Commuters Perspective on Urban Public Transport System Service Quality

GEORGE BOTZORIS[1], ATHANASIOS GALANIS[2],
VASSILIOS PROFILLIDIS[1], NIKOLAOS ELIOU[2]
[1]Section of Transportation, Department of Civil Engineering, Democritus Thrace University,
67100 Xanthi, GREECE
[2]Department of Civil Engineering, University of Thessaly,
Pedion Areos 38334, Volos, GREECE
gbotzori@civil.duth.gr atgalanis@uth.gr vprofill@civil.duth.gr neliou@uth.gr

Abstract: - Today, 54% of the world's population lives in urban areas, a proportion that is expected to increase to 66% by 2050. Without public transport these areas are hardly liveable, unsustainable, and very far from equitable. Improving of perceived by users service quality of urban transport is important for the attractiveness and thus the increase of frequency of their usage, which could lead to significant reduction of total greenhouse gas emissions due to urban transport. In this paper, an evaluation of environmental effects of urban transport is presented and a correlation between air pollutant emissions and the market share of urban public transport is conducted. The definition of service quality and effect on the attractiveness of urban public transport are analyzed. An extended literature review of evaluation methods of the quality of services offered is also conducted. The commuters' perception on service quality offered by the public transport system of the city of Thessaloniki (Greece's second-largest city) is measured by using customer satisfaction survey. Finally, an exploratory factor analysis is performed to determine the principal components of service quality, in which public transport must focus on in order to improve its services offered, increase frequency of services usage, and to contribute for the reduction of harmful environmental effects of urban transport.

Key-Words: - Urban public transport, Environmental effect, Service quality, Demand, Questionnaire survey.

1 Introduction

The transport sector is a key enabler of economic growth. By providing the necessary infrastructure and services upon which the economies and societies depend for the people and goods mobility, transport increases the access of businesses and consumers to markets and services, promotes economic diversification and regional integration, supports the growth of trade and the growth of the economy. From the social perspective, transport supports individual mobility so that all people can benefit from access to public services and labor markets, having in this way important positive implication for economic inclusion and for human equality.

About 75% of the European Union citizens live in urban areas (Fig. 1), where almost 85% of the EU Gross Domestic Product (GDP) is produced. In urban areas, public transport modes allow citizens to travel daily for utilitarian purposes or recreation ones thus confronting the raising environmental, financial and social problems of traffic congestion and road accidents that creates the extreme private vehicles usage.

Urban motorized transportation is responsible for the 40% of CO_2 emissions and for the 70% of other air pollutants emissions which provoked by road transportation. Figure 2 presents the annual CO_2 emissions per capita and per year in various cities worldwide, in relation to the modal share of public transport modes and non-motorized ones.

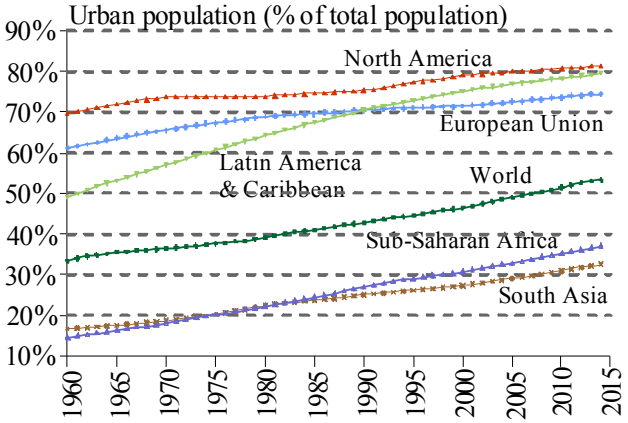


Fig. 1: Evolution of urban population as percentage of total population for the various geographical areas of the world, [compiled by authors based on data of [1]].

