

Proposal of a scale for measuring user satisfaction in the use of public transport in Algiers

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Abstract :

The objective of our research is to contribute to the reflection on the satisfaction of the of public transport users' in the context of the dominance of very small-business. We propose a scale for measuring user satisfaction to improve the governance of public transport. To do this, we have used the data from the results of the household survey on travel and transport that we conducted at the end of 2019 in 38 municipalities in Algiers province. The statistical analysis of the data allowed us to extract a measurement scale of the satisfaction of the user of public transport in the city of Algiers, this scale is composed of three essential elements according to the degree of their importance according to the perception of this user: the elements related to the notion of time, the elements related to the accessibility to the infrastructure and to the information and the elements related to the comfort.

Keywords: satisfaction, measurement scale, public transport.

Jel Classification Codes : L91, M31, R49, R41

Introduction

The role of a public service is not limited to satisfying a general interest but must also meet the expectations of users of this service². The involvement of public transport users in satisfaction surveys is one of the means of control and evaluation

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² Cluzel-Métayer L. (2006), Le service public et l'exigence de qualité, Nouvelle Bibliothèque de thèses, Dalloz.

by the transport organizing authority of compliance with the service standards defined in the specifications for the operation of this service. Following the recommendations of the International Union of Public Transport to make public transport more attractive, the providers and operators of this public service must define a strategy focused on users' expectations and promote a culture of public service excellence¹. This supposes in the first place to know the expectations of the users and to take them into consideration in order to offer a quality service in terms of availability, frequency of passage, comfort within the transport and at the level of reception infrastructures, security, ... etc.

The research carried out in marketing has dealt extensively with the issue of quality of service. Thus, the quality of service is defined as the difference between the user's expectations and the perceived quality of a service used and for which the user has cumulative experience of its use². In our research, the quality of the service offered was measured through the quality perceived by the user according to his cumulative experience of using this service. There are few empirical studies that have addressed the question of user expectations and their satisfaction with public transport services in Algiers. In addition, the last household transport survey conducted in Algiers dates back to 2004. The first public transport user satisfaction survey in Algiers was conducted in 2015³. The authors used the survey of users' satisfaction of three modes of rail transport in Algiers, namely the train (513 respondents), the metro (446 respondents) and the tram (495 respondents). The objective was to guide the authorities on the strategy to be developed to adapt their actions to users' expectations; the emphasis has been placed on accessibility for people with reduced mobility, system and pedestrian safety, and the care of users. Public transport by bus, which covers 80% of users' trips in Algiers, has not been covered in this work, and non-users of public transport were not taken into consideration, to find out the reasons for non-use and improve the quality of service attributes to capture these non-users in the future. In addition, in our survey sample (1704 users of public transport), we took into consideration all public transport, where there are 1267 users of the bus, the metro (222), the tram (174), the train (38) and the cable car (3). Unlike this survey, our survey took place at the homes of the respondents through interviews; the respondent had enough time to answer the question after having fully assimilated the meaning of the question asked. We also took the time to question 955 people who do not use public transport. Our sample is large enough to be able to conduct an analysis and understand users' expectations and assess their satisfaction.

The objective of our research is to assess the governance of public transport services from the bottom, by analyzing the perception and satisfaction, by users, of the different attributes of the quality of the public transport service offer, but above

¹ Union International des Transports Publics [UITP]. (2018), Building a culture of service excellence to develop a public transport business, Action Points. UITP: Brussels.

² Grönroos C. (1984), «A Service Quality Model and its Marketing Implications», *European Journal of Marketing*, vol. 18, n° 4, p. 37-44.

³ Machado-León, J.L., de Oña, R., Baouni, T and de Oña, J. (2017), « Railway transit services in Algiers: priority improvement actions based on users perceptions ». *Transport Policy*, vol. 53, pp. 175-185.

all, to propose a measurement scale for user satisfaction that can be used by academics and the transport organizing authority in the city of Algiers. To do this, we used the data from the results of the household survey on travel and transport that we carried out at the end of 2019, in particular the “use of public transport” sheet. Our research is part of a quality approach, it is an analysis which identifies the attributes of the quality of service offered by public transport which are decisive and defines the criteria which are the most important for the user, finally, to assess users' perceptions of the service received.

