Available online at www.ijournalse.org

Emerging Science Journal

(ISSN: 2610-9182)

Vol. 7, No. 6, December, 2023

A New Combined Model for Assessing the Perceived Accessibility of Public Transport by Consumers in the Megapolis

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Abstract

This research aims to create and test a new combined model to identify causal relationships between the perceived accessibility of the non-rail urban ground public transport (UGPT) route network and consumer experience in megacities. The methods used in the research are based on a combination of two models for assessing the perceived accessibility of UGPT passengers and the frequency of UGPT use. An online survey of 1,500 megapolis residents based on the quota sample was organized. Contingency tables were used to test the hypothesis, with the result reliability at a significance level of 5%, which was checked using the chi-square test. The impact of consumer experience on passengers' perceived accessibility of the UGPT route network was identified. The relationship between the attributes of transport accessibility and the passengers' frequency of using UGPT highlights significant differences between the perceived accessibility of transport and the frequency of using UGPT. Practical recommendations were formulated for developing transport accessibility for residents of megacities. The novelty of the research lies in the combined approach, which provides a deep understanding of causal relationships between customer experience (frequency of using UGPT) and the residents' perceived accessibility of UGPT services. This helps to develop a theoretical model and practical recommendations for the improvement of the public UGPT system and transport services.

Keywords:
Transport Accessibility;
Ground Public Transport;
Consumer Perception;
Customer Experience;
Marketing; Customer Value.

Article History:

Received:	03	August	2023
Revised:	08	November	2023
Accepted:	11	November	2023
Published:	01	December	2023

1- Introduction

The development of large cities and urban agglomerations requires continuous development and improvement of the public transportation system to ensure residents' mobility and the availability of various "points of attraction" (centers of interest for residents). Transport accessibility is a comprehensive and ambiguous concept based on certain characteristics: affordability, physical access to the service infrastructure, the ability to receive the service itself, and the acceptability of the service characteristics for passengers. All these characteristics of transport accessibility form the perceived accessibility of the metropolitan transport system by the residents of megacities. The concept of urban public transport accessibility was discussed in 2005 at the conference Thredbo 9 in Lisbon (Portugal), where public transport accessibility was announced as a key factor for the level of comfort for residents in large cities [1]. The methodology for monitoring this factor of public transport accessibility is proposed to use a combination of the four most important measurement attributes: "(1) affordability; (2) availability; (3) accessibility; and (4) acceptability", which in fact comply with the proposed concept of the 4As of marketing to create value for customers [2]. Simultaneously, measuring the quality of services (including those of public transport) based on the concept of user (client) experience is one of the key factors that shape an individual's perception of service quality [3–6].

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DOI: http://dx.doi.org/10.28991/ESJ-2023-07-06-023

In this regard, it is important to understand whether the perceived accessibility of urban transport and individual characteristics of transport accessibility (with the use of four attributes) differ depending on the passenger's (consumer) experience. Therefore, it was stated that in this research, the perception of the provided urban ground public transport (UGPT) accessibility by metropolis residents depending on the frequency of their use of public transport should be analyzed and evaluated. As noted in the literature, there is a task for the transition of passengers to environmentally friendly modes of transport [7–11]. Its solution is critical to the sustainable development of urban public transport in urban agglomerations. In a study by scholars from Beijing, China, three heterogeneous latent passenger groups were identified: group A (20.4%, travel with low frequency and prefer multimode transport), group B (30.3%, travel with medium frequency and prefer a car), and group C (49.3%, travel with high frequency and prefer green modes of transport) [12].

In this research, the following limitations on the impact analysis of consumer experience on the assessment of UGPT accessibility by passengers in the megacity of Moscow were stated. The passenger transport system is rapidly developing in Moscow. This includes complete changes in the routes of ground non-rail transport and the introduction of through routes that provide residents with the opportunity to abandon individual transport and the use of overcrowded metros. Therefore, the transport accessibility of UGPT and the frequency of its use (passenger experience) become the most important parameters for determining the satisfaction of residents with transport services. Earlier scientific studies and publications did not analyze the relationship between the definition of perceived transport accessibility and the frequency of UGPT use in large cities.

The article is structured as follows: Section 1 (Introduction) provides background information on the topic of the article and explains why the study was undertaken. Section 2 (Literature Review) contains an analysis of previous studies in the field of transport accessibility and its characteristics and research on the influence of passenger experience on their perceived accessibility of a transport service. This section describes the transport accessibility characteristics and the attributes included in each transport accessibility characteristic. This helped develop the research hypotheses. Section 3 (Methodology and Hypothesis Development) provides details on the design and implementation of the study. Section 4 (Results) presents the research results. This section begins with presenting the results of testing the first hypothesis about the dependence of perceived accessibility of transport on the frequency of public transport use. They are followed by the results of testing the second hypothesis, which states that the perceived accessibility of transport by individual attributes will differ for respondents who use public transport with different frequencies. Section 5 (Discussion) is devoted to explaining the role of customer experience in passengers' perceived mobility provided by the UGPT for everyday trips, the accessibility of the route network itself for respondents, and the accessibility of attraction points provided with its help. This section discusses the relationship between attributes of individual transport accessibility characteristics and frequency of using UGPT services, leading to unexpected conclusions and highlighting significant differences between perceived accessibility of transport and frequency of UGPT use. Section 6 (Conclusions) highlights the main findings of the study and describes the limitations and opportunities for future research.

The novelty of the research lies in an attempt to identify differences in the perceived accessibility of transport depending on consumer experience (frequency of using UGPT) based on the research design.

2- Literature Review

The starting point for the literature review is the multifaceted definition of "accessibility" for transport. The 9th International Conference (Thredbo 9), "Competition and Property in Ground Passenger Transport" held in 2005 in Lisbon (Portugal), presented research results concerning the methodology for monitoring population access to public transport services using a synthetic index [1].

The authors of the methodology used the following measurement attributes: (1) affordability; (2) availability; (3) accessibility; and (4) acceptability, which, in fact, comply with the proposed concept of the 4A's of marketing for creating value for customers [1]. This marketing concept approaches the evaluation of a service or product in terms of consumer value, with the only difference being that the concept of "4's of Marketing" primarily highlights "Awareness". Availability and accessibility indicators are jointly considered in this article. Customer value is associated with customer satisfaction with public transport services. It is a holistic affective construct after the service experience that forms the customer experience [13, 14]. The importance of this kind of research for evaluating factors of customer satisfaction and its implication on customer loyalty and further frequency of public transport use is underlined in the literature [15]. The relationships between public transport usage and perceived service quality are studied in large urban agglomerations [16], and it is stated that "passengers' perception of satisfaction based on travel experience attributes [17]. Noteworthy, customer value is a complex of perceived factors that will be considered.

Affordability: The literature distinguishes "affordability" as one of the most important aspects for consideration. The aspect of affordability is discussed together with other indicators in a study analyzing transport accessibility for the poorest segments of the population in India [18]. The authors used the methodology of "monitoring the access of the population with low incomes to public transport services using a synthetic index". Besides, the criteria for "adequate

transport" were identified as follows: *affordability*; *physical accessibility* (includes such accessibility indicators as distance to the bus stop, information about services at the stop, accessibility for people with disabilities, etc.); *accessibility as an opportunity to move* (hours of operation and route options for delivery to the "point of interest", waiting time at the bus stop, the possibility of transport operation at night and on weekends, etc.); *acceptability as the quality of service* (driver behavior, age, and condition of the bus fleet, safety, comfort, etc.). During the study, the ticket cost for travel was named only as the second problem that caused the greatest concern of the respondents, while the first problem was the timely arrival at work. This is explained by the fact that "being late could mean that someone else was hired, and this is a job loss". Note that in other research papers considerable attention was paid to the economic aspect. For example, in a series of transport studies in the Bogotá Region (Colombia), an analysis of the impact of poverty on transport accessibility showed that the higher the household income, the better the transport accessibility [19-21]. As some researchers have demonstrated in their studies, even in prosperous countries there is a problem of economic inequality in the provision of public transport and the risk of "transport poverty" [22-25].

Availability: In turn, the issues of availability are considered in different aspects in numerous studies. Most of them are dedicated to the first and last mile (FLM) which means access to or exit from railway, metro, or public transport hubs. Some studies analyze the FLM issue through the notion of "household modal style" (reflecting heterogeneity in group decision-making) to account for intra-household interactions in choosing mode of travel [26].

The problem of the first and last mile holds back passenger traffic, even if the main system provides a high quality of service in terms of access to railway stations and impact on increasing rail use by passengers [27]. Other researchers have discussed how megacities are building environments for walking and cycling for residents [28], as well as analyzed the role of last mile issues for passengers [29].

In addition, a significant part of the researchers considered the issues of public transport proximity, the distance between stations, walking routes, and infrastructure for bicycles [30], the accessibility and connectivity for transit choice [31], accessibility measures for public transit service equity [31], and also the last mile problem solution [32], and connection of FLM solutions via bicycling to improve transit accessibility and advance transportation equity [33]. For example, the development of a bicycle-sharing system in China is considered to be a promising solution to the first/last mile problem. At the same time, it should be recognized that the development of the road network and the social environment are important factors determining the passengers' choice [34]. If there is a developed public transport system, a bike-sharing system (including scooters and electric vehicles for personal use) that solves the "last mile" problem will be rather complementary [35].

In some publications, the aspect of availability was considered as the FLM multimodality (public transport for delivery to the main stations) through the passengers' perception (subjective level) and objective indicators [36]. For example, a study based on a survey in Manila (with the use of logistic regression analysis) identified the statistically significant variables depended on the type of transport and qualitative variables affected individual decisions of passengers. As a result, it was found with a high degree of probability that entry and/or exit time, cost compared to travel time, safety, and accessibility of the pedestrian environment were the most significant factors [37, 38]. Some researchers considered the question of the last mile as an element of passenger perception, analyzing the relationship between the passenger's chosen means of overcoming FLM and their sociodemographic and gender characteristics [39].

