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Parametric Approach to the Assessment of Service Quality Attributes of Municipal Passenger Transport in Moscow

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Abstract

The paper presents the results of research of passenger transport services in the city of Moscow by public transport. The research method is based on assessing the quality by using "Mystery Shopper" observation method. The peculiarity of the method involves the use of parametric indices outlined by researchers and affecting quality of the provided transportation service. These parameters include cleanliness, ticket-selling speed, presence of cellular signal, etc. The obtained results demonstrate that, given the existing features of automatic vending machines, they still cannot completely replace traditional ticket offices. The results of the research demonstrate that the applied method does not allow relating the presence of a particular inspected parameter to service quality perception by consumers. The researchers see the future direction of their work on the revision of the applied methodology in the part for calculation the level of satisfaction, for example, based on a special index. In particular, inclusion of the parameters of perceived quality, use of a multi-stage or stratified sampling to improve the representativeness of the research results, use of frequency measurement - 4 times per year to account for the seasonality factor.

Keywords: marketing, public transport, Moscow, parameters, quality of services, consumer satisfaction

1. Introduction

Public transport plays an important, strategic role in the life of modern cities. The system of municipal public transport is constantly changing because of technological change, and because of development and changes in urban spaces under the influence of changing social demands and standards of living.

Liberalisation processes have not yet affected the sphere of municipal public transport in Moscow. The main monopoly in this area belongs to state unitary enterprises and joint stock companies. Private companies offering bus services are no significant competition to the monopolists. At the same time, the administration of the city needs to alleviate the problem of traffic congestion, which is mainly provided by private cars. Finding ways to solve this problem, force the Department of Transport and Road Infrastructure of the city of Moscow to pay closer attention to their customers in order to increase customer loyalty and demand for transportation of municipal public transport. At the meeting of the Board of the Department of Transport and Road Infrastructure of the city of Moscow on February 28, 2013, a presentation was given by the Deputy Mayor of Moscow, the head of the Department of Transport and Road Infrastructure of the city of Moscow Maxim Liksutov. In particular, he said: "The results of our work will become not just kilometres of roads and highways, but also the degree of satisfaction of inhabitants of our city. This is the high standard we set for us"- and thus he stressed the importance for the Government of the city of developing not only infrastructure, but also the positive perception of the changes by the passengers.

Providing quality services for passengers and for good price may attract (Efimova, 2013) some of those passengers who tend to use private transport because of its convenience and fast speed (Redman, et al., 2013; Pascu, 2011). Thus, it will lead to a significant development of both economy and ecology and social environment. Improvements in the economy will contribute to the provision of additional funds for

modernisation of the transport system including by the cost of attracting investors (Zuev and Efimova, 2014; Friman, M., 2004)

The present research describes the results of the inspection of municipal aboveground (buses, trolley buses, and trams) and underground (metro) passenger transport and is aimed at analysing the parametric indicators of perceived quality of public transport services in the city of Moscow.

2. Literature Review

Research of a number of scientists demonstrates that "public transportation as a functional system for meeting important public needs forms a special sphere of social and cultural relations with its spatial and temporal boundaries, determined by a complex role expectations and values learned". (Sorokina, 2009)

The starting point of our research shall be the directions guiding the behaviour of existing consumers of municipal public transport services and those who prefer using private transport. On the one hand, it shall be noted that consumers' value expectations of public transport services are connected to its ability to provide the most reliable (performing) and cost-effective transport services (Costa, et al., 2012; Nevrela, 2008). At the same time, this area forms a specific area of social and cultural relations with its spatial and temporal boundaries, determined by a complex role expectations and values learned (Sorokina, 2009). Marketing in Russia was used since the times of the Soviet Union (Fox et al., 2008; Sidorchuk, 2010). The experience of researchers suggests that in Russia, these values are still defined by owning a private car as an element of "luxury" rather than as a means of transportation (Bondarchouk, et al., 2010). In this regard, one can assume that the role of the additional transportation service attributes raises. Indeed, some researches have shown that enhanced positive perception of public transport can help users transition from the private car to public transport mode (Steg, 2003). Such factors as perception of service quality and customer satisfaction have been found (Webb, 2010) deeply affected by the degree of loyalty to public transport.

It is necessary to take into account the peculiarities of assessing the quality of services, which are as follows:

- it is more difficult for consumers to determine the quality of services rather than the quality of goods;
- services quality is the result of the comparison of consumer expectations and the actual service level;
- assessing services quality occurs both based on the received result and on the process of providing services.

