Quality Assessment and Passenger Satisfaction from Public Transport Services in Radom

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Abstract: The following document shows the results of the survey research carried out on the inhabitants of Radom. The entire analysis concerned the observed satisfaction of public transport services in this city. As a result of the conducted research, there was a model created with the purpose of identifying the factors influencing the satisfaction from the public transport which include adjusting public transport to the needs of the disabled, the features of the public transport (ticket price, frequency of the shuttling, punctuality of the arrivals, accessibility of the bus stops, time of the ride) as well as the course of the bus communication line. The results of the conducted analysis suggest that the attitudes towards the public transport differ in the particular groups of passengers. The presented data indicate that the level of satisfaction from the public transport decreases with age. The observed satisfaction from the public transport also differs depending on the respondents' sex. The conducted analysis proves that women tend to assess the quality of the public transport services more negatively than men. It points to the need of the improvement of the quality of the provided public transport services with particular reference to these social groups.

The following research adds the theoretical knowledge in the area of the quality of the public transport services as well as presents the way of shaping transport services with particular reference to the role of demographic factors on the perceiving the quality of services.

Keywords: *quality of service; public transport; customer perceptions.*

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1. Introduction

Transport is a service that accompanies humanity from the beginning of civilization. Transport also plays an important role in the present world. Efficient and effective transport is one of the factors that enables countries to develop efficiently and sustainably. The concept of postmodern society is also associated with the development of transport. Postmodern society is an ambiguous concept, difficult to clearly define. Postmodern society is often identified as knowledge society and a consumer society. A knowledge based society is a social model in which knowledge and intellectual capital play a key role. Knowledge-based society as the expression of global society is trying to reconcile needs of human nature, proposing ways development that absorbs inexhaustible human represented resources such as intelligence, thanks to knowledge, a tendency to innovation, entrepreneurial ability, creative association (Rieu, 2005). The consumer society is based on the acquisition of goods and their consumption in order to improve their own quality of life. In postmodern society, consumption is the central value, which not only serves to meet the needs of the individual, but also is a carrier culture (Janas, 2016). The basic cultural values include material culture which includes all products of human activity as well as social culture containing certain patterns of behavior and thinking. In the postmodern city, the most important values are tolerance, freedom and pluralism (Szoltysek, 2015). The impact of postmodernism is also visible in public transport. Postmodernism influences the shaping of urban policies and sets out paths for their development. In the field of city planning, post-modern urban planners strive to integrate all elements in order to create appropriate living conditions in the city for visitors by easy access to all transport services (Barreiro Leon, 2017).

The organization of public transport in the conditions of post-modern society is a difficult task. This is due to the individualized nature of postmodern society, which makes modern transport planning a difficult undertaking because it is difficult to undertake the implementation and joints actions for the common good (Searle & Thompson, 1999). For this reason, the issue of quality in urban transport is a socially important and topical topic

The following article presents the review of the literature in terms of the quality of the public transport services. Also, it shows the transport policy of Poland with regard to the public transport. The publication also presents the results of the survey research carried out in the city of Radom

in years 2017-2019 on the group of 454 respondents. The paper presents the results of analyses. Later on, one can observe the further description of the conclusion of the aforementioned analyses.

This article consists of five sections. Following this introduction, the second part presents the characteristics of the researched city. The third section shows the review of literature and the role of quality of the public transport services. The entire methodology is discussed in the fourth subchapter. Subsequently, the results are presented in the fifth section. Finally, the paper ends with the conclusion and practical implications.

2. Research Area

Radom is a city located in central-eastern Poland in the Masovian voivodeship which currently has 214566 inhabitants what places it at the 14th position in the country in terms of population. Radom is located 105 kilometres from the country capital Warsaw.

In the strategy of the development of the city of Radom in years 2008-2020, there are developmental goals of the public transport stated which are as follows (Mordak, Tetlak, & Rawski, 2008):

- Working on and implementing complex conception of transport development as a part of the “Radom Regional Metropolitan Area” in regard with infrastructural roads and rail connections as well as integrated system of public transport;
- Improvement of the quality of the road infrastructure in Radom, primarily in terms of technical condition and road capacity;
- Improvement of the communication system of Radom with particular reference to transferring transit traffic from the city centre;
- Improvement of the public transport system of Radom to make it maximally environmentally friendly;
- Constructing the bicycle path system in a cooperation with the neighbouring boroughs and towns attractive in terms of the tourism aspect.