A separate issue of availability, widely presented in the literature, is the analysis of accessibility as an inclusive environment [40]. Studies on this issue consider the barriers faced by wheelchair users in public transport that limit equal access to vehicles [41]. For example, in a study of public transport in Santiago de Chile, the authors examined attributes that influence perceived accessibility: audio-visual information at bus stops, height of stops, bus ramps, and travel time. The analysis of the survey data revealed a greater significance of these attributes for people with limited mobility compared with other people [42]. At the same time, studies have shown that different attributes are of particular importance for different groups in an inclusive environment. For example, the perceived convenience of traveling in public transport with a guide dog is critical for people with limited vision [43]. This shows the degree of significance of the perception by the individuals (passengers) of the factors that have significant personal significance for them.

Accessibility: It should be noted that accessibility as a possibility of movement (hours of work and possibilities of the route to reach the "point of interest", waiting time at the bus stop, the possibility of transport operation at night and on weekends, etc.) has been studied by many researchers. In general, the authors have focused on various approaches to modeling transport accessibility, for example, the use of open data [44].

Another approach is based on operational data using regression model simulations to evaluate the reliability of the bus schedule and identify potential factors affecting traffic delay [45]. Many studies have used attributes such as workload, schedule, and travel time stability for simulation [46-48]. In addition, the opening hours of various services significantly influence the simulation [22]. However, the disadvantage of these approaches is that the actual availability of transport and the possibility of passenger movement are assessed, whereas perceived accessibility is ignored. The analysis of subjective accessibility factors has been investigated in some studies based on the comparison of transport accessibility, using first an objective and then a subjective approach to compare the results [49-51].

In some studies, aimed at understanding what factors shape perceived accessibility, discrepancies were shown between the calculated indicator and the perceived accessibility of transport by passengers [52]. The authors of this publication believe that inconsistencies are related to a problem in passenger awareness and measurement deficiencies that may ignore subjective assessments of accessibility components. The awareness problem mentioned here can be partly solved using mobile applications for route planning and the use of transport networks [53].

At the same time, studies conducted in Madrid show that accessibility is not a key factor in stimulating passengers' transition from personal to public transport. This finding also indirectly confirms the significance of the perceived quality of public transport services [54].

The role of perceived accessibility of transport in a situation where passengers have incomplete information was studied in Leng and Corman [55]. This study revealed that the resulting delays in transport routes affect the perceived quality of service by passengers, which can also affect the assessment of travel time by passengers and the choice of the route in general.

Acceptability as the quality of movement: Acceptability as a quality of service (driver behavior, age and condition of the bus fleet, safety, comfort, etc.) for the passenger is sometimes inseparable from accessibility. Thus, according to Jones and Stopher [56], the quality of transport services covers the quality of servicing in transport terminals and in vehicles as well as the comfort of passengers during transport motion. Other researchers distinguish such indicators of the quality of transport services as punctuality/reliability of transport services [57]. In some studies, the authors pay attention to additional attributes that expand the basic service: the quality of information provided at stops and with interactive tools (the Internet, mail), staff behavior, etc. [58, 59]. In the authors' previous research, Heterogeneous Customer Satisfaction Index has been proposed, which is based on the traditional marketing customer satisfaction index but considers the heterogeneity of users' judgments about various aspects of servicing [60].

An interesting approach to the analysis of perceived availability was implemented by researchers using probabilistic graphical models and Support Vector Machines (for classification and regression) based on quality-of-service analysis data from 2015 to 2018. The results show some differences in the impact of service quality on the perceived accessibility of the four types of public transport. At the same time, all types of public transport are characterized by the problems of overcrowding, inconsistencies in the arrival-departure schedule between urban and suburban routes, and passengers' resulting dissatisfaction due to the increased waiting time [61].

- This literature review shows that despite the various attributes of measuring the accessibility of transport, its perception by passengers is an important factor for analysis and evaluation. At the same time, previous studies have not assessed the differences in the perceived accessibility of public transport by passengers who actively use UGPT (urban ground passenger transport) on trips and passengers who use it irregularly. It can be assumed that regular users navigate the route more easily, understand the principles of public transport operation, and do not have false expectations. Therefore, we see a certain gap in existing studies, which allows us to put forward the following research hypotheses:
- ***Hypothesis 1.*** Passengers' perceived accessibility provided by the transport system depends on the frequency of using this type of public transport.
- ***Hypothesis 2.*** Passengers' perceived accessibility of transport according to individual attributes will differ among respondents who use this type of transport with different frequencies.
    - ***Hypothesis 2.1.*** Passengers' perceived accessibility of transport according to the attribute "Proximity to bus stops" will differ among respondents who use this type of transport with different frequency.
    - ***Hypothesis 2.2.*** Passengers' perceived accessibility of transport according to the "Availability of transferring to other types of transportation" attribute will differ among respondents who use this mode of transport with different frequency.
    - ***Hypothesis 2.3.*** Passengers' perceived accessibility of transport according to the "Waiting time at a stop" attribute will differ among respondents who use this type of transportation with different frequency.
    - ***Hypothesis 2.4.*** Passengers' perceived accessibility of transport according to the "Bus congestion" attribute will differ among respondents who use this type of transportation with different frequency.
    - ***Hypothesis 2.5.*** Passengers' perceived accessibility of transport according to the "Feeling safe at the bus stop" attribute will differ among respondents who use this type of transportation with different frequency.
    - ***Hypothesis 2.6.*** Passengers' perceived accessibility of transport according to the "Feeling safe when on a bus" attribute will differ among respondents who use this type of transportation with different frequency.
    - ***Hypothesis 2.7.*** Passengers' perceived accessibility of transport according to the fare affordability attribute will differ among respondents who use this type of transportation with different frequency.
- ***Hypothesis 3.*** Regarding the transport accessibility attributes, there is no dependence on their perception by respondents using the UGPT type with different frequencies.

The definition of the research hypotheses is illustrated in Figure 1.

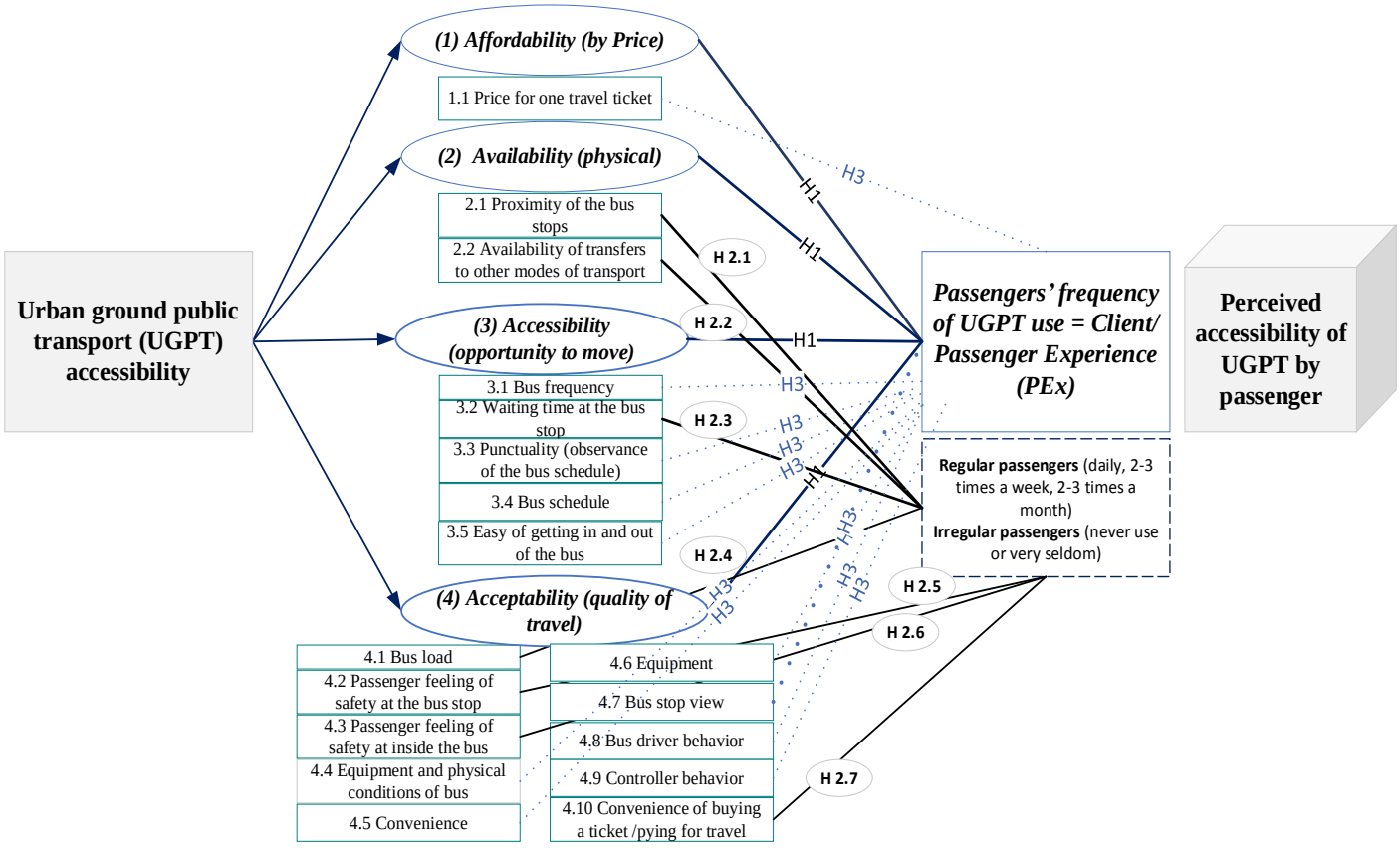

Figure 1. Hypothesis statement

3- Research Methodology

In the first stage, the existing models for assessing transport accessibility were identified for hypotheses verification. To test Hypothesis 1, the three-question model proposed by Lättman et al. [62] was used to assess transport accessibility. This model reveals how easily and comfortably individuals can perform their daily activities using their transportation system. This study showed that this approach is quite reliable for assessing urban transport accessibility [51, 62].