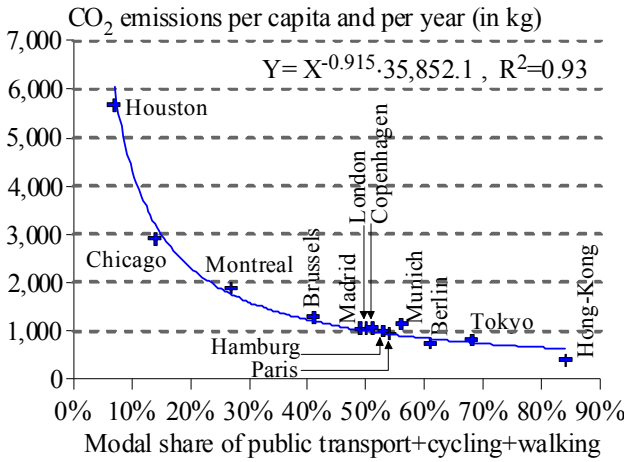


Fig. 2: Correlation between mobility patterns and per capita CO_2 emissions for various cities worldwide for the year 2011 [2].

Citizens expect from the authorities and transport sector stakeholders an attractive, viable and sustainable transport model for their region of habitation. Well organized and competitive urban public transportation are a perfect match for this challenge.

Public transport is an effective and vital alternative against climate change. By investing in low-carbon mobility models and doubling the market share of public transport, cities and governments can prevent the emission of 550 million tones of CO_2 equivalent by the year 2025, making the cities better places to live and work. Additionally, public transport's carbon footprint has an inverse relationship to the global carbon footprint. This means that the greenhouse gas emissions will decrease relatively to public transport's footprint increase, because of the lower emission and energy consumption of public transport in relation to other motorized transport modes and especially the cars, (Fig. 2 and Fig. 3).

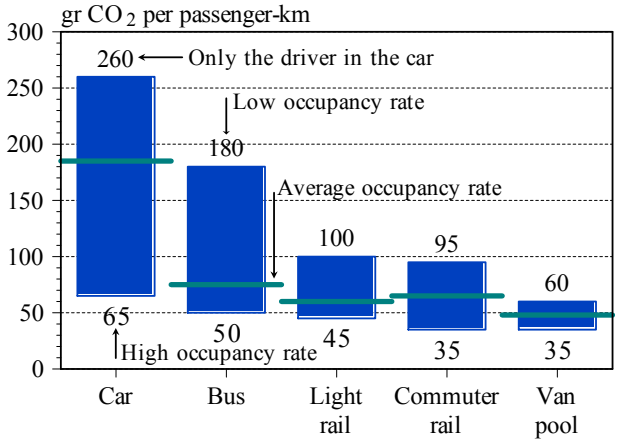


Fig. 3: Estimated CO_2 emissions per passenger kilometer for various transport modes [2], [3].

2 Impact of Quality of Services on the Modal Share of Public Transport

It is not easy to define quality of transport in a simple and brief definition, due to the fact that it is a relative term which depends on the correlation between the following three elements: objectives, means and results. Particularly on the subject of public transport, the objectives are not always clear, the results depend on the user's perception and the service provision can be considered in a satisfactory level only few of the times. Users from their perspective having regular or periodic contact with the urban public transport area shape and evolve on a daily basis their opinion regarding the delivered services. They often fail to prioritize in order of importance the components that comprise the concept of "service quality of urban transport", while the difference between the offered, on the part of services providers of urban transport, and the perceived, from a user-customer's perspective, service quality is important.