In the first part of this research we present a review of the literature on the concept of satisfaction in public services and in public transport in particular. In the second part we will develop the adopted methodology. The results of the quantitative analysis of the survey results are presented in the third part.

1- Theoretical framework and conceptualization of satisfaction

Improving the public transport system has been a constant concern of the authorities, resulting in significant progress. The approach of authorities and public operators (ETUSA and EMA) has mainly focused on supply, furthermore understanding the demand for public transport, represented by user satisfaction has become relevant. Although there are several definitions of the satisfaction of public transport users. According to Mouwen, satisfaction is an emotional response following a service delivery experience¹. This way, the satisfaction can vary between users, and even for different travel situations. For example, a person's expectations for a trip to work are generally related to the aspect of travel time, while for a long trip they may be related to aspects of safety and of comfort. Satisfaction, being an intangible variable, generally measured by surveys. The most common way to measure user satisfaction is to create ordinal scales or use Likert scales.

The literature on the attributes of user satisfaction is rich and the concept of satisfaction has been studied since the 1960s². However, it was not until the 1980s that new studies appeared with more consolidated methodologies which conceived of public transport as a product, but as a service³. These attributes can be quantifiable, such as journey time, wait times and prices, and also non-quantifiable, such as driver behavior and comfort. There is a wide range of attributes of the transport system used to try to understand user satisfaction, which can easily exceed 20 attributes, so these are usually grouped into dimensions. These dimensions are, like the attributes, very variable, and their definition depends on the analyzed context. Although there are “lists” of generic attributes to be incorporated into satisfaction surveys, these are usually only references and researchers define both attributes and dimensions depending on the case study.

¹ Mouwen, A. (2015), «Drivers of customer satisfaction with public transport services». Transportation Research Part A : Policy and Practice, Vol, 78, pp. 1–20.

² Lewis, D. L. (1983), The automobile and American culture, University of Michigan Press.

³ Lewis, D. L. (1983), The automobile and American culture, University of Michigan Press.

The literature review shows that there are certain characteristics of transport which are generally relevant in most cases; these include reliability, punctuality and frequency¹ and other intangible variables such as staff treatment, information and security².

In addition, the majority of studies on the satisfaction of public transport users focus on the bus, probably because the authorities would benefit if the number of bus passengers increases, as it is a relatively inexpensive mode, we cite the three main studies as follows:

Morfoulaki designed and conducted a satisfaction survey defining 20 relevant attributes. The analysis indicates that the most important variables are frequency, regularity, payment system and safety at stops³. However, Greene and Hensher conducted a user preference survey to measure satisfaction with Tyne and Wear buses in England, using 17 service attributes. The model used for the analysis was a generalized ordinal logit, which showed that frequency and safety are the most important factors for users⁴. The Wana team studied the satisfaction of users of a BRT system in New York through systems of structural equations. The model is based on survey results which include 13 attributes measured on a scale of 1 to 5 and general satisfaction measured on a scale of 1 to 10⁵.

2- Methodology

2.1. Data collection

The data used in this research are taken from the “use of public transport” sheet of the household survey questionnaire on travel and transport. In this survey, we were able to interview people who use public means of transport, but also those who do not use them. The questionnaire was administered to respondents in November and December 2019 in 38 municipalities of the city of Algiers, all household members in our sample of the household transport survey were questioned. The survey took place at the household's home, the questionnaire contained three questions:

1. Evaluate the importance of several attributes of public transport.
2. Evaluate the quality of service offered according to several attributes.
3. What are the elements that can prevent the use of public transport?

The first two questions were asked to users of public transport and the third question was asked to non-users of public transport. We collected 2659 valid

¹ Dell'Olio, L. I. (2010), «Modelling user perception of bus transit quality». *Transport Policy*, pp. 388-397.

² Cirillo, C. E. (2011), «On the asymmetric user perception of transit service quality». *International Journal of Sustainable Transportation*, pp. 216-232.

³ Morfoulaki, M., Tyrinopoulos, Y., and Aifadopoulou, G. (2010, October). «Estimation of satisfied customers in public transport systems: a new methodological approach». *Journal of the Transportation Research Forum*, Vol. 46, N° 1, pp. 63-72.