To test Hypothesis 2, based on the analysis of the literature and specific research papers on comprehensive models for assessing transport accessibility presented in the literature review, we settled on the approach of four dimensions (characteristics) of perceived accessibility of transport. Each of them consisted of several attributes, therefore, it was necessary to identify specific attributes for each characteristic of transport accessibility. In total, 16 attributes were identified, which were distributed according to the characteristics (elements) of accessibility as follows:

(1) Affordability: (1.1) ticket price.

(2) Availability: (2.1) proximity to bus stops, (2.2) availability of transfers to other modes of transportation.

(3) Accessibility: (3.1) bus frequency, (3.2) waiting time at the bus stop, (3.3) punctuality (scheduling) of buses, (3.4) bus schedule, (3.5) ease of entry/exit from the bus.

(4) Acceptability: bus congestion; (4.1) feeling safe at the bus stop; (4.2) feeling safe when on a bus; (4.4) facilities and condition of the bus; (4.5) convenience; (4.6) equipment; (4.7) appearance of the stop; (4.8) driver behavior; (4.9) controllers' behavior; (4.10) the convenience of buying a ticket/paying for travel.

To test the working hypotheses, Moscow city residents were surveyed online. The survey was conducted between October and November 2020. The sample size was 1500 observations. Representativeness was ensured using quotas by sex and age in accordance with the structure of the population of Moscow, which was 12 million and 678 residents officially [63]. To build a sample for online survey, quotas were developed for the frequency of public transport use (as it was recommended in the study [12]). This decision was dictated by the results of our previous study that was conducted at the beginning of 2020 before the introduction of restrictions on movement due to the coronavirus infection and showed that more than 50% of respondents did not indicate public transport among the main ways of moving around Moscow (February – March 2020, a sample of 2275 respondents, geography of the study – Moscow within the boundaries of

2012). Statistics showed that the number of journeys made by Moscow city residents on public transport in 2020 was 3.6 billion journeys that is 37% less than in 2019 due to travel restrictions during the COVID-19 pandemic according to the statistics of Department of Transport and Development of Road and Transport Infrastructure of Moscow [64]. Thus, they either do not use it at all or use it extremely rarely and therefore, they do not refer to it as their usual way of moving around the city. Thus, those who do not use or rarely use the route network cannot be excluded because their share is large and they make a significant contribution to shaping public opinion about the quality of public transport in the city. It is required to know by what parameters they evaluate quality and what determines their attitude and behavior. This is significant from the viewpoint of making managerial decisions and developing programs to work with this group of citizens, conducting a communication campaign when preparing and introducing changes to the route network, and managing public opinion.

To test the relationship between perceived transport accessibility and the frequency of UGPT usage, the questionnaire was designed using the 5-point Likert scale, where 1 = disagree, 2 = rather disagree, 3 = somewhat agree, somewhat disagree, 4 = somewhat agree, 5 = strongly agree.

To test the relationship between individual attributes of transport accessibility and frequency of GUPT use, the questionnaire was also compiled using the 5-point Likert scale, where 1 = Dissatisfied, 2 = Rather dissatisfied, 3 = Somewhat satisfied, somewhat not, 4 = Rather satisfied, 5 = Completely satisfied.

The IBM SPSS Statistics and Microsoft Excel packages were used to analyze the survey results. Hypotheses 1 and 2 were tested using contingency tables, and the reliability of the results was checked using the chi-square test at a significance level of 5%.

4- Results

Hypothesis 1 was confirmed. The perceived accessibility of the transport system depends on the frequency of using this type of public transportation.

The influence of the frequency of using ground (non-rail) public transport on the degree of respondents' agreement was checked using the following statements:

- My daily activities can be easily performed with the help of route ground (non-rail) public transport (PT);
- Considering my movements, the stops of the route ground (non-rail) PT are located in comfortable proximity;
- Considering my movements, the route ground (non-rail) PT provides satisfactory access to the places necessary for me.

All three dependencies were confirmed.

1. The impact of the frequency of using ground (non-rail) PT on the ease of performing everyday activities with the help of route ground public transport (mobility) is shown in Figure 2.

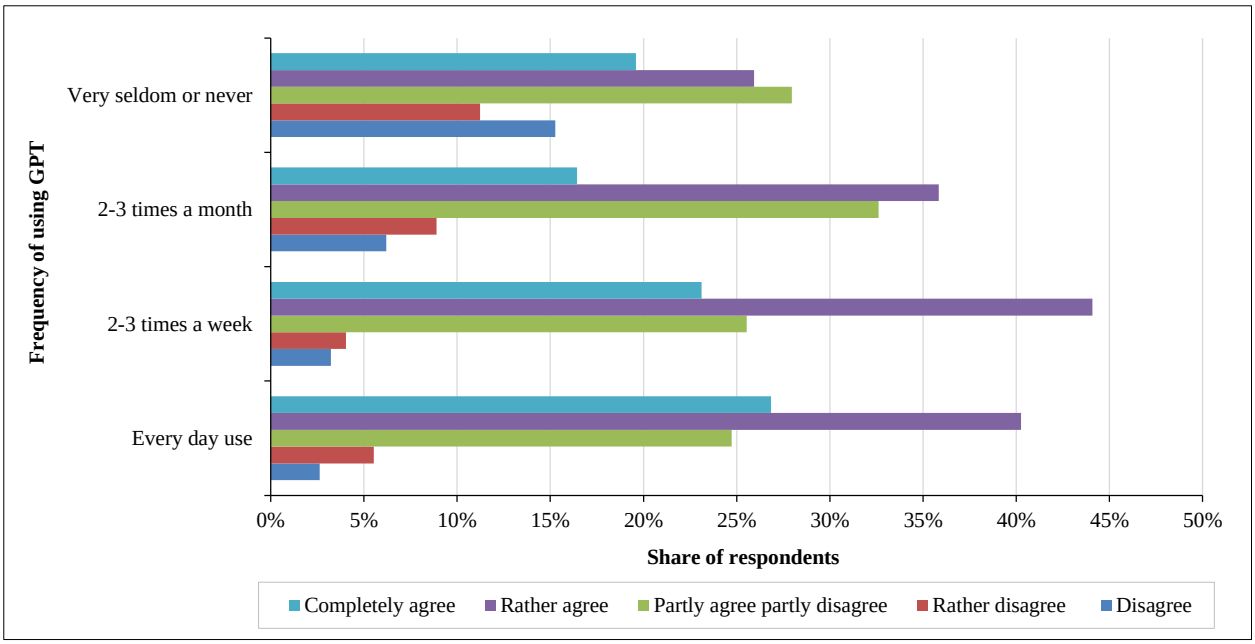

Figure 2. Impact of the frequency of using ground (non-rail) public transport on the ease of doing everyday activities using route ground public transport

The share of respondents who disagree that everyday activities are easy to do using route ground (non-rail) public transport increases significantly as the frequency of public transport use decreases: from 7–8% for passengers using public transport daily or 2-3 times a week to 15% for those who use PT 2–3 times a month and 27% for those who very rarely use public transport or do not use it at all. At the same time, the share of respondents who agree that everyday activities are easy to do using route ground (non-rail) public transport increases significantly as the frequency of using public transport increases: from 46% for those who very rarely use public transport or do not use it at all, 52% for those using PT 2–3 times a month, and up to 67% for passengers using public transport 2–3 times a week or daily. Thus, active users of PT show a higher level of perceived accessibility. Also, we can infer that the low level of perceived accessibility that has been considerable doubt expressed by not active users can be as objective fact (they can't do their everyday activities with the help of route ground public transport) as their subjective perception (they have low level awareness of PT system).

2. The impact of the frequency of using ground non-rail PT on the perceived convenient proximity to ground public transport stops (UGPT accessibility) is shown in Figure 3.

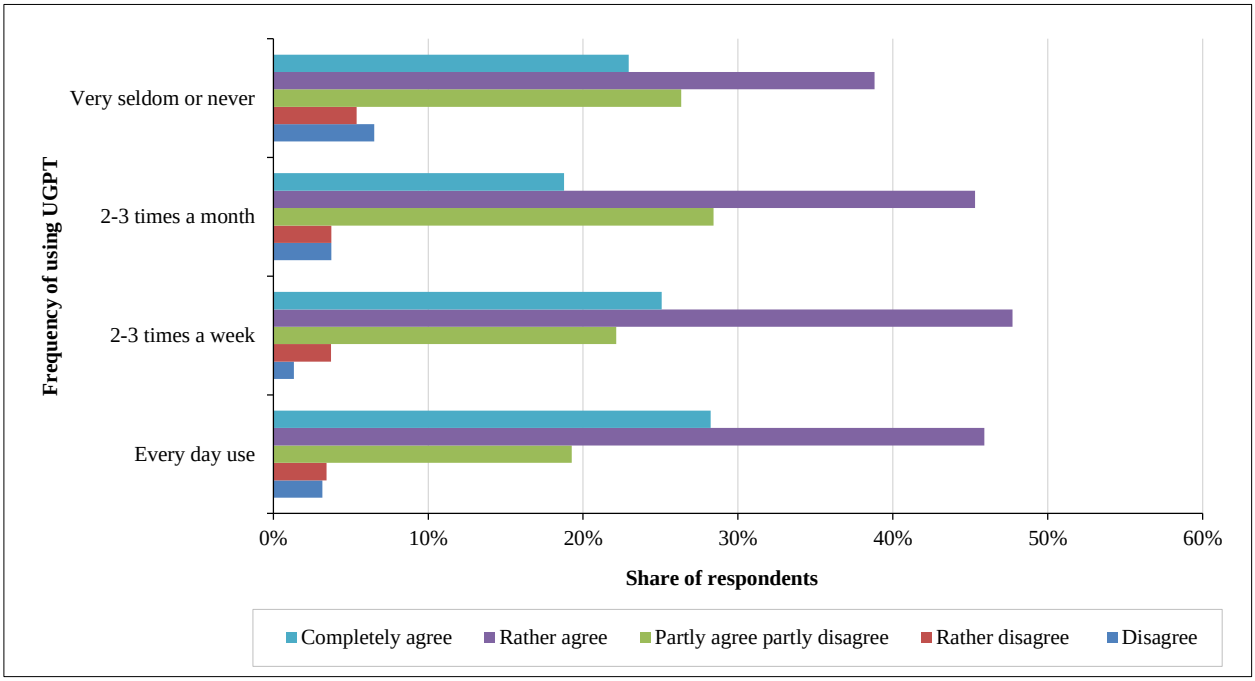

Figure 3. Impact of the frequency of using ground (non-rail) public transport on the perceived convenient proximity to the route of urban ground public transport stops

The share of respondents who disagree that route ground (non-rail) UGPT stops are located in convenient proximity increases significantly as the frequency of public transport use decreases: from 5–6% for passengers using public transport daily or 2–3 times a week up to 12% for those who very rarely use public transport or do not use it at all. At the same time, the proportion of respondents who agree that route ground (non-rail) UGPT stops are located in convenient proximity increases significantly as the frequency of public transport use increases: from 62–64% for those who very rarely use public transport or do not use it completely and for those using UGPT 2–3 times a month, up to 73–74% for passengers using public transport 2–3 times a week or daily. Thus, active UGPT users satisfied by route ground (non-rail) UGPT stop locations. Brons et al. concluded that access to railway stations impact on increasing rail use by passengers [27].