In many cases, the perceptual quality differs from the services quality received. The difference between the perceived and the received services quality depends on the experience of the passengers using the transport service, as well as cultural and social environment of the consumer transport services (Gordon, 1989, Takyi, 1995). In addition, we shall in mind that the quality of transport services covers not only service quality in transport terminals and vehicles, but also the comfort of passengers during trips (Stopher P. & Jones, 2003).

In this context, satisfaction with the work of public passenger transport operators is determined by services quality provided based on its assessment by the passengers (Anastase, 2012). At that, the perception of quality is subjective and based on the lifestyle of consumers and transport behaviour. (Dragu 2004, James, 2001, Raicu & Dragu, 2012).

Among the attributes associated with total customers satisfaction, there is often punctuality / reliability of services (König, 2002), the quality of the information provided by both stops and using interactive tools (Internet, mail), responsiveness and helpfulness of the staff (Eboli and Mazzulla, 2007; 2009).

At the same time, as noted in some researches (Friman and Felleson, 2009), service quality is not always relevant to consumer satisfaction. There is a possibility that improving the quality of services provided, dissatisfaction will increase.

It is also necessary to note that according to the researchers there is a relative ambiguity on the issue of perceived quality and customer satisfaction with public transport services. In particular, this problem manifests itself in the choice of attributes for satisfaction assessment (Khurshid, et al., 2012). In our opinion, this choice is related to the level of market development of public transport services and features of the socio-cultural space reflecting the value systems of consumers (Takyi, 1995). Less developed markets are marked with the relevance of basic quality parameters including those measured objectively (waiting time, availability of shelter at bus stops, etc.). The higher the level of market development the greater the role of intangible, subjectively estimated parameters (e.g., responsiveness and helpfulness of the staff).

3. Methodology

This research is the first stage in the Moscow municipal public transport services quality research.

The method for this stage is the parametric method, which is the most objective among other methods. The method for data collection is observation.

The research objects are the services by aboveground public transport (buses, trams, trolleybuses) and the metro.

The parameter (index) refers to the quantitative properties of the research object. Each service has a defined set of parameters to be objectively measured.

Five groups of aboveground public transport services were allocated:

1. navigation during a trip by above-ground municipal passenger transport,
2. cleanliness in the passenger compartments of above-ground municipal passenger transport,
3. Wi-Fi quality in on above-ground municipal passenger transport,
4. navigation at the stops of above-ground municipal passenger transport,
5. state of the stops of aboveground municipal passenger transport.

Assessment of the metro service quality was made under the four groups of parameters:

1. speed of tickets selling at ticket offices and vending machines at the metro stations,
2. cleanliness in the metro halls and cars,
3. air conditioning in the metro cars,
4. quality of mobile and internet connection in the metro.

Detailed parameters can be found in Table 1.

The most of the parameters are qualitative in nature: we noted either availability or absence of certain properties under the nominal (dichotomous) scale. For example, the availability of roadmaps in the passenger compartment, graffiti at bus stops, etc.

In some cases, the ordinal scale is used to measure the gradation of a parameter (for example, the number of leaflets at bus stops or operation of an electronic display). A number of parameters are measured quantitatively under the absolute scale. For example, the number of working ticket offices, time spent for ticket purchase at ticket offices or vending machines. Thus, it is possible to measure objectively those parameters directly controlled by the service providers and improvement of which can be fixed with regular monitoring.

Table 1. Parameters of aboveground public transport services

Parameter	Parameter values
Navigation during a trip by above-ground municipal passenger transport	
availability of roadmaps	yes/no
comfort of roadmap using: an opportunity to step up and take advantage of	yes/no
availability and convenience of voice announcements: announcements at each stop	yes/no
availability of an electronic display	the display is available and correctly shows stops/the display is available, but does not show stops/the display is not available
Wi-Fi quality in on above-ground municipal passenger transport,	
availability of free wireless access	yes/no/access closed
Cleanliness in the passenger compartments of above-ground municipal passenger transport	
cleanliness in the passenger compartment	"No litter and dirt" / "There is some litter or dirt" / "A lot of litter and dirt"

quantity of leaflets with ads, rules, information	"No or almost no leaflets" / "There is some number of leaflets" / "Too many leaflets"
Navigation at the stops of above-ground municipal passenger transport	
availability of route descriptions with a complete list of stops	the stop has a glass for placing information and has information on all routes/stops have glasses for placing information, but no information on all of the routes/the stop has no glass
Electronic information display	working/not working/absent
City orientation maps	yes/no
State of the stops of above-ground municipal passenger transport	
cleanliness at the bus stop and in litter boxes	
presence of graffiti	yes/no
necessity of repair of any of the elements at the stop	yes/no
waiting rooms availability	yes/no
hardscaping availability	yes/no
accessibility	yes/no

The present research was conducted in the period from 23 June to 11 July 2014. The geography of the research is the city of Moscow.

