272 (2022) https://doi.org/10.1080/01441647.2022.2044590