This conclusion could be translated as the low level of perceived convenient proximity to the route ground public transport stops is a factor that holds back passenger traffic. The obtained results show a fairly high level of perceived accessibility of ground public transport stops (>60%); thus, the convenience of ground public transport stops location is not a holding back factor for passengers in the studied megapolis.

3. The impact of the frequency of using non-rail UGPT on ensuring satisfactory access to the desired places using the non-rail UGPT route network (point of attraction accessibility) is shown in Figure 4.

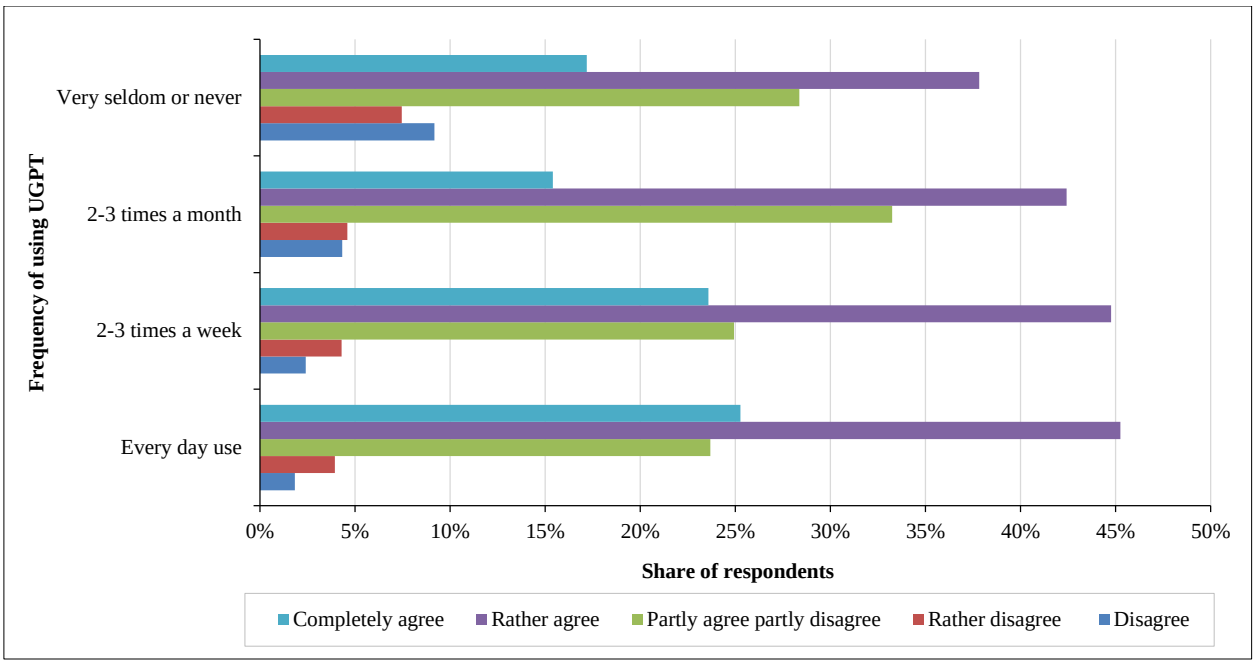

Figure 4. Impact of the frequency of using ground (non-rail) public transport on the ensured satisfactory access to the required places using route ground public transport

The share of respondents who disagree that the non-rail UGPT route network provides satisfactory access to the right places increases significantly as the frequency of public transport use decreases: from 6-7% for passengers using public transport daily or 2–3 times a week up to 17% for those who very rarely use public transport or do not use it at all. At the same time, the share of respondents who agree that the non-rail UGPT route network provides satisfactory access to the right places increases significantly as the frequency of its use increases: from 55-58% for those who very rarely use public transport or do not use it at all and those using PT 2-3 times a month, up to 68-71% for passengers using public transport 2–3 times a week or daily. Thus, the more often passengers use UGPT, the more positively they perceive transport accessibility. The obtained results show a direct relationship between the respondent's frequency of public transport use and perception of accessibility of PT. Moreover, the respondents' answers confirm a positive connection between the frequency of PT use and perceived accessibility. This is especially interesting to compare with results obtained by Rocha et al. [16], where respondents with a high frequency of PT use demonstrated a lower level of perceived accessibility. Rocha et al. concluded that the observed results are outcomes of low level of PT service quality [17].

The assessment of the significance of differences in the frequency of using the non-rail UGPT route network and indicators of the perceived accessibility of transport using Pearson's chi-square test is given in Table 1.

Table 1. Assessment of the significance of differences in the frequency of using ground (non-rail) public transport and indicators of the perceived accessibility provided by the transport system

An indicator of the perceived accessibility provided by the transport system	Pearson's chi-square	Degrees of freedom	Sig. (2-tailed)
Ease of doing everyday activities using route ground public transport	103.605	12	0.00
Perceived convenient proximity to ground public transport stops	34.867	12	0.00
Ensuring satisfactory access to desired places using route ground public transport	55.726	12	0.00

Hypothesis 2 was confirmed. The perceived accessibility of transport according to individual attributes will differ among respondents who use this type of transportation at different frequencies (see Table 2). The impact of the frequency of using UGPT on respondents' satisfaction with the components of the UGPT route network was tested.

Table 2. The share of satisfied/dissatisfied respondents according to individual attributes, depending on the frequency of using urban ground non-rail transport

No	Attributes of perceived accessibility provided by the transport system	Degree of satisfaction	Frequency of using ground non-rail public transport (answer options)			
			Daily	2-3 times a week	2-3 times a month	Very seldom or never
1	Proximity of bus stops	Satisfied	75%	80%	77%	67%
		Dissatisfied	7%	4%	6%	9%
2	Satisfaction with possibility to transfer to other modes of transportation	Satisfied	67%	67%	66%	55%
		Dissatisfied	7%	6%	8%	13%
3	Satisfaction with waiting time at bus stops	Satisfied	46%	46%	45%	39%
		Dissatisfied	22%	18%	21%	20%
4	Satisfaction with bus congestion	Satisfied	45%	54%	49%	39%
		Dissatisfied	23%	16%	20%	22%
5	Satisfaction with feeling safe at the bus stop	Satisfied	64%	67%	65%	56%
		Dissatisfied	11%	9%	13%	16%
6	Satisfaction with feeling safe when on a bus	Satisfied	65%	72%	70%	61%
		Dissatisfied	10%	6%	9%	11%
7	Satisfaction with the convenience of buying tickets/payment for the travel	Satisfied	61%	61%	58%	53%
		Dissatisfied	20%	17%	16%	20%

Analysis of the data in Table 1 makes it possible to conclude that the research results confirm ***Hypotheses 2.1–2.7*.**

Hypothesis 2.1 was also confirmed. As can be seen from Table 1, the perceived accessibility of transport according to the "Proximity to bus stops" attribute differs for respondents who use this type of transportation with different frequency.

Figure 5 shows the impact of the frequency of using ground (non-rail) public transport on passenger satisfaction with the proximity of bus stops. Noteworthy, the smallest share of respondents dissatisfied with the proximity of bus stops (4%) are regular passengers who used UGPT 2–3 times a week, 2–3 times a month, or daily. At the same time, occasional passengers show dissatisfaction with the proximity of stops to a greater extent: 6–7% of those who use UGPT rarely and 9% of those who do not use it at all. It was assumed that this is possible due to the lack of experience of these passengers in using UGPT, as traditionally in megacities with a developed network of metro (rail modes of transport), ground transport was unpopular enough or was used only for traveling within one administrative area.

However, with the introduction of UGPT through-routes to connect different parts of the city, the development of road infrastructure, the number of dedicated public transport routes on the main roads in the megacity, and a targeted communication campaign to explain the value of such through-routes, the popularity of UGPT began to grow, satisfaction and passengers' loyalty to this type of transport increased. Such a high level of satisfaction with the proximity of bus stops makes it possible to conclude that the existing perceived convenient proximity to bus stops creates the opportunity to increase the passenger flow in ground (non-rail) public transport. This conclusion is confirmed by the outcomes of Beimborn et al. [30] and Karner [31], who defined connectivity for transit choice, passenger traffic, and perception of UGPT accessibility. The maximum share of respondents who are satisfied with the proximity of bus stops is distributed as follows: 80% use UGPT 2–3 times a week, 75–77% are daily users, 75–77% of passengers use UGPT 2–3 times a month, and 67% of occasional passengers are rather satisfied with the proximity of bus stops.

Thus, regular passengers who use ground public transport 2-3 times a week are most satisfied with the proximity of bus stops. This finding is apparently determined by the fact that, on the one hand, they have sufficient experience in using ground transport, and on the other hand, problems associated with transport do not irritate these passengers in the same way as those who use public transport daily. It is also possible that a significant proportion of them travel during off-peak hours.