Despite the absence of a clear identification of individual components that compose the concept of "service quality of urban transport", as such the quality of services involves different dynamics and poses different interpretation, as it may express either the existing or the desired condition both from the user's perspective and from the perspective of urban transport providers. Thus, the following concepts are distinguished in terms of quality of service [4], [5], (Fig. 4):

- *Expected service quality*, which is defined as the level of quality expected by the customer and can be defined in terms of anticipated expectations.
- *Targeted service quality*, which regards the level of quality that the provider aims to provide to passengers. It depends on the level of quality expected by the passengers, the internal and external dependencies (internal and external environment), the financial constraints and the competitors' performance.
- *Delivered service quality*, which expresses the level of quality that is offered on a daily basis to users.
- *Perceived service quality*, which expresses the level of quality as perceived by the passengers during their movements. However, the way passengers perceive service quality depends on their previous personal experience with the service or with relevant services and of all information received for the service.

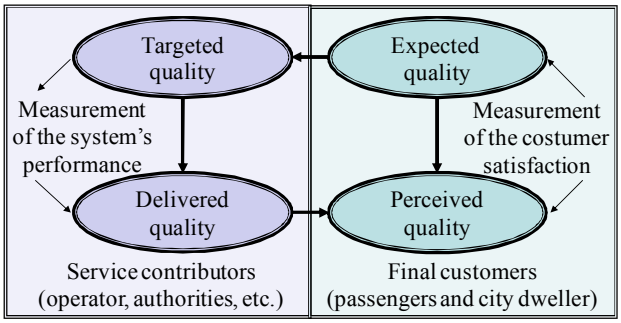


Fig. 4: The assessment of the service quality is supported by four main pillars that interact: expected, perceived, targeted and delivered quality [6].

The effective management of the quality of the services offered in the field of urban transport is fundamental to the attractiveness of services, the improvement of efficiency and effectiveness of companies, the revenue growth, the attraction of traffic volume, without underestimating the importance of urban transport on quality of life and the environment (Fig. 5).

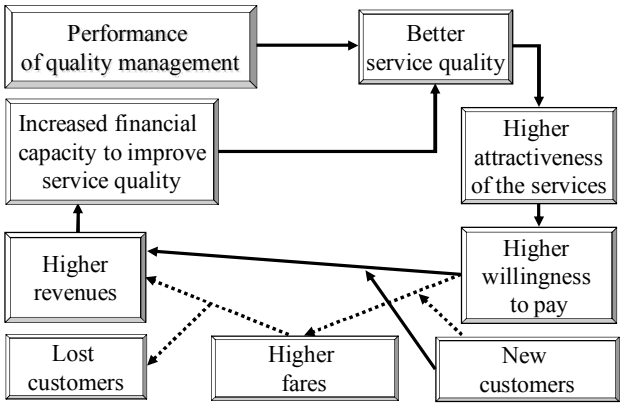


Fig. 5: The effect of service quality in the attractiveness of urban transport [6].

The scope of this paper in principle is the valuation of the perceived (and expected to some extend) quality of services offered by the "Organization of Urban Transportation of Thessaloniki" (abbreviation: OASTH), the second largest city of Greece with a population of about 1,005,000 inhabitants, through a customer satisfaction survey (questionnaire survey) which was carried out in 2014. Additionally, the questionnaire also included questions that were appropriately phrased in order to elicit the passengers' reaction on future service improvements and to record their views on specific policies.

In the second phase, the results of the questionnaire surveys were used so as to identify and describe the principal components that compose the concept of the quality of services of OASTH as it is perceived by the users. For this purpose an exploratory factor analysis was performed.

3 Literature Review of Methods for the Evaluation of Service Quality

The evaluation of expected and perceived, by users, quality of services offered is carried out through a Questionnaire Survey. Typical work on the subject of valuating the quality by urban transport users is this of Silcock (1981) [7], Pullen (1993) [8] and Friman et al. (2001) [9] in which it was found that the parameters that contribute the most to the perception of quality by the users' perspective are the accuracy and frequency of routes, the reliability of services and the information before and during the trip. Stradling et al. (2007) [10], Krizek and El-Geneidy (2007) [11], Fellesson and Friman (2008) [12], Eboli and Mazzulla (2007, 2009, 2011) [13], [14], [15], Agarwal (2008) [16], Tyrinopoulos and Antoniou (2008) [17], Budiono (2009) [18], Wu et al. (2009) [19], Ji and Gao (2010) [20], Dell'Olio et al. (2010) [21], Stefanis and Botzoris (2014) [22] and Redman et al. (2013) [23] came to similar conclusions.