The analysis of changes in demand and supply for the public transport in Radom indicates the existence of unused potential connected with the improvement of the quality of the transport services providing that the offer of the public transport of Radom is adjusted to the transport postulates of the passengers (Gromadzki, 2013).

By virtue of these conditions, the aim of the following research was to analyze the quality of the transport services offered by the Municipal

Transport Company in Radom. The company has the fleet of 126 city buses transporting nearly 30 millions of people a year.

3. Quality of services in public transport

Along with the increase of wealthiness and economic development of Poland, the way of perceiving transport services has changed as well.

In the public transport, the observed quality is the result of the combination of the factors connected with the realization of the services (time of the travel, cost of the travel, security etc.) and subjective passengers' experience associated with the travels realized with the use of the same means of transport. Customer satisfaction from the public transport can be defined as the overall level of attainment of the customers' expectations. It was measured as the percentage of the customers' expectations, which have actually been fulfilled (Tyropoulos & Antoniou, 2008).

An increased satisfaction of the customers leads to such behaviors as devotion and attachment, what enables them to establish the relations between them and the services provider (Rehaman & Husnain, 2018).

An observed quality of the provided public transport services and their influence on the environment has an impact on the users' attitude. Inhabitants who assess the quality of the public transport services very well, and who are aware of the influence of the car transport on the environment, have a tendency to use this form of commuting (Borhan et al., 2014).

In order to improve the quality of the public transport services, it is significant to take into consideration the customers' needs and expectations in regard of the transport policy of the city. Conducting periodic researches on the satisfaction among the passengers can have a huge impact on the improvement of the public transport. Getting familiar with their opinions enables us to distinguish current problems connected with functioning of the public transport in the area of agglomeration.

The questionnaires of the customers' satisfaction are very often used during collecting and processing the passengers' opinions to take adequate actions in terms of the improvement of the quality of the services in compliance with the inhabitants' requirements.

In literature, we can distinguish different methods of measuring the quality of the provided services. Some approaches are based on the use of data connected with the customers' satisfaction putting them in a role of one of the crucial determinants used to measure the quality of the services (Eboli & Mazzulla, 2011). Other methods are based on the use of other types of data (e.g. objective rates and standards) (Eboli & Mazzulla, 2010).

In literature, there are different methods determining the quality of the services, some of them were developed especially for the public transport services:

- SERVQUAL (Parasuraman, Zeithaml, & Berry, 1988) – the most known tool which is used to measure the consumers' quality in multi-attribute scales with comprehensiveness of the following five dimensions: tangibility, reliability, responsiveness, assurance and empathy^{15 16}. These 5 measurements are measured with the use of inquiry form including 44 statements on 7-step Likert scale (Fodness & Murray, 2007).

- SERVPERF (Service Performance) created on the basis of SERVQUAL criticism developed by Cronin and Taylor (1994). SERVPERF measures quality as an attitude, not satisfaction. This approach combines customers' satisfaction with further purchase intentions. In contrast with SERVQUAL, SERVPERF includes 22 statements referring to the same measurements as SERVQUAL.

- Public Transportation Excellence Index (PTE-Index) is a model created and implemented in the Turkish cities which is used to support a culture of excellence and improve the quality of the services for the public transport providers, the authorities and the public transport operators (Canitez, 2015).

- Service Quality Index (SQI) is a model developed in order to identify the importance of the attributes of the quality of the services on the customers' satisfaction. This model is dedicated to the specific category of the users of the public transport (university students) (Eboli & Mazzulla, 2008).

- Customer Service Quality Index (CSQI), this approach analyses an actual passengers' experience connected with the use of public transport in order to determine the importance of the preferences for each of the significant attributes defining the quality of the services (Hensher, 2015). These data are used to determine CSQI for every individual user through aggregation, productivity of the services and quality offered by the public transport operators.

It is obvious that there is no common agreement as far as an ideal set of performance indicators for the public transport is concerned because they depend on the local factors connected with the particular city (Pullen, 2007).

Among different methods of measuring the quality of the public transport services, the authors decided to accept the method based on the customer's perspective because of the belief based on the literature of this section that the passengers, as users, are the most appropriate group to be

taken into account when it comes to the assessment of the quality of the transport services and, for this reason, the analysis based on their beliefs and observations allows us to critically look at functioning of the public transport and enables us to improve this service more effectively (Eboli & Mazzulla, 2015).