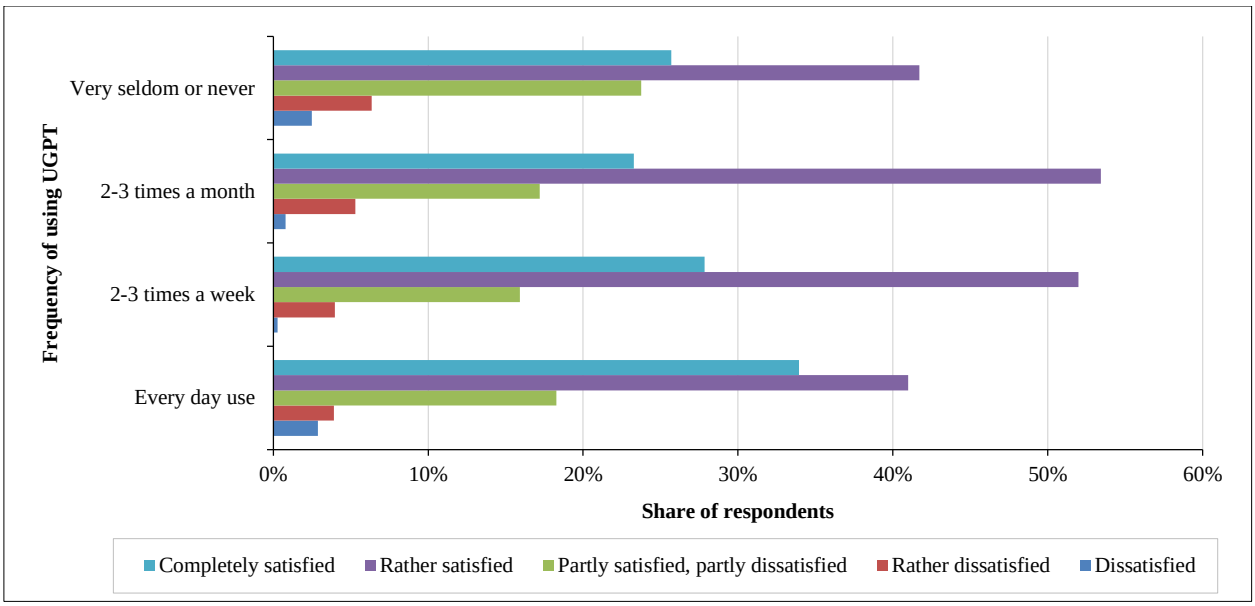

Figure 5. Impact of the frequency of using urban ground (non-rail) public transport on satisfaction with the proximity of bus stops

Hypothesis 2.2 was confirmed. The perceived accessibility of transport according to the "Availability of transferring to other modes of transport" attribute differs among respondents who use this type of transportation with different frequency (Figure 6).

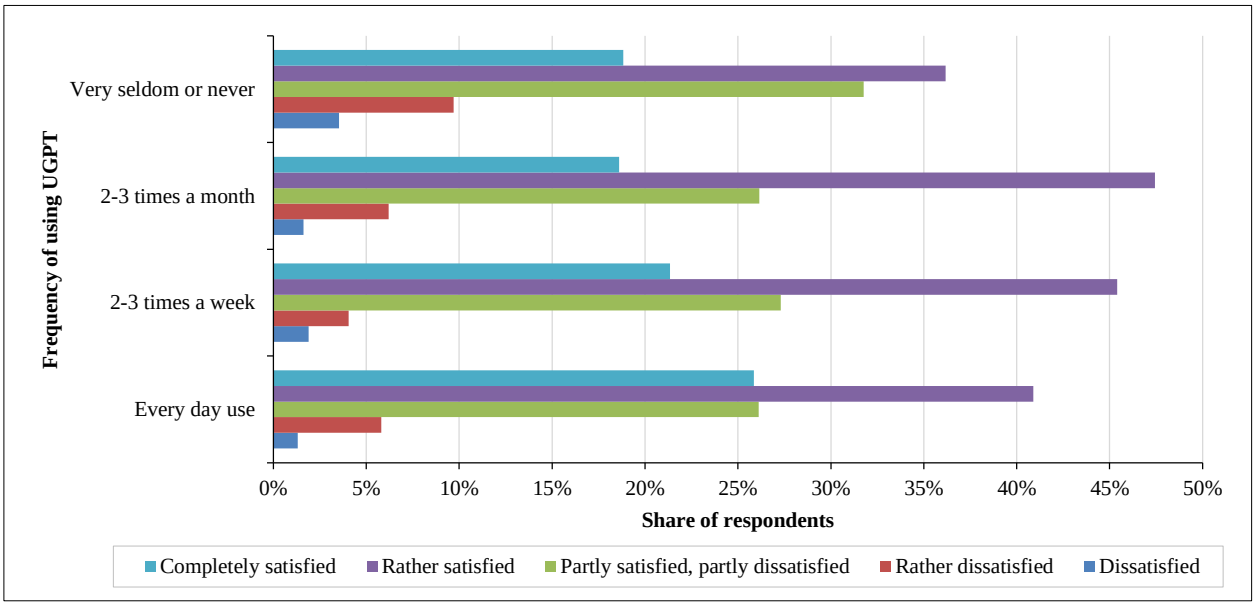

Figure 6. Impact of the frequency of using urban ground (non-rail) public transport on satisfaction with the convenience of the availability of transferring to other types of transportation

The smallest share of respondents was revealed among regular passengers who use ground transport daily, 2-3 times a week, and 2–3 times a month, while the maximum proportion of dissatisfied passengers, or 13% of the respondents, consisted of occasional passengers who use ground transport very rarely or never.

The maximum share of respondents who are satisfied with the availability of transfers to other types of transportation (66-67%) includes regular passengers who use ground transport daily, 2-3 times a week, and 2–3 times a month, against 55% of respondents who belong to occasional UGPT passengers. Satisfaction of regular passengers (using UGPT daily, 2-3 times a week and 2–3 times a month) was found to be close and higher than that of occasional passengers. This could be explained by the differences in the use experience of passengers of ground (non-rail) public transport, which is strongly supported by and correlates with the findings of the study of Tannady & Purnamaningsih [17].

Hypothesis 2.3 was confirmed (Figure 7). The proportion of respondents who are dissatisfied with the waiting time at the bus stop is 20-22% (this includes almost all groups, except for those who use UGPT 2-3 times a week, whose share is 18%).

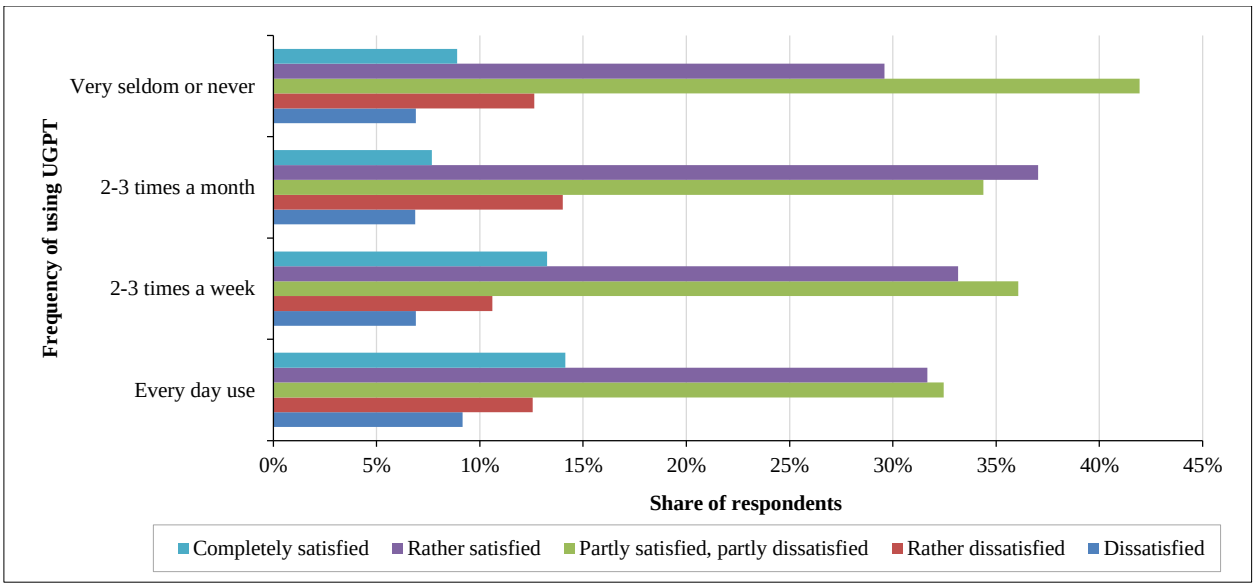

Figure 7. Impact of frequency of using urban ground (non-rail) public transport on satisfaction with waiting time at a stop

The share of respondents satisfied with the waiting time at the stop is 45-46% (regular passengers), whereas 39% of occasional passengers are satisfied with the time (it is irrelevant to them at all). This is the problem of ground (non-rail) public transport that affects passenger satisfaction. Waiting time at the bus stop was defined as the most important factor for respondents in some studies [18] because "being late could mean a job loss".

Hypothesis 2.4 was confirmed (Figure 8). The perceived accessibility of transport according to the "Bus congestion" attribute will differ among respondents who use this type of transportation at different frequencies.