Paulley et al. (2006) explored the influence of fares, quality of service, income and car ownership on public transport demand and they calculated the appropriate elasticities [24].

Beirão and Sarsfield Cabral (2007) explored the perceptions of users of urban public transport in relation with those of private car users concluding that travel time, cost, comfort, safety, reliability and information (before and during the trip) are the predominant parameters for choosing public transport [25]. On the contrary, moving from door to door, flexibility and shorter travel times are considered as the main reasons to prefer private cars [25], [26].

Tyrinopoulos and Aifadopoulou (2008) presented an integrated proposal about controlling the quality of services in public transport, as it was formed by the Greek Institute of Transport, which includes 39 quality indicators [27].

Wang et al. (2010) developed, through factor analyses, an instrument for measuring urban transport service quality from a stakeholder perspective, [28]. The application was illustrated through an empirical study at the Taipei metropolitan area. The analytical results revealed that stakeholders were more concerned with reliability and safety.

Galanis and Eliou (2011) evaluated the pedestrian infrastructure in urban areas using walkability indicators [29] and presented a methodology in order to grade the pedestrian urban road environment [30], confronting thus the passengers' accessibility problems to public transport facilities.

Besides urban public transport, methodologies for evaluating the quality of services have been made for other transport modes as well. Hanna and

Drea (1998) [31] and Drea and Hanna (2000) [32] have studied the quality of service and their research focused on the quality factors that influence the choice of means of transport. Convenience, cost, location (the ability to move where the commuter desires) and the ability to work while commuting were the initial factors that were examined. Later, the accessibility of the station, the possibility of parking, the seating comfort and the cleanliness of the space were examined.

Nathanail (2008) suggested a methodology and valuation indicators concerning the quality of rail services [33], which includes punctuality, safety, cleanliness, passenger comfort and information, while Prasad and Shekhar (2010) confirmed the above indicators adding also corporate social responsibility [34].

4 Survey for the Assessment of the Perceived Services Quality of Urban Transport of Thessaloniki

The questionnaire survey was conducted between the 15thand 30thof September 2014. The hours that the research was carried out were between 9:00 and 16:00, while no distinction was made between peak and off-peak hours. The questions were closed-ended and formulated mainly in the form of statements where the interviewees were asked to respond to what extent they agree or disagree with the opinion issued question-statement having the following five possibilities (five-point Likert scale):

(1) Disagree completely with the statement,
(2) Disagree with the statement,
(3) Take a neutral stance,
(4) Agree with the statement,
(5) Agree completely with the statement.

The questionnaire was formulated from 22 questions in total, (Table 1), of which the first 19 aimed at evaluating the quality of services and identifying, through factor analysis, the principal components that make the concept of "quality of service", the last one (Q22) was about the overall evaluation of the perceived service quality by users (so as to be compared with similar surveys in different European cities), while two questions were made with a different purpose:

- The question-statement Q20: *"If urban transport will be modernized (greater frequency, shorter travel times, better information), I will use them more"* aims to explore the degree in which passengers respond to improvements in service quality.