Two samples were formed for the research: for observation in the metro and aboveground public transport. The sample size for the metro services assessment amounted to 304 metro cars at 53 metro stations. Selection method is quota-based. The size of the quota was set by the Department of Transport and Development of Road Transport Infrastructure of the city of Moscow based on the load of the metro lines and the rolling stock differences, allowing inspection of stations with varying workload and of different cars types.

The sample size for assessment of aboveground public transport services amounted to 1003 vehicles, including 852 buses (including 1 half-express), 36 trams, 114 trolleybuses at 134 public transport routes. All the stops were inspected on these routes. Routes selection method is quota-based. The size of the quota was set by the Department of Transport and Development of Road Transport Infrastructure of the city of Moscow based on the share of each mode of transport (bus, tram, trolleybus) in the total number of routes, length, and geography of routes.

Limitations of the research. The main limitations are set by selecting the units of observation, i.e. quota-based. Despite the fact that this method gives results similar to the selection probability, it is not possible to assess the statistical error margin of the research. In further assessments, this limitation can be overcome by using a multi-stage or stratified sampling, which will enhance the representativeness of the research results.

Another limitation is the single measurement of parameters, without regard to the seasonality factor.

4. Results

4.1 The Research of Services Quality Attributes for Transporting Passengers of the Moscow Metro

Cars, hall, ticket offices, and ticket vending machines in the Moscow metro were selected as the observation objects for the research.

The inspected service quality parameters were as follows: tickets selling speed, cleanliness, availability of 3G and Wi-Fi connection, and air conditioning.

It shall be noted that each observation unit had individually set parameters of quality reflected in the special data collection forms.

Comparison of metro tickets selling speed at ticket offices and by ticket vending machines.

As we can see in Figure 1 at the time of the research, absolutely all the ticket offices worked only at the inspected stations of the Kalininskaya line (100%).

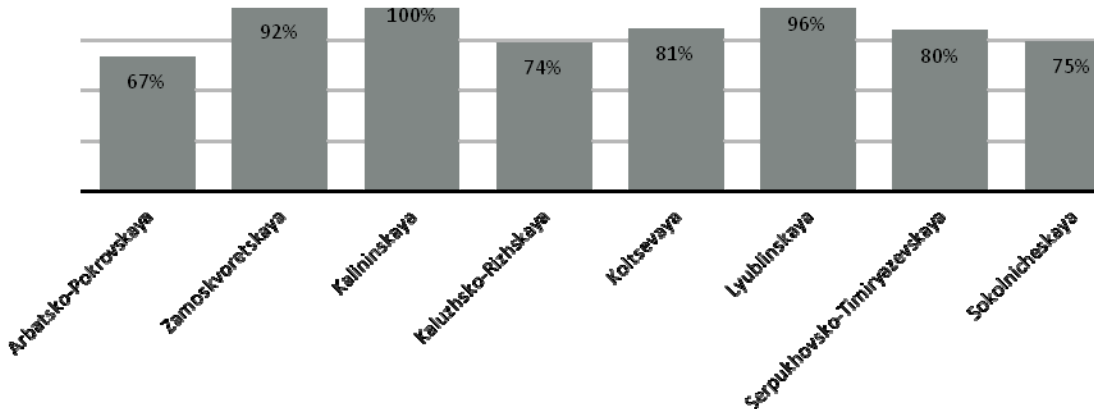

Figure 1. The number of working metro ticket offices

The least quantity of working ticket offices is observed at stations of Arbatsko-Pokrovskaya line (67%) and Sokolnicheskaya line (75%). At that, there were stations at those lines where only half of the ticket offices were working; these are Kievskaya, Semyonovskaya, and Yugo-Zapadnaya stations.

The average speed of ticket purchase at a ticket office at the inspected stations constitutes 1 minute 49 seconds.