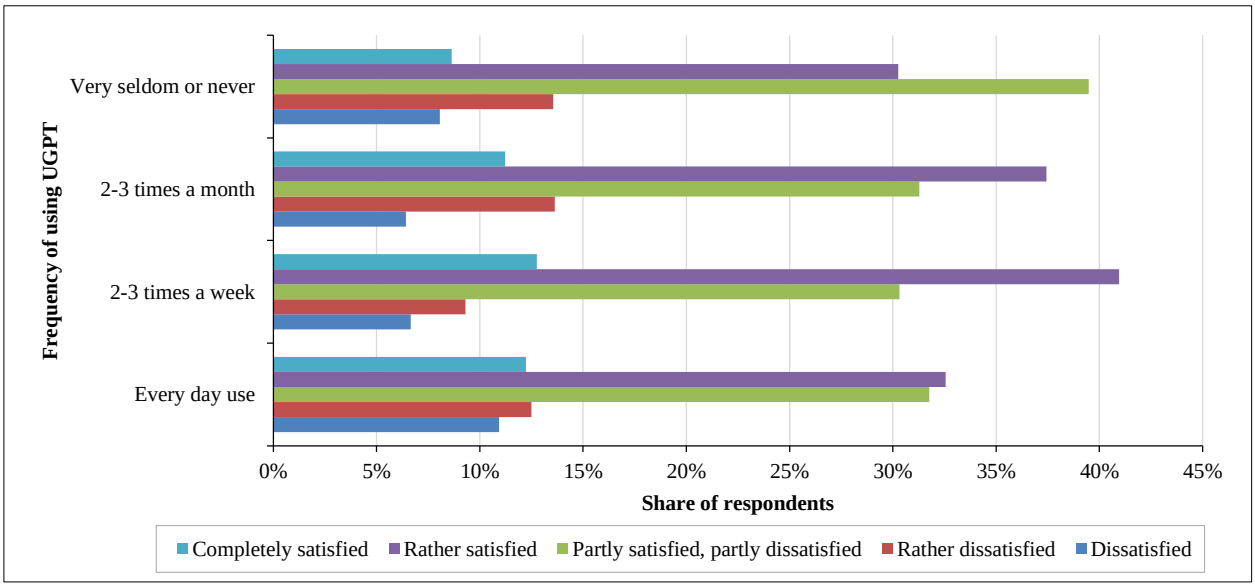

Figure 8. Impact of frequency of using urban ground (non-rail) public transport on satisfaction with bus congestion

The smallest share (16%) of respondents dissatisfied with bus congestion was found among those who use UGPT 2–3 times a week; the share of other groups of regular UGPT passengers is 20–23%, with the share of dissatisfied daily UGPT users being a maximum of 23%, but not much different from the share of dissatisfied occasional passengers (22%).

The share of respondents who were satisfied with bus congestion was distributed as follows: 54% are regular passengers who use UGPT 2-3 times a week, 45% are daily UGPT users, 49% are passengers who use UGPT 2–3 times a month. At the same time, the share of occasional passengers who were satisfied with bus congestion amounted to 39%.

Thus, regular passengers who use UGPT 2-3 times a week are satisfied with bus congestion to a greater extent. This finding may be determined by the fact that, on the one hand, they have sufficient experience in using the UGPT, and, on the other hand, problems associated with transport do not annoy them as much as passengers using the UGPT daily (maybe some of them travel off-peak hours).

Hypothesis 2.5 was confirmed (Figure 9). The impact of the frequency of using non-rail urban ground public transport on satisfaction with the "Feeling safe at the bus stop" attribute differs among respondents who use this type of transportation at different frequencies

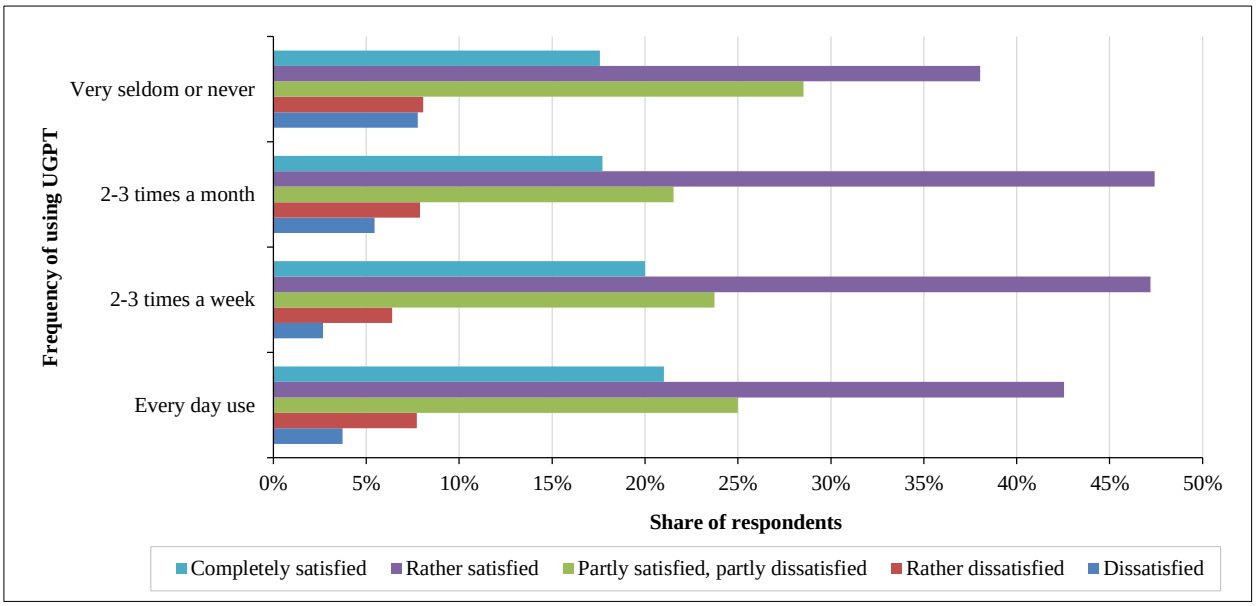

Figure 9. Impact of the frequency of using urban ground (non-rail) public transport on satisfaction with feeling safe at the bus stop

The smallest share (9%) of respondents who are dissatisfied with feeling safe at the bus stop are regular passengers using UGPT 2-3 times a week, while the share of occasional passengers dissatisfied with these attributes is 16%, and the share of daily UGPT users is 11%.

The maximum share of respondents (67%) who were satisfied with feeling safe at the bus stop was revealed among regular passengers who use ground transport 2–3 times a week. Furthermore, 64% of daily users were satisfied with this attribute, 65% of regular passengers who used UGPT 2–3 times a month were also satisfied, while the proportion of occasional dissatisfied passengers was 56%. Satisfaction scores for those using public transport daily and 2–3 times a month were close. This difference in satisfaction and the relatively higher level of dissatisfaction of occasional passengers can partly be explained by the differences in their use experience: the less experience of using UGPT, the stronger psychological discomfort that also impacts the feeling of safety at the bus stop.

Hypothesis 2.6 was confirmed (Figure 10). The influence of perceived accessibility of transport on the "Feeling safe when on a bus" attribute differs among respondents who use this type of transport with different frequency

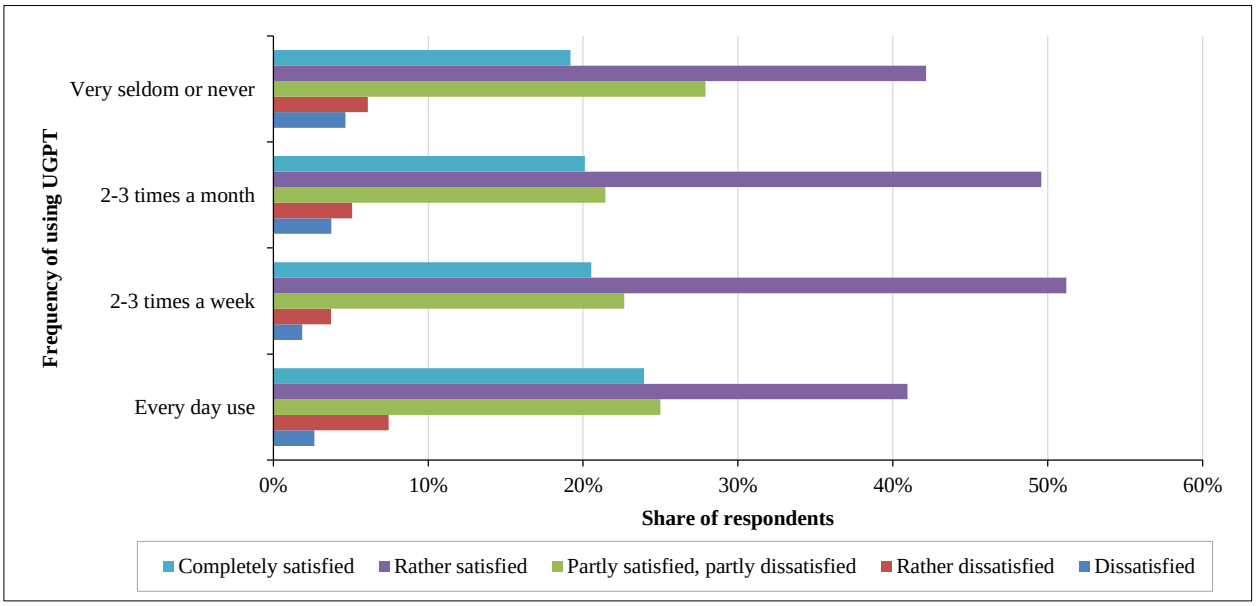

Figure 10. Impact of the frequency of using urban ground (non-rail) public transport on satisfaction with feeling safe when on a bus

The smallest share (6%) of respondents dissatisfied with feeling safe on a bus was revealed among regular passengers who use ground transport 2–3 times a week. Furthermore, the shares of passengers dissatisfied with this attribute were distributed as follows: 10% of regular passengers (daily users) and 11% (or the maximum share) were occasional passengers.

The largest share (72%) of respondents satisfied with feeling safe when on a bus was found among regular passengers, especially those who use UGPT 2–3 times a week, followed by 65% of daily users and 70% of passengers who use UGPT 2–3 times a month, whereas the share of occasional passengers was 61%. Therefore, passengers who use UGPT 2-3 times a week are more satisfied with this attribute. Satisfaction scores for this attribute for daily users and occasional passengers were found to be close.

Hypothesis 2.7 was confirmed (Figure 11). The influence of perceived accessibility of transport on the fare affordability attribute differs among respondents who use this type of transportation at different frequencies.