⁴ Greene, W. H. (2010), *Modeling ordered choices: A primer*, Cambridge University Press.

⁵ Wan, D. K. (2016), «Customer satisfaction with bus rapid transit: a study of New York City select bus service applying structural equation modeling». *Public Transport*, pp. 497-520.

responses, 1704 responses from public transport users and 955 responses from non-users of public transport. People using public transport (64% of all respondents) were interviewed on their perception of the importance of each of the attributes of the public transport service offer and to assess their satisfaction with the quality of the service offer according to the same attributes of the service offer. People who do not use public transport (36% of all respondents) were also interviewed to find out the reasons for not using public transport. As a tool for collecting user opinions, we opted for the Likert scale which is the tool indicated in the study of the quality of services¹. Thus, we opted for a Likert scale with the following five points:

Likert scale points					
Statement 1	1 (not important)	2 (of little importance)	3 (moderately important)	4 (important)	5 (very important)
Statement 2	1(not satisfied)	2 (slightly satisfied)	3(moderately satisfied)	4 (satisfied)	5(very satisfied)
Statement 3	1(strongly disagree)	2 (disagree)	3((moderately agree)	4 (agree)	5(strongly agree)

2.2. Data analysis

For the exploitation of our database we used the statistical method of the factorial analysis in principal components which was carried out using the software SPSS. The confirmation of the result of a factorial analysis in principal components was done first by the selection of the items characterizing the factors retained for each variable of the model. The items used for the analysis of the perception of the importance of the attributes of the service quality and the evaluation of the service quality offered are taken from the literature review and empirical studies² as well as the experience of the authors on this question.

3- Results and discussion

Our field survey shows that the public transport mode most used by the people questioned is the bus (74.35% of public transport users); this service is operated by private operators or by ETUSA. Then comes the Metro and the Tramway (respectively 13.03% and 10.21% of public transport users) followed by the train and cable car (2.23% and 0.18% of public transport users). In table 2, we have

¹ Parasuraman A., Zeithaml V. et Berry L. (1988), «SERVQUAL: A Multiple-item scale for measuring consumer perceptions of service quality», *Journal of Retailing*, vol. 64, n° 1, p. 12-40; Llosa S. (1997), «L'analyse de la contribution des éléments de service à la satisfaction : un modèle Tetraclass», *Décisions Marketing*, vol. 10, Janvier-Février, p. 81-88.

² Fellesson, M. and Friman, M. (2008), «Perceived Satisfaction with Public Transport Service in Nine European Cities», *Journal of the Transportation Research Forum*, Vol. 47, n° 3, pp. 93-103; Imam, R. (2014), «Measuring Public Transport Satisfaction from User Surveys», *International Journal of Business and Management*, Vol. 9, n° 6, pp. 106-114; Machado-León, J.L., de Oña, R., Baouni, T and de Oña, J. (2017), « Railway transit services in Algiers: priority improvement actions based on users perceptions ». *Transport Policy*, vol. 53, pp. 175-185.

restored the number of valid responses to our questions depending on whether the respondent uses (64.08%) or not (35.92%) one of the means of public transport.

Table 1: Distribution of people questioned by mode of public transport used

Mode of transport	Frequency	Percentage	Cumulative percentage
ETUSA bus	177	6.66	6.66
Private operator bus	1090	40.99	47.65
Train	38	1.43	49.08
Metro	222	8.35	57.43
Tram	174	6.54	63.97
Cable car	3	0.11	64.08
None	955	35.92	100.00
Total	2659	100.0	

Source: household, mobility and transport survey, 2019.

The attributes of the offer of a public transport service that we have chosen to carry out this research are: the frequency of the services, the punctuality of the services, the public transport takes me to the places I want to go, the number of transfers , transfer times, duration of the journey on board the vehicle, the price of the ticket and the monthly fee, the availability of seat, the good condition of the stop, the load of the vehicle, the driving of the vehicle (safe and comfortable), availability of information, stops are near my home / work.