In addition to ticket offices at the inspected stations, tickets vending machines were inspected as well. The inspected parameters were working/not working state and selling speed. As a result, it was found that one hundred percent of working vending machines at the selected time interval was found at none of the lines (see. Figure 2). On average, the highest number of vending machines was found at stations located at the Kaluga-Riga line on average 97%. The least amount of working vending machines was observed at Arbatsko-Pokrovskaya line (58%), especially at Semyonovskaya (0%) and Smolenskaya (33%) stations.

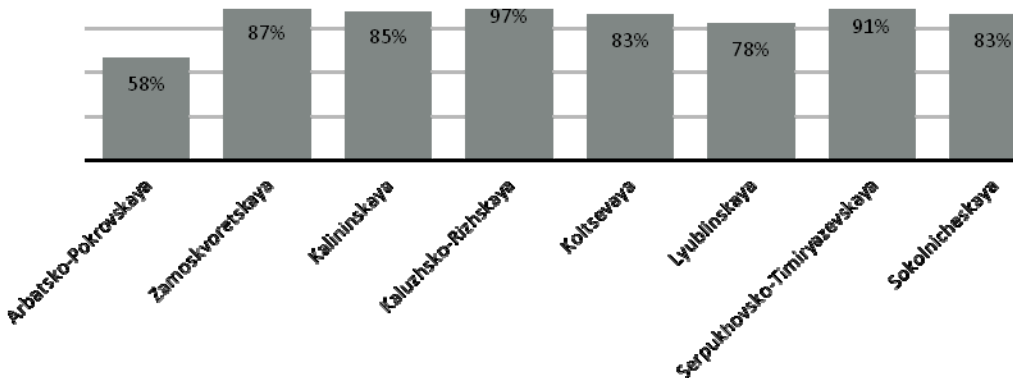

Figure 2. The number of working ticket vending machines

The time spent on the purchase of a ticket in the vending machine constitutes 1 minute 11 seconds.

Thus, the difference between the average speed of ticket selling in a ticket office and a vending machine is 38

seconds.

For the purposes of the further analysis of the difference in metro tickets selling speed in ticket offices and in vending machines, we calculated the statistical mode measure, which revealed the most common average speed of ticket selling. The indicator for ticket offices constituted 1 minute 44 seconds, and for vending machines - 32 seconds. Thus, we can conclude that in terms of mode, vending machines sell tickets usually faster than ticket offices.

Availability of radio signal at metro stations

Radio signal in the research refers to the availability of 3G and Wi-Fi. These connection types are considered available at the metro stations, even if the devices used for measurements demonstrated the minimum signal level.

Measuring devices included cell phones, smart phones, tablet computers supporting receiving of GSM, 3G and Wi-Fi signal.

The research has shown (see Table 1), that the high 3G level is observed at the stations of Koltsevaya line - 30.43% at all inspected metro stations, especially at Paveletskaya landside station (13.04%).

No 3G was found at Sokolncheskaya line.

Table 1. Availability of 3G and Wi-Fi - at the platforms of the Moscow metro

Metro line	The sum of 3G fields (platform)	The sum of Wi-Fi fields (platform)
Arbatsko-Pokrovskaya	4.35%	0.00%
Zamoskvoretskaya	8.70%	7.69%
Kalininskaya	17.39%	7.69%
Kaluzhsko-Rizhskaya	8.70%	7.69%
Koltsevaya	30.43%	30.77%
Lyublinskaya	21.74%	23.08%
Serpukhovsko-Timiryazevskaya	8.70%	0.00%
Sokolnicheskaya	0.00%	23.08%
Grand total	100.00%	100.00%

Wi-Fi was found at the inspected stations of Koltsevaya line - at two of the four inspected stations - Paveletskaya and Prospekt Mira - both have 15.38%, and at all stations of Sokolnicheskaya line (23.08%) and at three of five stations of Lublinskaya line (23.08%).

Cleanliness in the hall at the entrance to the station and on the platform of the metro stations.

Cleanliness inspection was conducted under a 3-point scale where 0 means no litter, 1 - small amount of dirt litter and 2 - a lot of litter.

The only line with a lot of litter is Koltsevaya line, specifically at the entrance to Paveletskaya and Prospekt Mira stations.

The cleanest stations with no observed litter are located at Sokolnicheskaya line. (Table 2)

Table 2. Cleanliness at the entrance to the station and on the platform of the Moscow metro

Line	Litter (entrance to the station)	Litter (hall)	Litter (platform)
Arbatsko-Pokrovskaya	1	1	1
Zamoskvoretskaya	0	1	1
Kalininskaya	1	1	1
Kaluzhsko-Rizhskaya	1	0	1
Koltsevaya	2	1	1
Lyublinskaya	1	1	1
Serpukhovsko-Timiryazevskaya	1	1	0
Sokolnicheskaya	0	0	0
Grand total	7	6	6

The results of metro cars inspection

The cars inspection comprised of the following parameters: working air conditioning, availability of 3G, Wi-Fi, GSM, and cleanliness. Find the inspection results below.