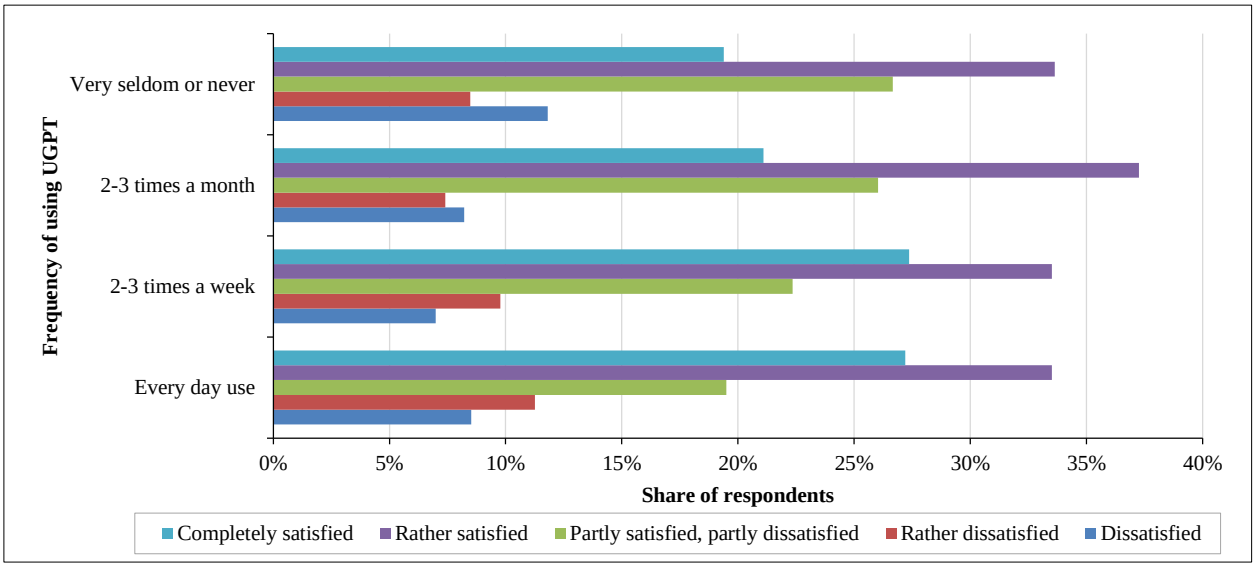

Figure 11. Impact of the frequency of using urban ground (non-rail) public transport on satisfaction with the convenience of buying a ticket/paying for travel

The research data show a slight decrease in perceived accessibility of transport as the frequency of UGPT use decreases: from 61% for regular passengers – daily users and those using UGPT 2–3 times a week – to 53% for occasional passengers. It is interesting that the degree of dissatisfaction among passengers using UGPT daily and occasional passengers (who very rarely use or do not use it at all) was 20%. The smallest share (16–17%) of respondents dissatisfied with the convenience of buying a ticket/paying for travel was determined among regular passengers (the group of those who use ground transport 2–3 times a week and 2–3 times a month). The maximum share of dissatisfied passengers (20%) falls on regular passengers – daily users and occasional passengers.

The maximum share of respondents satisfied with the convenience of purchasing a ticket/paying for travel (61%) falls on daily users and those who use UGPT 2–3 times a week, whereas 63% of respondents – occasional passengers – were also satisfied with this attribute. Satisfaction of regular passengers using public transport daily, 2–3 times a week, and 2–3 times a month turned out to be close and higher than that of occasional passengers. We have identified differences in the perceived accessibility of non-rail UGPT depending on the frequency of using the UGPT route network, which are presented in Table 3.

Table 3. Attributes for which differences in perceived accessibility of transport were identified depending on the frequency of using UGPT

Transport accessibility element (characteristic)	Attributes of transport accessibility element (characteristic) with identified differences in passenger perception
Physical Availability of Transport Infrastructure	- Proximity of bus stops - Availability for transfers to other modes of transport
Accessibility – possibility to use transport service to get to points of attraction	- Waiting time at bus stop
Acceptability as a quality of movement	- Bus congestion - Feeling safe at bus stops - Feeling safe when on a bus - Convenience of ticket buying/paying for the travel

The assessment of the significance of differences in the frequency of using non-rail UGPT and the attributes of perceived accessibility provided by the transport system using Pearson's chi-square test is presented in Table 4.

Table 4. Assessment of the significance of differences in the frequency of using ground (non-rail) public transport and attributes of the perceived accessibility provided by the transport system

An indicator of the perceived accessibility provided by the transport system	Pearson's chi-square	Degrees of freedom	Sig. (2-tailed)
Proximity of bus stops	40.468	12	0.00
Availability of transfers to other modes of transport	29.197	12	0.00
Satisfaction of waiting time at the bus stop	55.726	12	0.00
Satisfaction with bus congestion	22.374	12	0.03
Satisfaction with feeling safe at the bus stops	22.171	12	0.04
Satisfaction with feeling safe when on a bus	22.292	12	0.03
Satisfaction with ticket buying/paying for the travel	21.805	12	0.04

Hypothesis 3 was confirmed. We identified attributes of elements of the non-rail UGPT route network accessibility that do not affect passenger satisfaction, regardless of the frequency of UGPT use (Table 1). For convenience, the attributes are grouped into four transport accessibility characteristics, and the results are presented in Table 5.

Table 5. Attributes for which differences in perceived accessibility of transport were not identified depending on the frequency of using UGPT

Transport accessibility element (characteristic)	Attributes of transport accessibility element (characteristic) *without* identified differences in passenger perception
Affordability (by Price)	Price of one-way ticket
Accessibility - possibility to use transport service to get to points of attraction	- Bus frequency - Punctuality (adherence to the timetable) - Bus schedule - Ease of getting on and off the bus
Acceptability as a quality of movement	- Equipment and condition of the bus - Convenience, equipment, appearance of the bus stop - Driver behavior - Behavior of controllers

The first four attributes presented in Table 5 are associated with objective indicators (ticket price, transport schedule), and the rest are based on a general attitude to convenience, equipment, and behavior, regardless of the frequency of using ground public transport (i.e., user experience). The obtained results can be explained by the fact that the Moscow government has renovated the park for buses over the past several years. Gasoline-powered buses have been converted into full-electric buses. This also means that a modern designed and superior comfort electric bus fleet has been imposed in Moscow. This explains the similar level of satisfaction of respondents with different frequency of using UGPT.

Some researchers have summed up that there is a problem of economic inequality in the accessibility of public transport in different countries [24, 25]. The similar perception of affordability (by Price) of respondents in Moscow can be explained by the high level of social support of the population with low incomes. For instance, students and pupils of the school use PT with a large discount, and retirees use PT for free.

5- Discussion

The research results confirmed Hypothesis 1 stating that the frequency of using and the perceived accessibility of urban ground public transport have a positive relationship. Discussing the results obtained, one could say what, in fact, is surprising here?! If public transport did not satisfy the respondents, they would not use it, but this is not true. Here it should be immediately clarified that, unlike many consumer services where consumers facing a negative experience can switch to the services of competitors or refuse to use a particular type of service, it is rather problematic to refuse public transport services completely or even partially. Even if public transport limits the mobility of an individual and is not sufficiently accessible. For instance, Rocha et al. [16] observed that the Metropolitan Area residents "had a higher overall rating of public transport services, despite being less likely to use PT". The authors explained these results as "the characteristics of the household and the municipality location" [16]. This research showed that a passenger (residents of megacity) who actively uses public transport (2–3 times a week or more often) is not only forced to actively use the non-rail UGPT route network, but is satisfied with the mobility implemented with its help, the availability of stops

(convenient proximity) and the provided availability of points of attraction. The differences in results can be explained by the specific metropolitan areas in Portugal and Russia. Despite similarities in the area of the Porto Metropolitan Area (PMA) and Moscow (According to Federal Agency of Statistics 'Rosstat', approximately 2041 km^2 of PMA [65] and 2562 km^2 of Moscow [63], the density differs significantly (a population of PMA is about 1.7 million people, a population of Moscow is about 13.1 million people [64]. Therefore, the use of private motorized vehicles (PMVs) is hindered, and public transport as an alternative is becoming increasingly popular in Moscow for people with higher average incomes. Moreover, there are unified standards for all types of PT in Moscow, including the target accessibility indicators. In contrast, the PMA has "multiple PT operators within the same metropolitan area, which complicates quality control of PT systems" and connectivity of routes at PT operators given that "each operator may have different standards and procedures" [65]. These facts on the one hand make the UGPT accessibility differ in these two metropolitan areas and on the other hand make it possible to explain the differences in the results of the studies.

It is quite natural in our opinion that approximately 27% of occasional passengers who do not use UGPT are convinced that they cannot do their daily activities with its help, that is, in their opinion, the existing UGPT route network does not provide them with the necessary level of mobility.

The elements (characteristics) of accessibility and some attributes of the transport service accessibility elements were analyzed, which caused the most negative opinion among the respondents of this group. The lowest level of satisfaction was revealed regarding affordability. This corresponds with earlier research where the cost of a ticket for travel affects the risk of "transport poverty" [22-25] and must be under hard control. The ability to get the service itself (Availability) and its attributes: bus waiting time, bus punctuality, bus frequency, and bus schedule, also affect passenger dissatisfaction. Finally, the "service acceptability" element and its "bus congestion" attribute have a similar effect. Maitra and Sadhukhan [18] defined the cost of a ticket for travel (Affordability) only the second of the problems that cause the greatest concern of the respondents, while the first problem was the elements (characteristics) of accessibility such as bus punctuality [18]. This result may be associated with both the actual non-compliance of UGPT routes with the respondents' expectations and needs for making everyday trips and the low awareness of respondents about the UGPT possibilities. Since this is a fairly large group (23.6% of all respondents in the sample very rarely use or do not use UGPT at all), the reasons for their refusal to use the non-rail UGPT route network can have significant social consequences, such as congestion of metropolitan motorways, environmental pollution from personal transport used to move around the city, and high congestion of other types of public transport: ground and underground rail transport. And here it is very important to understand that such a survey result is either associated with the actual inconsistency of the route network with the residents' tasks, which requires its development, or is associated with a low level of awareness, which requires completely different management decisions and efforts to disseminate knowledge about routes, simplifying the receipt of these knowledge, building effective communications with potential users of the non-rail UGPT rout network. This could not be verified within the scope of the present study, which is a limitation of this research.

It is interesting that among the passengers who use the UGPT quite rarely (2–3 times a month), 52% of respondents are convinced that this type of public transport allows them to easily perform their daily activities with the help of route ground (non-rail) public transport, that is, it provides an acceptable level of mobility.