3.1. Study of user perceptions of the attributes of the quality of public transport service and assessments of the quality of the service offered

• *Perceptions of the importance of the attributes of a public transport service*

In a first question in the “use of public transport” sheet in our questionnaire, respondents who are users of public transport were asked to assess the importance of several attributes of public transport, and this by assigning a score to each attribute on a scale of 1 to 5, where 1 indicates that the attribute is not important and 5 indicates that it is very important. This indicator will allow us to know what is the perception of the importance of each quality attribute of public transport services from the point of view of the user and to classify them according to the order of importance assigned to them.

The opinions are concentrated around the answers "important" and "very important", obtaining together a total of 91.18% of the answers; it is a good indicator of the importance of all the quality attributes of public transport services from the point of view of the user of that means of transport. This result also shows that the user living in the city of Algiers can be qualified as “severe” in his judgment, in particular when he attaches great importance to the various attributes of the service offered during his trip. The users qualifying one (or more) attribute (s) as being “not important” represent less than 1%, and “of little important” a little more than 1% while “moderately important” is at 7%. It is clear that according to the data collected that the public transport users questioned are largely for the importance of all the attributes without exception but with a slight differentiation in the ranking of the degree of their importance. In this same context, the attributes

had fairly balanced results and the users who answered "very important" to the different attributes were between 47% and 62%, Figure 2 shows how the attributes converge. This result comforts us in the choice of all these attributes to subsequently evaluate the satisfaction of these users with the quality of the service offered by public transport according to these same attributes.

To obtain more clarity on the data collected and achieve an enriching classification, it is recommended to use a synthetic value representative of the degree of importance of each attribute. To do this, we chose the average score recorded for each attribute, taking into account all the opinions expressed by the users of our survey sample. As it was underlined above, no attribute is distinguished compared to the others, the synthetic values are very close, but the attribute "price of the ticket / monthly fee" (U1_7) is separated from the group and is found last, this does not mean that this attribute is not important, since its synthetic value is clearly greater than 4, but the distance of (-0.212) from the following attribute makes it less important than the rest.

Nevertheless, some attributes arouse more interest than others; the analysis shows that the attribute proximity to stops (U1_13) constitutes the most important element for the user followed by the duration of the journey (U1_6).

• *Assessments of the quality of service offered by public transport*

In the second question of the "use of public transport" sheet, respondents who are also users of public transport were asked to assess the quality of service offered according to the same attributes stated in the first question, on a scale of 1 to 5, where 1 indicates that the user is not satisfied with the quality of the offer and 5 indicates that he is very satisfied.

The results indicate that 52.39% of users responded that they are dissatisfied with the quality of public transport service, while 3.19% said that they are very satisfied. For the intermediate values, 44.43% are between satisfied and slightly satisfied.

Figure 5 brings together all the attributes in order to describe in detail the perceptions of the users. The results clearly show that users are mostly dissatisfied with the transport services provided, the percentages are between 36.20% and 76.41%. At a more detailed level of the analysis, it is observed that the attribute U2_10 "the load of the vehicle" receives a high percentage of dissatisfaction (76%). However, the share of users who answered satisfied or very satisfied for the attribute U2_13 "the stops are near my house / my work" is equal to 35.46% and it is the attribute that received the greatest number of satisfied users. The aggregated data give more meaning, it is important to gather the opinions around a synthetic value, the results confirm that the attribute U2_10 "the load of the vehicle" is the least appreciated by the users, with a synthetic value of 1.45.

Likewise for the attribute U2_13 "the stops are near my house / my work", the results are put on the same line as before, with a value of 2.47, thus this attribute is relatively appreciated by the users.

In summary, it is quite clear that the users of public transport in Algiers, in our survey sample, agree on their dissatisfaction with the quality of the service offered

and that in relation to all the service quality attributes, without exception and with almost total convergence.

3.2. Reasons for not using public transport

In the third question of the “use of public transport” sheet, respondents who do not use public transport were asked to give a score for each statement of one of the reasons that may dissuade them from using public transport. The scores of the respondents' responses were reported according to the Likert scale of five points where 1 indicates that the respondent strongly disagrees with the statement and 5 indicates that he strongly agrees.

Results indicate that out of the thirteen reasons that may dissuade the use of a public transport service, eleven reasons marked the total support of more than 50% of those questioned. The overload in vehicles, the duration of the trip, the duration and the number of connections are the reasons which had the most agreement on the part of the respondents. This is followed by the lack of information on services and the lack of display, the extent of the network, the low frequency of services and accessibility to the network.