Table 1: Average value and standard deviation of Customer Satisfaction Survey responses

	Statement/Question	Average value	Std. deviation
Q1	The frequency of services is satisfactory	2.81	1.09
Q2	Travel times are satisfactory	2.98	1.05
Q3	Transfers are well organized	2.88	1.06
Q4	The bus lanes are well organized and properly enforced	3.78	1.17
Q5	Buses are clean	2.57	1.14
Q6	There is reasonable and adequate access to buses for people with disabilities	2.09	1.08
Q7	The information inside the bus is sufficient	3.01	1.17
Q8	The security against robbery inside buses is satisfactory	2.00	1.08
Q9	Air conditioning-ventilation of buses is satisfactory	2.36	1.17
Q10	The on-board ticketing system of automatic vending machine is satisfactory	3.41	1.18
Q11	The waiting areas at bus stands are satisfactory	2.22	1.18
Q12	There are appropriate facilities at bus stops for people with disabilities	1.79	0.91
Q13	The security against robbery at bus stops is satisfactory	1.95	1.05
Q14	The driving behaviour of bus drivers makes me feel safe	3.25	1.07
Q15	Drivers respond to questions from passengers	3.68	0.99
Q16	How satisfied are you with the organization of urban services?	3.15	0.71
Q17	How satisfied are you with the rolling stock of public transport?	2.71	0.80
Q18	How satisfied are you with the facilities of bus stops?	2.01	0.88
Q19	How satisfied are you with the bus drivers?	3.69	0.90
Q20	If urban transport will be modernized, I will use them more	4.40	0.87
Q21	Drivers of private vehicles and taxi drivers make difficult the movement of buses	4.17	0.94
Q22	How satisfied are you by the services provided?	2.51	1.21

For all statements 1→Strongly disagree and 5→Strongly agree, except questions Q16, Q17, Q18, and Q19 where 1→Completely dissatisfied and 5→Completely satisfied.

- The question-statement Q21:*"Drivers of private vehicles and taxi drivers make difficult the movement of buses"* aims to explore the perceived by urban transport passengers impact of taxis in smooth and unhindered operation of urban transport.

For 5% confidence interval, 95% confidence level and a population (in this case the passenger traffic of OASTH) between 170,000,000 and 175,000,000 passengers per year, the sample size was calculated equal to 400 questionnaires [35]. It was decided that 500 questionnaires to be filled in, 400 of which concerning typical days and 100 concerning weekends.

Table 1 illustrates the average values and the standard deviation of passengers' responses of the Customer Satisfaction Survey whereas Figure 6 (adjacent column and next pages) depicts the responses in the five-point Likert scale.

Figure 7 gives a comparative evaluation of overall satisfaction and individual parameters of quality services of urban transport in various European cities, as it was estimated by Friman and Fellesson (2009) [36]. It is obvious that the perceived quality of services offered in the city of Thessaloniki falls significantly behind other European cities. The satisfaction level of the public transport services is also presented as a percentage of urban transport modes in urban mobility. The cities of Wien and Helsinki present the highest value for overall satisfaction from urban transport services, with a market share of 39% and 34% respectively, comparing to the cities of Oslo and Thessaloniki with an overall satisfaction of 25%.

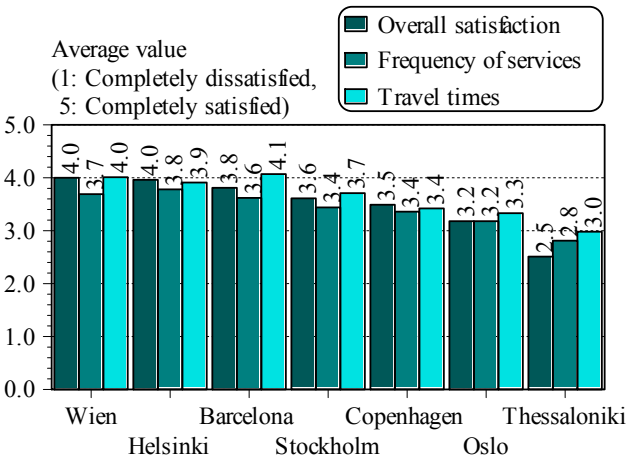


Fig. 7: Comparative assessment of overall satisfaction and individual parameters of quality of services offered by urban transport at various European cities [compiled by authors based on data of [36]].