4. Methodology

The section concerning the methodology of the work includes a description of the research sample and the results of the statistical analyses referring to the connections of the particular variables with the observed satisfaction from the quality of the transport services. As a result of the conducted regression analysis, a certain model was created which explains the satisfaction from using the public transport in Radom.

4.1. Description of the research sample

The aim of the conducted research was a willingness to get familiar with the current passengers' postulates concerning the functioning of the public transport in Radom. Collected information can help the city's ruler make better decisions concerning the transport offer. Later on, it can result in the permanent improvement of the quality of provided transport services. An ultimate set of data used in the following analysis was presented in the following manner. Personal data of the respondents at the age of 18 and more were used for the analysis in order to provide appropriate socio-demographic features (education, income) to carry out the Spearman's rank correlation coefficient for the relation of the socio-demographic variables with the assessment of the public transport in Radom. Subsequently, the only answers that were taken into account, were of the respondents who used the public transport services during the last month.

Such schema of the conducted research allowed us to prepare a reliable profile of the passenger of the public transport in Radom which is essential to carry out the statistical analysis. There was an authorial inquiry form used to conduct the research which was shared online on the discussion groups, Internet forums and websites associated with the city of Radom. The questionnaire was prepared on the basis of literature analysis related to the quality of public transport services, consultations with passengers and brainstorming with stakeholders. The research with the use of online questionnaire was conducted on a sample of N=454 people. 64% of the tested sample were women. Most people were at the age of 18-24 (65%) and 25-34 (23%). The distribution of the education indicated the prevalence of the people with secondary education (45%) and higher

education (23%). Most of the responders studied due to the age groups. The material situation in the tested sample was not good. Most people were with monthly income up to 1500zł (50%).

As the mentioned data indicate, the questionnaire was filled in mainly by young people, working or studying with the higher or secondary education. The high percentage of the students can stem from the online form of sharing the research questionnaire. Young people use the Internet relatively more frequently and they are more active participants of the discussions on the internet forums and social networks.

4.2 Opinions on the public transport in Radom

Respondents, certainly because of their age, declared that they have used the public transport very often (67%) or often (13%). In the early hours, over the 70% of the respondents used the public transport, then in the afternoon and the least in the night hours. Travelling by the public transport usually took 11-20 minutes of the respondents' time (45%) or 21-30 minutes (33%). On a 10-point scale, respondents assessed their satisfaction from the travels by the public transport rather for 3-4 points (46%). In terms of travel frequency 35% of the respondents were convinced of the fact that the hours of the travels by means of public transport are inappropriate and 30% of them did not have an opinion concerning the subject matter.

Figure 1. *Distribution of the satisfaction from the travels*

The respondents most often used the public transport in order to get to the university or school as well as get to work and, then, to socialize and

go shopping. 32% of the responders did not use night-time transport and the remaining ones assessed it rather badly or very badly. 36% of the respondents had their own cars. The half of the respondents did not have an opinion concerning adjusting the public transport to the needs of the disabled people and the rest of them usually assessed it well. The respondents most often looked for the information about the timetable on the website, then, on the boards on the bus stops and by means of the application for the phones.

Figure 2. *Assessment of the frequency of shuttling and the accessibility to the needs of the disabled people*

The most common reasons of choosing the public transport included the bus stops accessibility, the time of the ride and the ticket price. As far as rarer reasons as concerned, the respondents chose the public transport because of the lack of their own cars or because of the other possible opportunity to travel. The frequency of shuttling of the buses, the punctuality of the rides and the ticket price were the worst rated.

Figure 3. *Assessment of the transport features*

The respondents most often used one-time and monthly tickets, rarer – tickets from the electronic purse and 30-day personal tickets. The respondents usually assess the transport lines in Radom for 3-4 points (42% and 37%) on the 5-point scale. 52% of them observed the changes for the better in the public transport in Radom over the last 5 years and 42% of them did not notice any changes. The respondents who were tested the most often noticed the changes in the look and class of the buses, ticket prices, time of the ride and frequency of shuttling, also in the night hours.