The classification of the reasons for the non-use of public transport by the respondents in our sample according to the average of the answers reveals that comfort and time are the most important indicators which can dissuade the use of this mode of transport. Indeed, the overload and the lack of free seats in public transport, the duration of the journey and the high number of connections that must be taken to reach their destination and which waste a lot of time for users, make this mode of transport unattractive compared to individual mode of transport.

In summary, we can classify the reasons for not using public transport services into three categories according to the scores recorded in accordance with the statements proposed in the questionnaire:

1. Reasons linked to the notion of time: duration of the trip, time and number of connections.
2. Reasons linked to the performance and quality of the network: overloading in vehicles, low frequency of services, low extent and accessibility to the network.
3. Reasons linked to communication faults: - lack of information and display on the services.

4- Development and validation of a public transport satisfaction measurement scale

In this section, we briefly describe the analysis of the data relating to the first two questions, namely: the importance of several attributes of public transport according to the user's perception and the evaluation of the quality of service offered according to a user satisfaction measurement scale. We have opted for an exploratory analysis which will allow us to detect the relationships that may exist between the perception of the importance of thirteen attributes of a public transport service offer and the evaluation of the quality of the offer of this service following these same attributes. This analysis will also allow us to propose a scale for measuring user satisfaction in the use of public transport in Algiers.

To do this, a principal component analysis was applied to the data, we chose the principal component analysis, since it allows to explain a large part of the variance

with a minimum of factors. 1704 people answered the first two questions. To carry out our analysis, we exceed the minimum of 100 participants in total and that of 10 people per variable as recommended by Hair et al.¹.

We carried out several factor analyzes to obtain a better representation of the variables on the different factors extracted from our analysis. After several tests we eliminated four variables which were not positioned in a significant way on one of the factors extracted. The statistical tests confirm the validity of our analysis, the KMO index of 0.925 can be qualified as excellent, and it indicates to us that the correlations between the items are of good quality. Then, the result of Bartlett's sphericity test is significant at the threshold of $p < 0.0005$. We can therefore reject the null hypothesis that our data comes from a population for which the matrix is an identity matrix, so not all correlations are zero.

Table 2: KMO index and Bartlett test

Kaiser-Meyer-Olkin index for measuring sampling quality.		,925
Bartlett's sphericity test	Approx. Chi-square	30255,019
	Df	231
	Sig	,000

We finally retained the first three factors extracted since they have an eigen value of more than 1 and they explain 67.20% of the variance. The first factor alone explains 39.06% of the total variance of the 22 items of the analysis.

Table 3: Eigen values and total explained variance

Factor	Eigen values of variance	%	% accumulated
1	7,959		36,177
2	4,853		22,061
3	1,971		8,959

Before doing the rotation, we observed that 13 variables saturate more strongly on the factor 1 and therefore allow us to define it. Between one and two variables saturate on the other factors. In order to determine the combination of variables which is most associated with each of the significant factors, we applied a VARIMAX rotation, this type of rotation allows to preserve the independence between the factors. We note this time that the variables are much better distributed over the different factors. In addition, the difference between the correlations is higher after the rotation has been performed. Since at least three variables saturate on each of the factors, we can keep them to build scales.

Table 4: Rotation of the component matrix a

	Composante		
	1	2	3
U2_2 Punctuality of services	.845		
U2-6 Travel time on board	.842		

¹ Hair J.F.J., Anderson R.E., Tatham R.L. et Black W.C. (1998), *Multivariate Data Analysis*, 5th ed., Prentice Hall, Upper Saddle River, New Jersey.

U2_5 Time of connections	.841	
U2_4 Number of connections	.835	
U2_12 Availability of information	.829	
U2_11 Driving is safe and comfortable	.814	
U2_9 Good condition of the stop	.814	
U2_3 Public transport takes me to places I want to go	.813	
U2_1 Continuity of service	.758	
U2_10 Vehicle load (not crowded)	.721	
U2_8 Seat availability	.719	
U2_13 The stops are near my house / my work	.638	
U2_7 Ticket price / monthly fee	.614	
U1_5 Time of connections	.866	
U1_4 Number of connections	.850	
U1_6 Travel time	.839	
U1_1 Continuity of service	.832	
U1_2 Punctuality of services	.817	
U1_3 Public transport takes me to places I want to go	.722	
U1_9 Good condition of the stop		.805
U1_11 Driving is safe and comfortable		.743
U1_8 Seat availability		.613

Extraction method: Principal component analysis.