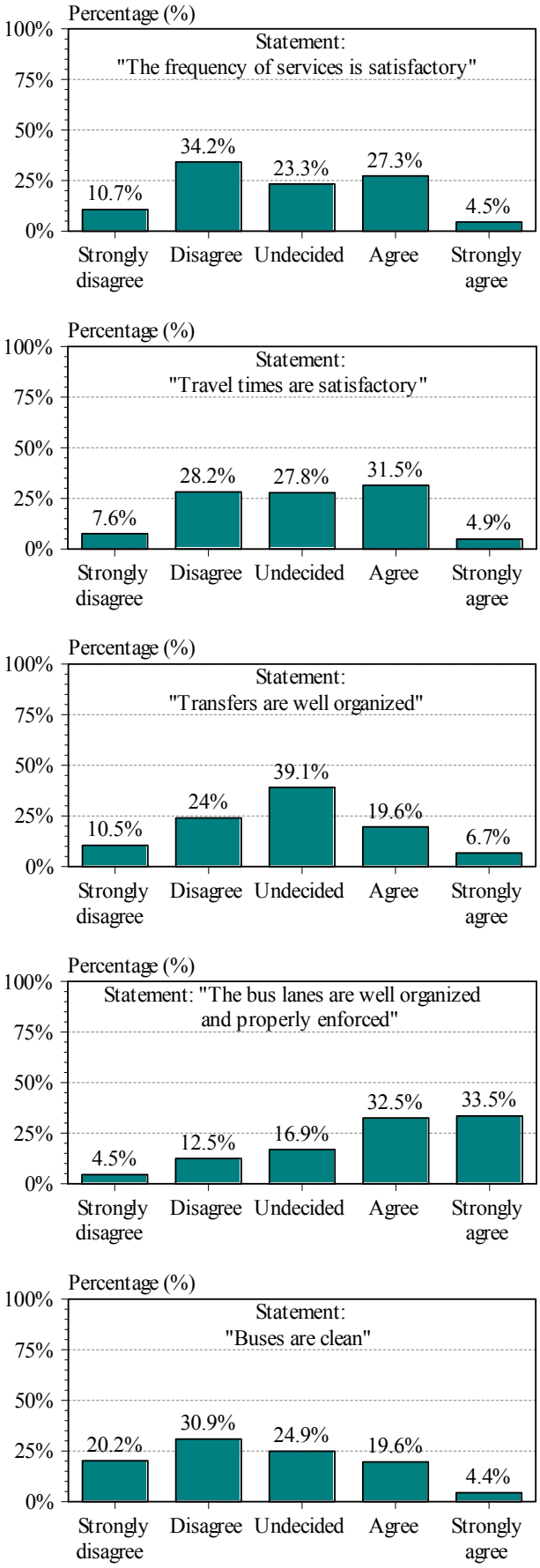
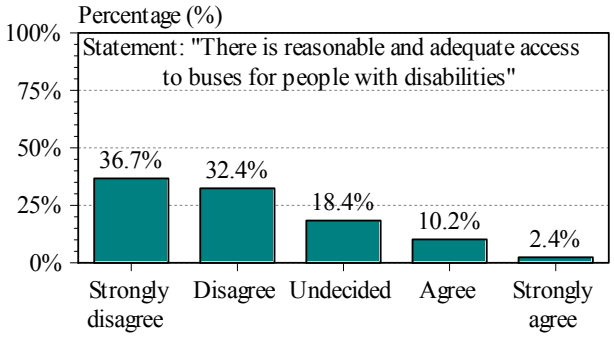
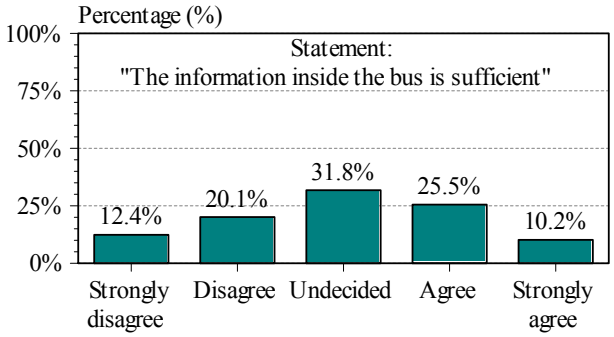
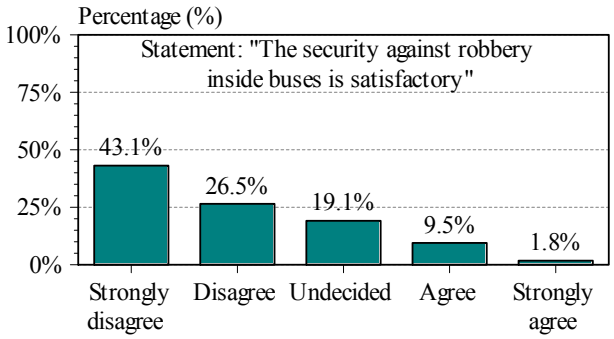
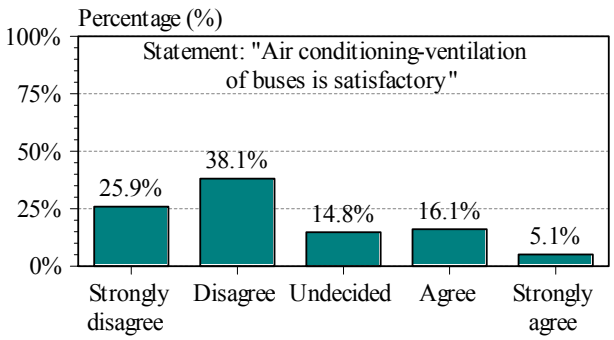