4.3 *The relation between the ratings and the opinion on the public transport in Radom*

One of the aims of the research was to check if the opinion on the public transport in Radom depended on the respondents' sex, age and material standing. In the first instance, the analysis of the Spearman's rank correlation was carried out for the quantitative and ordinal variables. The variable assessment of the transport features can be understood as the average of the assessment of: ticket price, frequency of shuttling of the buses, punctuality of the rides, accessibility of the bus stops and time of the rides. The rating was created and used because these positions correlated with one another strongly and were the part of one question.

The analyses proved that the satisfaction from the rides was statistically significantly connected with the age $\rho=-0,20$; $p<0,001$, the education $\rho=-0,12$; $p<0,05$, and the income $\rho=-0,17$; $p<0,01$. These

relations were negative which means that, with the increase of age, education level and income, the respondents' satisfaction from the rides by the urban means of transport was decreasing. The satisfaction from the travels was also negatively related to the frequency of these travels $\rho=-0,14$; $p<0,01$. The respondents who travelled more often were less satisfied from these travels.

The further analysis showed that the assessment of the frequency of shuttling of night bus lines was statistically significantly related to the education $\rho=-0,16$; $p<0,01$ and the frequency of the travels $\rho=-0,12$; $p<0,05$. In the tested sample, the assessment of the frequency of shuttling of night bus lines was decreasing with the increase of the education level. Also, people travelling more often assessed the frequency of shuttling of night bus lines worse.

The total rating of the transport features, such as ticket prices, frequency of shuttling of the buses, punctuality of the rides, accessibility of the bus stops and time of the rides, was connected with the income $\rho=-0,10$; $p<0,05$ and the frequency of shuttling $\rho=-0,15$; $p<0,01$. The respondents with the higher income as well as the ones travelling more often by the public transport in Radom assessed its features worse.

The analysis of the Spearman's rank correlation also proved that the assessment of the route of the bus lines was related to the frequency of the travels $\rho=-0,16$; $p<0,01$. The respondents who travelled by the public transport more often assessed the route of its lines worse.

Table 1. Results of the analysis of correlation of Rho Spearman for the relation between the socio-demographic variables and the assessment of the public transport in Radom

	Satisfaction from the rides	Assessment of the frequency of shuttling of night-time bus lines	Assessment of the accessibility for the disabled	Assessment of the transport features	Assessment of the route of the bus lines
Age	-0,20***	0,02	-0,04	-0,02	-0,05
Education	-0,12*	-0,16**	-0,04	-0,08	-0,03
Income	-0,17**	0,00	-0,06	-0,10*	-0,10
Time of the rides	-0,02	0,05	0,09	-0,02	-0,02
Frequency of the rides	-0,14**	-0,12*	-0,02	-0,15**	-0,16**

* $p<0,05$; ** $p<0,01$; *** $p<0,001$

The subsequent analysis was carried out for the relation between the sex and the assessment of the transport. The comparisons were made with the use of the set of U Mann Whitney tests. The analyses proved that the sex had, actually, statistically an impact on the assessment of the accessibility of the public transport for the disabled $Z=-2,65$; $p<0,01$. Men assessed the accessibility of the public transport in Radom for the disabled better than women did ($M=2,78$; $SD=0,87$ vs. $M=2,53$; $SD=0,74$). It was not proved that the sex influences the remaining aspects of the assessment of the public transport in Radom.

Table 2. Results of the analysis with the use of U Mann Whitney tests for the relation between the sex and the assessment and satisfaction from using the public transport

	Women		Men		Z	p
	M	SD	M	SD		
Satisfaction from the rides	4,0	2,1	4,0	2,1	-	0,53
	0	2	9	4	0,61	9
Assessment of the frequency of shuttling of night-time bus lines	1,9	0,8	1,9	0,8	-	0,97
	1	1	1	1	0,03	7
Assessment of the accessibility for the disabled	2,5	0,7	2,7	0,8	-	0,00
	3	4	8	7	2,65	8
Assessment of the transport features	3,4	0,6	3,3	0,7	-	0,76
	2	4	7	9	0,30	5
Assessment of the route of the bus lines	3,3	0,8	3,1	1,0	-	0,32
	0	2	6	6	0,98	6

M- medium, SD- standard departure, Z- factor of U Mann- Whitney, p- level of statistical significance

It was also tested whether the sex had an impact on the assessment of the hours of the rides, the purpose of using the transport and the noticing of the changes in the level of public transport in Radom over the last 5 years. The analysis was carried out with the use of the set of Chi- square tests of independence. The results are presented in the table below.