1) Air conditioners. Two hundred eleven cars have working air conditioning, which is only 69% of the sample.

2) 3G, Wi-Fi, GSM

One hundred twenty-two cars (40.13%) have access to 3G.

One hundred sixty cars (54.28%) have access to Wi-Fi.

GSM is available in two hundred fifteen metro cars (70.72%).

3) Cleanliness. The results indicate that at the time of the study 82.2% of the surveyed cars were clean. At that, "a lot of litter" was in five cars (1.6%) and there was some litter in forty-nine cars (16.1%).

4.2 Research of the Passenger Compartments Parameters in the Moscow Passenger Aboveground Transport

Research of the passenger aboveground transport was carried according to the following parameters: cleanliness, passenger data ware: availability of Wi-Fi, voice announcement of stops and presence of electronic displays, as well as the availability of roadmap.

1) Cleanliness. The cleanliness level, similarly to the research carried in the metro, was assessed from 0 to 2.

Litter was not found at 72% of the inspected vehicles: 97 trolleybuses, 8 trams, 1 half-express, and 624 buses. The cleanest passenger vehicles are under the bus route No. 90 (23 vehicles).

The cleanliness level of "a lot of litter" was recorded in 71 buses and 10 trolleybuses. Most often, this level was marked on the bus route No. 171 (26 vehicles).

2) Availability of Wi-Fi was established in 7 buses, 1 half-express and 13 trolleybuses, which is 2% of the total number of the inspected vehicles.

3) Voice announcement of stops. Voice announcement of stops had 91% of buses, 97% of trams, and 90% of trolleybuses.

4) Electronic display. This parameter is absent in 70 buses, 29 trams and 25 trolleybuses (6 of them are trolleybuses under the route No. 65), representing 12% of the total number of inspected vehicles. It was also found that despite of the availability; an electronic display may malfunction, which was observed in 21% of buses and 31% of trolleybuses.

5) Roadmap. Despite the fact that the roadmap of the aboveground transport routes is present in 83% of the vehicles, a passenger not always has the opportunity to use it because of physical inaccessibility (see Table 5 of Annex 2). Thus, it was found that only 78% of the inspected vehicles have the available roadmap.

5. Discussion

When comparing the time of purchase of a metro ticket at the box office or in a ticket vending machine, we can see the obvious advantage in speed of purchase from the vending machine. However, machines do not take banknotes of any value thus restricting passengers.

The results showed that not all vending machines are working, possibly due to the run out supplies, or too much cash was accumulated and encashment is required, or there is other technical malfunction. This fact indicates firstly that additional vending machine servicing staff is required. Secondly, this fact proves the impossibility of selling tickets only through vending machines.

Availability of 3G and Wi-Fi in public transport witnesses that the trip becomes more comfortable, but at the time of the research completion, not all lines, cars, and land vehicles had the proper opportunity to transmit the signals.

We believe that passenger comfort level is characterized primarily by a lack of dirt in all stages of transportation services by public passenger transport. The identified volume of this service quality parameter cannot prove for sure how exactly the fact of their presence affected passenger comfort, and therefore satisfaction, as according to the given methodology this is impossible. The applied methodology does not allow relation of the presence of a particular researched parameter to the perception of the services quality by consumers.

Moreover, the applied methodology does not allow setting the threshold for the service quality parameters for public transport, which limits the direction of our conclusions, since it is not known how much dirt there should be, or how quickly Wi-Fi should work in the metro to make a passenger feel comfort or discomfort during the trip.

6. Conclusion

Our research on the one hand demonstrated that the method of observation called "Mystery Shopper" is valid for the collection of information on the parameters value for quality passenger transport services provided by the city transport, however, significant improvement is required in the methodology used by us, especially in the part for calculations of the satisfaction level, for example, on the basis of a special index.

The authors attribute the directions for the future research with the development of the methodology given in the three directions: 1) the inclusion of perceived quality parameters; 2) the use of a multi-stage procedure or stratified sampling to improve the representativeness of the research results; 3) the frequency of measurements – 4 times per year for seasonality factor consideration.

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