Fig. 6: Responses (in the five-point Likert scale) of the commuters to the various statements/questions.









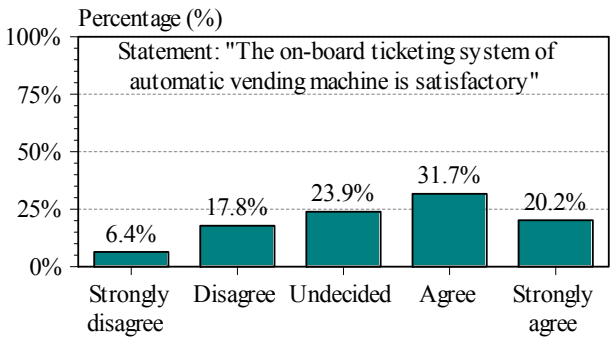
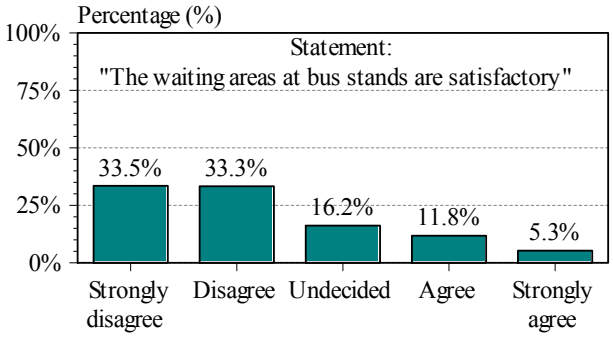
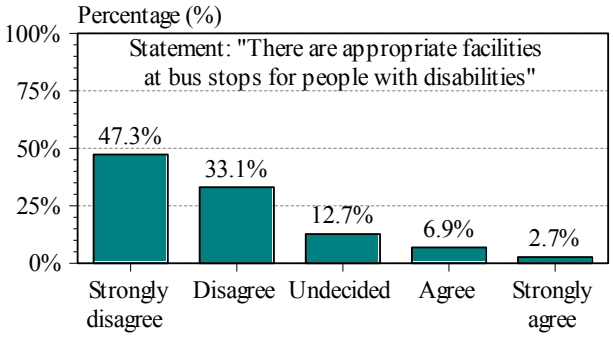
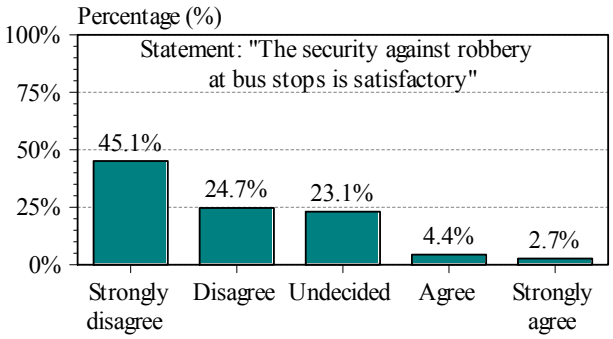
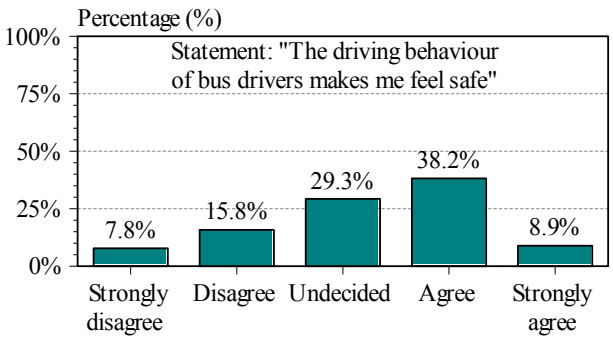