The analysis with the use of Chi- square tests of independence proved that the sex did influence the purpose of using the public transport $\chi^2(2)=5,87$; $p=0,053$; $V=0,12$ (the result on the line of the statistical tendency) and the noticing of the changes in the public transport over the last 5 years $\chi^2(2)=17,02$; $p<0,001$; $V=0,20$. Women used the public transport with the aim of going to some Social meetings or going shopping more often than men did. In the tested group, men more often noticed the changes in the transport in favor over the last 5 years and women the most often admitted that they had not noticed any changes.

Table 3. Results of the analysis with the use of Chi- square tests of independence for the relation between the sex and the assessment of the hours of the rides, the purpose of using the public transport and the noticing the changes in the level of public transport

		χ^2	df	p	V
Sex	Are the hours of the travels by means of public transport suitable?	4,36	2	0,113	0,10
	Purpose of using	5,87	2	0,053	0,12
	Have you noticed any changes in the public transport in Radom over the last 5 years?	17,02	2	0,000	0,20

χ^2 - Chi- square factor, df- number of degrees of freedom, p- level of statistical significance, V- power of V Cramer effect

The subsequent analysis was carried out in order to research whether the respondents' professional status influenced the assessment of the public transport. To achieve this goal, the analysis with the use of Kruskal- Wallis test was conducted. Indeed, this analysis brought statistically significant results for the satisfaction from the travels $\chi^2(3)=35,01$; $p<0,001$. The lowest satisfaction from the travels occurred in the group of seniors, disability pensioners and the unemployed ($M=2,56$; $SD=1,26$), then, in the group of the employed ($M=3,58$; $SD=2,11$) and the highest satisfaction occurred in the group of students ($M=4,49$; $SD=2,10$). It was not proved that the professional status influences the remaining aspects of the assessment of the public transport in Radom.

Table 4. Results of the analysis with the use of Kruskal- Wallis tests for the relation between the professional status and the assessment and satisfaction from using the public transport

Professional status	Student		University student		The employed		Other		χ^2	df	p
	M	SD	M	SD	M	SD	M	SD			
Satisfaction from the rides	4,49	2,10	4,39	2,09	3,58	2,11	2,56	1,26	35,01	3	0,000
Assessment of the frequency of shuttling of night-time bus lines	1,92	0,75	1,89	0,76	1,89	0,88	2,13	0,92	1,22	3	0,747
Assessment of the accessibility for the disabled	2,66	0,77	2,72	0,63	2,60	0,88	2,15	0,99	4,76	3	0,190
Assessment of the transport features	3,42	0,58	3,42	0,71	3,36	0,74	3,38	0,86	1,46	3	0,692

Assessment of the route of the bus lines	3,29	0,84	3,37	0,85	3,16	0,99	2,96	1,07	4,65	3	0,200
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M- medium, SD- standard departure, χ^2 - Kruskal- Wallis factor, df- number of degrees of freedom, p- level of statistical significance

With the use of the set of U Mann- Whitney tests, it was verified whether owning a car influenced the assessment of particular aspects of the public transport in Radom. The results proved to be statistically insignificant what means that owning a car did not influence the assessment of the transport in the tested group.

Table 5. Results of the analysis with the use of U Mann- Whitney tests for the relation between owning a car and the assessment and satisfaction from using the public transport

	People who do not own a car		Car owners		Z	p
	M	SD	M	SD		
Satisfaction from the rides	4,07	2,09	3,96	2,20	-0,55	0,581
Assessment of the frequency of shuttling of night-time bus lines	1,92	0,79	1,89	0,84	-0,53	0,595
Assessment of the accessibility for the disabled	2,60	0,76	2,67	0,86	-0,78	0,438
Assessment of the transport features	3,40	0,66	3,40	0,75	-0,03	0,976
Assessment of the route of the bus lines	3,26	0,90	3,24	0,94	-0,29	0,768

M- medium, SD- standard departure, Z- U Mann- Whitney factor, p- level of statistical significance

What is more, the research was conducted in order to prove whether owning a car influenced the assessment of the hours of the travels, the purpose of using the public transport and noticing the changes in the level of the public transport in Radom over the last 5 years. The analyses were carried out with the use of the set of Chi- square tests of independence. The results are presented in the table below.