Rotation method: Varimax with Kaiser normalization.

a. Convergence of rotation in 5 iterations.

• Interpretation of the extracted factors

Factor 1: On the first axis we find the question relating to the evaluation of the quality of the public transport offer. This axis is marked by the weight of the attributes of the quality of the public transport offer; here we find three categories of elements of the quality of the public transport offer:

TIME

- Elements linked to the notion of time: time of connections, journey time on board, punctuality of services, number of connection and times of connection.

The dimension of time

Attributes of the offer quality	Contribution of items
U2_2 Punctuality of services	, 845
U2-6 Travel time on board	, 842
U2_5 Time of connections	, 841
U2_4 Number of connections	, 835

ACCESSIBILITY

- Elements related to accessibility to infrastructure and information: Continuity of service, public transport takes me where I want to go, availability of information, stop near my home / work and the price of the ticket / monthly fee ;

The dimension of accessibility to infrastructure and information

Attributes of the offer quality	Contribution of items
U2_12 Availability of information	, 829
U2_3 Public transport takes me to places I want to go	, 813
U2_1 Continuity of service	, 758
U2_13 The stops are near my house / my work	, 638
U2_7 Ticket price / monthly fee	, 614

COMFORT

- Elements related to comfort: availability of seat, good condition of the stop and vehicle load.

The dimension of comfort

Attributes of the offer quality	Contribution of items
U2_11 Driving is safe and comfortable	, 814
U2_9 Good condition of the stop	, 814
U2_10 Vehicle load (not crowded)	, 721
U2_8 Seat availability	, 719

Factor 2: this axis is defined by the question on the perception of the characteristics of the public transport offer, the notion of time is the most significant on this axis, and the attributes which have the most weight in inertia are: Continuity of service, punctuality of services, number of connections, number of connections and journey time. We also find on this axis the notion of accessibility: public transport takes me to places where I want to go. In the opposite direction to this axis we have the dimension of comfort: Good condition of the stop and the driving is safe and comfortable.

Factor 3: the third axis is the axis of the perception of the elements of a public transport service offer. We notice that there is confirmation of the results on Factor 2. Indeed, there is an opposition between the aspects of comfort and the aspects related to the notion of time. Aspects of comfort in transport appear through elements such as: availability of seats, good condition of the stop and safe and comfortable driving. Aspects linked to the notion of time are: journey time, continuity of service, time of connection and number of connections. So we can conclude by starting from the analysis of the responses of our sample users that the more the user has a great perception of the notion of time among the indicators of the quality of the offer, the more the perception of the importance of the notion of comfort in the quality of the offer of this service decreases and vice versa.

• Analysis of the reliability of the construct

The two questions on which we are basing our analysis represent the elements that will compose the scales making it possible to measure the identified construct "Time, accessibility and comfort". These scales will therefore assess which attributes of the offer of a public transport service are the most important in the perception and in the evaluation of the quality of this offer from the point of view of the user of this transport.

In order to check whether this scale is stable over time and whether it allows the construct that we have identified to be properly measured, we carried out an analysis of the reliability of the measurement scale. The reliability of the measurement scale is checked by calculating Cronbach's alpha for each factor selected and for the entire scale.

The reliability indices of the factors used in our analysis are much higher than the required minimum of 0.7¹, in fact they are between 0.826 and 0.944. Cronbach's alpha is satisfactory, so the attributes are correlated and consistent with each other. Also, the total scale presents a good reliability with a Cronbach's alpha of 0.883, the quality of this coefficient is a necessary condition to calculate an overall score of the perception of the quality of service offered by public transport in the city of Algiers.

Table 5: Construct reliability statistics

Factors	Cronbach's alpha	Number of elements
Factor 1	0,944	13
Factor 2	0,919	6
Factor 3	0,826	3
Total scale	0,883	22

Thus, we can deduce that each attribute of the quality of public transport service exhibits consistency with all the other attributes of the scale to which it belongs.