Some researchers have concluded that the concept of user (client) experience is one of the key factors shaping an individual perception of service quality [3-6]. The results of this study, obtained when testing Hypothesis 2 (Hypotheses 2.1-2.7) about the existence of differences in the perception of certain attributes of the UGPT transport service accessibility elements, depending on the frequency of using the UGPT, lead us to the following reflections. Differences in consumer activity when using the UGPT service are not the basis for differentiating the perception of objective attributes of a transport service quality. A respondent may be an active user of this group of public transport, or may use it from time to time, and, nevertheless, will evaluate such attributes as "Ticket price", "Bus frequency", "Punctuality in a similar way. Certain subjective characteristics, such as the driver's behavior or the convenience of getting on/off the bus, also do not give differences in the perceived accessibility of transport, depending on the frequency of its use. In groups of respondents with different levels of activity in using UGPT, about 4–5% were dissatisfied with the driver's behavior, while the rest were satisfied. Here we can probably talk about well-developed standards and procedures for checking the driver's behavior on the UGPT that satisfies the passengers' expectations. Thus, state policies that have been instrumental in encouraging common standards or procedures for PT in Moscow have affected the perception of accessibility and satisfaction of PT service quality. It also provides the opportunity to harmonize services offered by multiple PT operators within the same metropolitan area.

At the same time, there are subjective attributes according to which active users of the service and those who use the service rarely perceive quality differently (Hypothesis 3). In general, it can be stated that, according to most attributes of transport accessibility elements, regular passengers who use surface public transport 2–3 times a week are most satisfied. Apparently, such a frequency of use allowed the respondents, on the one hand, to have sufficient experience in using UGPT to effectively use the transport service, and on the other hand, the problems that a passenger could encounter in the process of using the transport service did not overwhelm the "cup of patience" – some critical maximum.

The fact that passengers who use ground public transport 2–3 times a week showed the greatest satisfaction with most attributes of transport accessibility demonstrates a certain level of optimal frequency of using public transport. Thus, when assessing the perception of the quality of a public transport service, the decrease in satisfaction may be associated with a certain "oversaturation" or "fatigue" from the service and possibly with changes in consumer value [14] rather than with a decrease in the quality of services.

6- Conclusions and Policy Recommendations

6-1- Findings of the Study

The current study has multifaceted novelty, significance, theoretical, and practical contributions. The proof of the formulated hypotheses shows that consumer (passenger) experience affects the perception of the quality of transport services, which means that it must be considered when making managerial decisions to implement measures aimed at improving public transport services and when building communications with target consumers of transport services having different passenger experiences.

Following up on the research of de Avila Gomide et al. (2005) [1], the authors considered that a certain pattern has been revealed, according to which the more often passengers use public transport, the more positively they perceive transport accessibility and its individual elements. This is in line with the marketing concept [2, 13] and allows the results of this study to be used to evaluate customer satisfaction factors and their impact on customer loyalty and further frequency of public transport use, which is combined with the research described previously [14, 15].

The results obtained showed that the UGPT meets the expectations of mobility, the accessibility of the UGPT itself (comfortable proximity to stops), and the availability of attraction points for respondents. At the same time, a fairly large group of respondents indicate that they do not use or very rarely use ground transport considering the non-rail UGPT route network to be unsuitable for meeting their needs in everyday travel, as it does not provide the required level of mobility.

The obtained respondents' ratings on the convenient location of the UGPT stops generally show a high level of satisfaction, since the locations of the UGPT stops cannot be reasons for not using this type of transportation (regardless of the frequency of using the UGPT, most respondents agreed that public transport stops are located in convenient proximity). This is in line with earlier studies that have examined proximity to public transport [29]. Attributes related to the physical availability of the transport infrastructure require additional attention and research because their perception depends on the consumer (passenger) experience.

For a number of transport service attributes, there are differences in the perception of quality. It can be assumed that the active switching of the metropolis' residents from individual to public transport will lead to an increase in the frequency of its use and, as a result, the level of satisfaction with the quality of the service may decrease. It can also be concluded that based on higher ratings of perceived transport accessibility by passengers who regularly use it compared to passengers who rarely use it, it can be inferred that the quality of transport service in Moscow has improved recently.

6-2- Strengths and Limitations

The strengths of this study include a comprehensive approach to analysis and the availability of a significant empirical base, which makes it possible to obtain statistically sound conclusions and recommendations and to identify causal relationships. The exploratory approach applied in the study enabled to identify statistically significant variables that depend on the type of transportation and qualitative variables that affect the individual decisions of passengers based on the analysis using logistic regression.

The new combined model for assessing the consumer experience of using public transport proposed by the authors made it possible to identify the dependence of perceived accessibility of transport on the frequency of using public transport, to determine the differences among public transport users in perceived accessibility of transport according to individual attributes depending on their consumer experience of using public transport with different frequencies. The combined assessment model enabled the identification of attributes of non-rail UGPT route network accessibility elements that do not affect passenger satisfaction, regardless of the frequency of using the UGPT. This significantly expands the knowledge of setting priorities for managing the behavior of public transport consumers in large urban agglomerations.

6-3- Research Limitations

The survey questions do not allow us to establish how those who do not use UGPT to perform their daily activities, or 23.6% of respondents, are aware of the routes and operation modes of this type of transportation. The research had no aim to determine what other types of public transport the respondents use or whether they use public transport to do their daily activities. Thus, the obtained results do not allow us to conclude about the actual possibility; rather, they provide information about the perception of the mobility provided by the UGPT among occasional (inactive) users and non-users.

The results obtained for individual attributes of the transport service make it possible to identify differences in their perception depending on the user experience (frequency of trips), to record the presence or absence of differences in perception, but they do not allow us to explain the cause of the recorded differences.

The limitations associated with the research methods used should also be considered: an online questionnaire-based survey, quota sampling, conducting the study in one metropolis (Moscow), the Likert scale used in compiling the questionnaire, and the restrictions associated with the methods used for processing the survey findings. The transport accessibility assessment models used for the analysis also have certain limitations. The limitations associated with the methods and models used in this research are well described in the scientific and methodological literature, and it makes no sense to describe them in this article.

6-4- Recommendations for Future Research

In our opinion, it would be useful to analyze a group of occasional UGPT users (or non-users in general) and establish the reasons for their rejection of this type of transportation, and determine whether the refusal to use the UGPT is determined by a low level of awareness of the UGPT capabilities or the real restrictions on the individuals' mobility with the existing route network and the mode of the UGPT operation. In this case, theoretical significance will consist in identifying triggers that affect the individuals' behavior in this group, and practical importance will be in developing a non-rail UGPT route network and expanding practical knowledge in the field of social consequences of changing the transport behavior of city residents.

In our opinion, research aimed at identifying the causes of the observed phenomenon will be of interest, when for certain subjective attributes we have not recorded the differences in the quality perception depending on the respondents' consumer experience, and for others we have revealed statistically significant differences. In this case, the theoretical significance is to determine whether this reason lies in the quality standards set for these attributes for public transport, or with other reasons. Practical importance will consist in obtaining an evidence base for making managerial decisions and for reducing the psychological tension of public transport users.

Since our research showed a certain frequency of using public transport (2–3 times a week), at which respondents expressed the highest level of satisfaction for most quality attributes, it would be useful to explore in more depth the possibilities of increasing satisfaction with the public transport service for groups of users with high (daily) and low (2–3 times a month or less) frequency of using the non-rail UGPT route network transport service. In this case, the theoretical significance would be to test our assumption about the existence of a certain "fatigue" from the service among active users of public transport. If it really exists, this will make it possible to understand deeper the function of satisfaction with the transport service, depending on consumer experience. From a managerial perspective, practical importance would consist in the opportunity to avoid excessive expectations for passenger satisfaction, especially if municipal governments actively encourage citizens to switch to public transport.

6-5- Policy Recommendations

The findings and recommendations obtained during the study show that consumer experience significantly influences the perception of the quality of transport services; hence, it is necessary to use methods and models for assessing consumer experience and analyzing the perceived accessibility of transport by passengers when making managerial decisions aimed at improving public transport services. When making a state policy for developing public transport in large urban agglomerations, it is necessary to rely on the results obtained during the research, which showed that consumer experience affected the perceived mobility available to the passenger, the availability of the UGPT itself (convenient proximity to stops), and the availability of points of attraction.

6-6- Managerial Implications

Since the research revealed differences in the perception of the quality of transport services regarding some attributes, this knowledge should be considered when forming KPIs for managing the transport complex of large cities and urban agglomerations. The research findings make it possible to reduce uncertainty in making managerial decisions. They show that a decrease in satisfaction may be associated with a certain "oversaturation" or "*fatigue*" from the service, rather than with an objective decrease in the quality of the service. This, in turn, will require a periodic review of the target values of indicators for assessing the efficiency of the municipal transport complex and a revision of the methods for assessing the satisfaction of public transport passengers, which certainly needs to be accounted for when making managerial decisions and when developing indicators for assessing the efficiency of the municipal transport complex

7- Declarations

7-1- Author Contributions

Conceptualization, A.V.L., R.R.S., and S.V.M.; methodology, A.V.L., R.R.S., and S.V.M.; software, S.V.M.; validation, R.R.S. and S.V.M.; formal analysis, A.V.L., Z.B.M., and S.V.M.; investigation, A.V.L., R.R.S., and Z.B.M.; resources, I.I.S. and Z.B.M.; data curation, S.V.M.; writing—original draft preparation, S.V.M.; writing—review and editing, R.R.S. and I.I.S.; visualization, A.V.L. and S.V.M.; supervision, Z.B.M.; project administration, R.R.S. and I.I.S.; funding acquisition, R.R.S. All authors have read and agreed to the published version of the manuscript.

7-2- Data Availability Statement

The data presented in this study are available in the present article.

7-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7-4- Acknowledgements

The authors would like to acknowledge gratitude to the professors and the faculty of the Department of Marketing and the administration of PRUE for the support and technical assistance.

7-5- Institutional Review Board Statement

Not applicable.

7-6- Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

7-7- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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