Table 6. Results of the analysis with the use of Chi- square test of independence for the relation between owning a car and the assessment of the hours of the rides, the purpose of using the public transport and noticing the changes in the level of the public transport

		χ^2	df	p	V
Owning a car	Are the hours of the travels by means of public transport suitable?	1,58	2	0,453	0,06
	Purpose of using	53,79	2	0,000	0,35
	Have you noticed any changes in the public transport in Radom over the last 5 years?	0,23	2	0,894	0,02

χ^2 - Chi- square factor, df- number of degrees of freedom, p- level of statistical significance, V- power of V Cramer effect

The analyses with the use of Chi- square tests of independence proved that owning a car influenced the purpose of using the public transport $\chi^2(2)=53,79$; $p<0,001$; $V=0,35$. Car owners used the public transport in Radom the most often in order to get to some Social meetings or, what is interesting, get to work. The respondents who did not own a car used the public transport the most often to get to school.

4.4. The relation between particular aspects of the assessment of the public transport

It was also verified how the particular aspects of the assessment of the public transport in Radom were related with one another. The further Kruskal- Wallis tests indicated that the assessment of adjusting the hours of the rides was statistically significantly related to the remaining variables assessing the transport features (results statistically significant). The strongest relation occurred in case of the assessment of the timetable and the total assessment of the transport features, such as ticket prices, frequency of the buses shuttling, punctuality of the rides, accessibility of the bus stops and time of the rides.

Table 7. Results of the analysis with the use of Kruskal- Wallis tests for the relation between the assessment of the hours of the rides and the assessment and satisfaction from using the public transport

Are the hours of the travels by means of public transport suitable?	No		Hard to say		Yes		χ^2	df	p
	M	SD	M	SD	M	SD			
Satisfaction from the rides	3,1 8	1,7 6	4,3 6	2,1 4	4,5 9	2,1 5	42,74	2	0,00 0
Assessment of the frequency of shuttling of night-time bus lines	1,5 2	0,6 2	1,9 1	0,6 6	2,4 6	0,8 2	73,00	2	0,00 0
Assessment of the accessibility for the disabled	2,4 3	0,8 5	2,6 2	0,7 0	2,8 4	0,7 7	11,56	2	0,00 3
Assessment of the transport features	3,0 6	0,7 3	3,3 8	0,5 2	3,7 8	0,5 7	89,60	2	0,00 0
Assessment of the route of the bus lines	2,7 9	0,9 5	3,3 1	0,6 8	3,6 6	0,8 2	70,45	2	0,00 0

M- medium, SD- standard departure, χ^2 - Kruskal- Wallis factor, df- number of degrees of freedom, p- level of statistical significance

Moreover, with the use of the set of Kruskal- Wallis tests, there was a research conducted to show whether the purposes of travelling by the public transport the respondents listed the most often influenced the assessment of the transport. This analysis proved that the purpose of the travels diversifies the assessment of the satisfaction from the travels $\chi^2(2)=22,73$; $p<0,001$. People commuting to work ($M=3,31$; $SD=1,94$) assessed the satisfaction from the travels worse than the ones commuting to school ($M=4,38$; $SD=2,14$), to Social meetings and other purposes. However, there was not proved that the purpose of using the public transport influences its remaining aspects.

Table 8. Results of the analysis with the use of Kruskal- Wallis tests for the relation between the purpose of using the public transport and the assessment and satisfaction from using the public transport

Purpose of using	Commuting to school		Commuting to work		Social meetings		χ^2	df	p
	M	SD	M	SD	M	SD			
Satisfaction from the rides	4,3 8	2,14	3,3 1	1,9 4	4,06	2,1 2	22,73	2	0,000
Assessment of the frequency of shuttling of night-time bus lines	1,9 1	0,76	1,9 3	0,8 9	1,91	0,8 4	0,03	2	0,985

Assessment of the accessibility for the disabled	2,6 9	0,74	2,6 1	0,8 2	2,53	0,8 8	0,98	2	0,614
Assessment of the transport features	3,4 1	0,69	3,3 5	0,7 2	3,46	0,6 2	1,83	2	0,400
Assessment of the route of the bus lines	3,2 8	0,88	3,1 6	1,0 0	3,32	0,8 6	2,04	2	0,361

M- medium, SD- standard departure, χ^2 - Kruskal- Wallis factor, df- number of degrees of freedom, p- level of statistical significance

The respondents also assessed whether they had noticed any changes in the public transport over the last 5 years. Kruskal- Wallis tests indicated that the assessment of the changes in the public transport over the last 5 years was statistically significantly related to the remaining variables assessing the transport features (results statistically significant). The strongest relation was indicated in case of the changes and the assessment of the route of the bus lines. Therefore, it may mean that the most changes were made in this aspect, indeed.