In conclusion, it is necessary to know the elements which are important for the user in a posture of evaluation of the offer quality of a public transport service and in the posture of the perception of the scale of importance of these same attributes. In the descriptive analysis of the results of our survey, it appears that users are generally dissatisfied with the quality of service offered by public transport. The factorial analysis helped us to extract the items or attributes which have a weight in the perception and in the evaluation of the users. The three factors extracted from this analysis are as follows:

The factor of the quality of service perceived by public transport users is:

Factor 1 which represents: time, accessibility and comfort.

The two factors of the importance of the attributes of the offer of a public transport service according to the users' perception are:

Factor 2 represents time and accessibility.

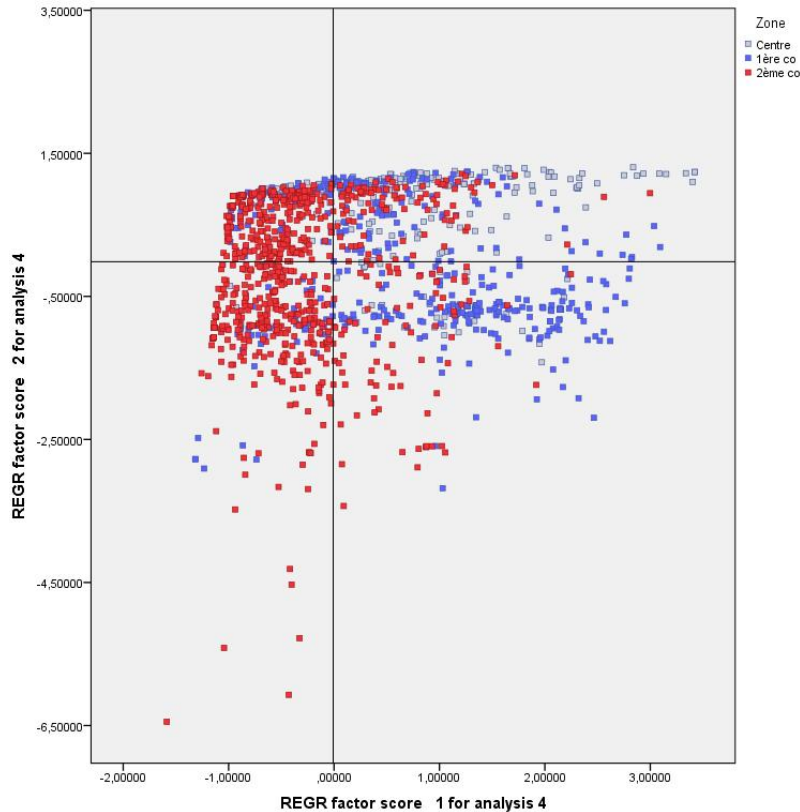
Factor 3 represents comfort.

• *Projecting the coordinates of individuals*

The projection of the coordinates of individuals on the factorial plane composed of axes 1 and axis 2 according to their area of residence shows that individuals who live in the second suburbs are the most dissatisfied with the offer quality of the public transport. Moreover, those who live in the Center are the most satisfied with the offer quality of the public transport. Also, those who have a higher perception of the characteristics of the offer linked to the notion of time are those who live in the Center then those who live respectively in the second and third suburbs.

¹ Nunally, J.C. (1978), *Psychometric Theory*, 2nd ed., New York, McGraw Hill.

Figure 9: Projection of the coordinates of individuals on the factorial plane



The respondents most dissatisfied with the offer quality of the public transport service are those who live in the municipalities of Baraki and Douera, in fact in these two municipalities which are located in the southern outskirts of the city of Algiers, the bus is the only existing means of public transport except for the Algiers-Center-Baraki connection which is served by a rail transport line. The bus being the means of transport that does not have a reserved lane suffered the vagaries of traffic jams; this is one of the reasons for user dissatisfaction.