Table 9. Results of the analysis with the use of Kruskal- Wallis tests for the relation between the changes in the public transport and the assessment and satisfaction from using the public transport

Changes in the public transport	On the minus side		No changes		On the plus side		χ^2	df	p
	M	SD	M	SD	M	SD			
Satisfaction from the rides	2,0 4	1,1 1	3,6 1	1,8 3	4,61	2,2 2	49,99	2	0,000
Assessment of the frequency of shuttling of night-time bus lines	1,2 6	0,5 6	1,8 0	0,7 2	2,09	0,8 4	22,53	2	0,000
Assessment of the accessibility for the disabled	1,8 1	0,8 7	2,4 8	0,7 7	2,85	0,6 9	31,15	2	0,000
Assessment of the transport features	2,4 7	0,8 6	3,2 7	0,6 4	3,60	0,5 9	53,11	2	0,000
Assessment of the route of the bus lines	1,9 2	0,8 9	3,0 8	0,8 4	3,54	0,8 0	72,25	2	0,000

M- medium, SD- standard departure, χ^2 - Kruskal- Wallis factor, df- number of degrees of freedom, p- level of statistical significance

The subsequent analysis tested the correlations between particular scales of satisfaction and assessment of the public transport. The analysis of Spearman's rank correlation proved that, statistically, significant correlation occurred between all the analysed variables. The strongest relation was

indicated between the assessment of the transport features and the assessment of the route of the bus lines $\rho=0,60$; $p<0,001$.

Table 10. Results of the analysis of correlation of Rho Spearman for the relation of particular aspects of the assessment of the public transport in Radom

	Satisfaction from the rides	Assessment of the frequency of shuttling of night-time bus lines	Assessment of the accessibility for the disabled	Assessment of the transport features	Assessment of the route of the bus lines
Satisfaction from the rides	1				
Assessment of the frequency of shuttling of night-time bus lines	0,32***	1			
Assessment of the accessibility for the disabled	0,48***	0,35***	1		
Assessment of the transport features	0,50***	0,44***	0,46***	1	
Assessment of the route of the bus lines	0,53***	0,44***	0,40***	0,60***	1

** $p<0,01$; *** $p<0,001$

The analysis of regression was carried out in order to complete the correlation. The satisfaction from the rides was chosen as the dependent variable because it is the most subjective assessment and the assessment of particular components of the public transport may have influenced it. The method of backward elimination was chosen as the major method because of the willingness to distinguish the maximum quantity of the variables explaining the satisfaction from the rides.

The model including all the variables turned to be statistically significant $F(4,164)=34,92$; $p<0,001$; $R^2=0,46$. The variable of the frequency of shuttling of the night-time bus lines, which turned out to be statistically insignificant $t=-0,51$; $p=0,611$; $\beta=-0,04$, was removed after the elimination. The new model also proved to be statistically insignificant $F(3,165)=46,69$; $p<0,001$; $R^2=0,46$. The change of the determination coefficient R^2 was not statistically significant $F(1,166)=0,26$; $p=0,611$. The variability in terms of the satisfaction from the rides was being explained in 46% by the variability of predictors located in the model.

Eventually, the statistically significant level of the satisfaction from the rides was influenced by the assessment of the accessibility for the disabled $t=4,15$; $p<0,001$; $\beta=0,28$, the assessment of the transport features $t=1,92$; $p=0,056$; $\beta=0,17$ (the result on the line of statistical tendency) and

the assessment of the route of the transport lines $t=4,61$; $p<0,001$; $\beta=0,38$. The strongest predictor of the satisfaction from the rides was the assessment of the route of the bus lines. The predictive model can be presented with the use of the following formula:

$$\text{Satisfaction} = -1,69 + 0,71 \cdot x_1 + 0,42 \cdot x_2 + 0,74 \cdot x_3$$

where x_1 – the assessment of the accessibility of the public transport for the disabled, x_2 – the assessment of the transport features, x_3 – the assessment of the route of the transport lines. The standardized factors can be understood in the following way: along with an increase of x_1 variable by 1 unit (here 1 point on the 5-point scale), the satisfaction from the rides was increasing by respectively $B=0,71$, $B=0,42$ or $B=0,74$ at a constant value of the remaining variables.