Conclusion

In order to gain an overview of the governance of public transport services from below, we used a satisfaction survey among public transport users. We have first identified the attributes of the quality of service offered by public transport which are decisive and defined the criteria which are the most important for the user of this service. We then analyzed the satisfaction, by users, of the various attributes of the offer quality of the public transport service. According to the analysis of the results of the survey, it appears that all the attributes of the quality of the service offer according to their importance for the user who has accumulated experience in the use of this service are important for the user, but with a slight difference in the

ranking of these attributes according to the degree of their importance from the point of view of that user. This indicates the requirement of the user regarding his expectation of the service provided by public transport.

A large part (52.39%) of users replied that they were dissatisfied with the quality of public transport service, while only 3.19% were very satisfied. The attribute "vehicle load" is the attribute for which there is the most dissatisfaction (76.41%), however, the attribute for which there is the most satisfaction (35.46%) is "stops are close to my house / my work".

The projection of the coordinates of the individuals in our sample according to their place of residence on the first factorial plane tells us that the individuals who live in the second suburbs are the most dissatisfied with the offer quality of the public transport. Moreover, those who live in the Center are the most satisfied with the offer quality of the public transport.

The most dissatisfied with the offer quality of the public transport service according to the results of our field survey are those who live in the municipalities of Baraki and Douera. In these two municipalities located on the southern outskirts of the city of Algiers and where the Bus is the only mode of public transport available, it is essential for local authorities to strengthen control over private operators to remedy this situation in addition to the reduction of the negative externalities of the excessive use of the private car in the city in particular the saturation of the traffic lanes.

The three main reasons for not using public transport according to the responses of the respondents and according to the ranking order of their importance are: reasons related to time (duration of the trip, time and number of connections), reasons related to the network performance and quality (overload in vehicles, low frequency of services, low extent and accessibility to the network) and finally reasons related to communication faults (lack of information and display on services).

The factorial analysis of users' responses on their perception of the importance of attributes and the evaluation of the offer quality of the public transport according to users' opinions helped to better understand the expectations of the user living in the city of Algiers.

The data analysis allowed us to extract a measurement scale of the satisfaction of the user of public transport in the city of Algiers, this scale is composed of three essential elements according to the degree of their importance according to the perception of this user:

- Elements related to the notion of time: connection time, journey time on board, punctuality of services, number of connections and times of connections;
- Elements related to accessibility to infrastructure and information: Continuity of service, public transport takes me where I want to go, availability of information, stop near my home / work and the price of the ticket / monthly fee ;
- Elements related to comfort: Safe and comfortable driving, seat availability, good condition of stops and vehicle load.

From a managerial standpoint, it is important to know the attributes for which users perceive their great importance and for which they are not satisfied with the quality of the offer according to these same attributes. These results of our research will be able to guide decision-makers and those in charge of the organizing authority on the levers on which they will have to work to improve the quality of the offer in order to make public transport more attractive. Also, the elements of the specifications on which it must be more demanding and careful for the future concession of public transport networks during calls for tenders. Through this contribution, we are offering decision-makers a tool for continuous monitoring of the performance of public transport service operators, according to a user satisfaction measurement scale. Also, the use of the electronic tablet for the collection of information and data "user satisfaction" is much more reliable and less expensive in terms of cost and time of survey; moreover it allowed us to access more information possible in a shorter time.

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Appendix

Figure 1: Global presentation of opinions on the importance of the quality attributes of public transport services in Algiers

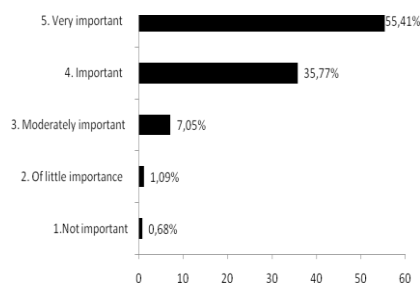


Figure 4: Global presentation of users' perceptions of their satisfaction with the public transport services quality

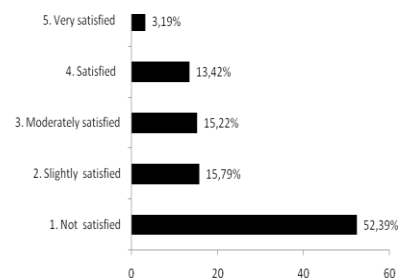


Figure 8: Ranking of the reasons for not using public transport in the city of Algiers according to the average of respondents' responses