Table 11. Results of the analysis of regression
(dependent variable: satisfaction from the rides)

	<i>F</i>	<i>df1</i>	<i>df2</i>	<i>P</i>	<i>R</i> ²
Model 1	34,92	4	164	0,000	0,46
Model 2	46,69	3	165	0,000	0,46

F- anova statistics, df- number of degrees of freedom, p- level of statistical significance, R²- determination coefficient

Table 12. Factors of the analysis of regression (dependent variable: satisfaction from the rides).

		<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	<i>VIF</i>
Model 1	(Constant)	-1,70	0,52		-3,29	0,001	
	Assessment of the frequency of shuttling of night-time bus lines	-0,09	0,18	-0,04	-0,51	0,611	1,59
	Assessment of the accessibility for the disabled	0,72	0,17	0,28	4,17	0,000	1,35
	Assessment of the transport features	0,46	0,23	0,18	1,99	0,049	2,54
	Assessment of the route of the bus lines	0,76	0,17	0,39	4,60	0,000	2,13
Model 2	(Constant)	-1,69	0,52		-3,28	0,001	
	Assessment of the accessibility for the disabled	0,71	0,17	0,28	4,15	0,000	1,34
	Assessment of the transport features	0,42	0,22	0,17	1,92	0,056	2,35
	Assessment of the route of the bus lines	0,74	0,16	0,38	4,61	0,000	2,03

B- non-standardized factor, SE- standard error, β - standardized factor, t- t Student statistics, df- number of degrees of freedom, p- level of statistical significance, VIF- collinear factor

Figure 4. Model explaining the satisfaction from the rides.

5. Conclusions

The main goal of the following article was to analyse the observed satisfaction from the quality of the public transport services offered by the city of Radom. Deciding to carry out the analysis of functioning the public transport in Radom was also caused by the willingness of getting familiar with the key postulates of the passengers connected with the opportunity to improve the quality of the provided public transport services.

The observed quality of the services differed significantly depending on the socio-demographic features of the respondents. It may suggest that the inhabitants, being in different phases of their lives, present characteristic attitudes concerning the observed quality of the services. Understanding and arranging how these differences are formed can turned out to be helpful to optimize the management of the public transport. The results of the presented analysis indicate that, with age, the level of the satisfaction from the public transport decreases. It may suggest that the transport in Radom does not meet the needs of the old people and the transport policy should concentrate on the people being in advanced age in order to improve the observed quality of the services.

The observed satisfaction from the public transport also differs depending on the respondent's sex. The results of the conducted analyses

indicate that women have a tendency to assess the quality of the public transport services more negatively than men do. The Scottish researchers got the similar results (Morton, Caulfield, & Anable, 2016). These implications require a more detailed analysis of the female passengers' needs to determine in what way one can meet their requirements and increase their satisfaction from the rides by the public transport.

As a result of the conducted analysis of regression, a model was created which aims at explaining what the inhabitants' observed satisfaction from the public transport services in Radom consists of. It was indicated that the assessment of the accessibility of the public transport for the disabled, the public transport features (ticket price, frequency of shuttling, punctuality of the arrivals, accessibility of the bus stops, time of the rides) and the route of the bus lines influence the level of the observed satisfaction from the rides the most.

The strongest predictor of the satisfaction from the rides by the public transport was the assessment of the route of the bus lines. Interpreting these results, it can be indicated that, in order to improve the satisfaction of the current customers, it is necessary to focus primarily on increasing the frequency of the services and improving their reliability and punctuality. The efforts of the city rulers should also concentrate on the improvement of the accessibility of the public transport for the people with the limited ability of moving.

The analysis presented in the following publication also provides the practical implications. The results of our research can be useful for the urban decision-makers and stakeholders in order to adjust the public transport services to the key postulates of the passengers.

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