Fig. 6 (cont.): Responses (in the five-point Likert scale) of the commuters to the various statements/questions.









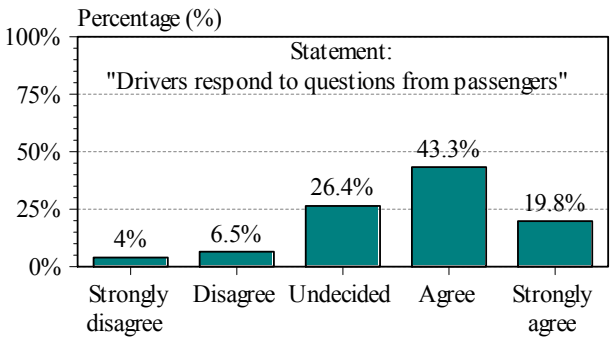
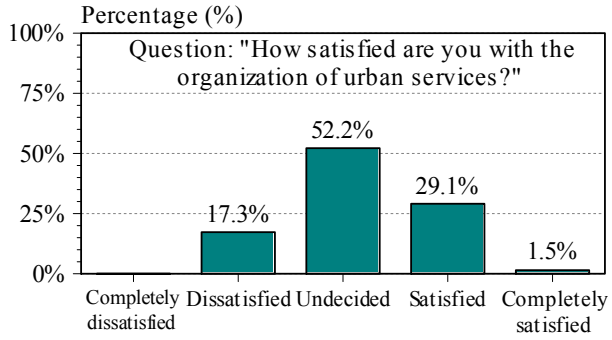
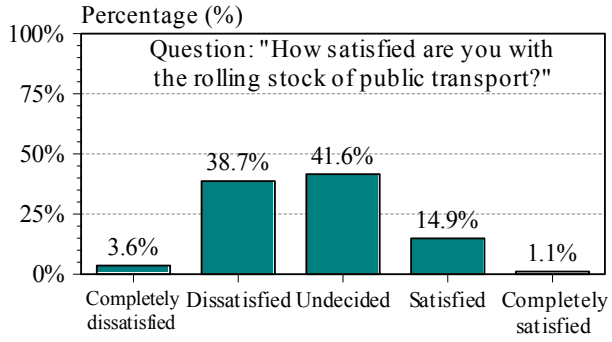
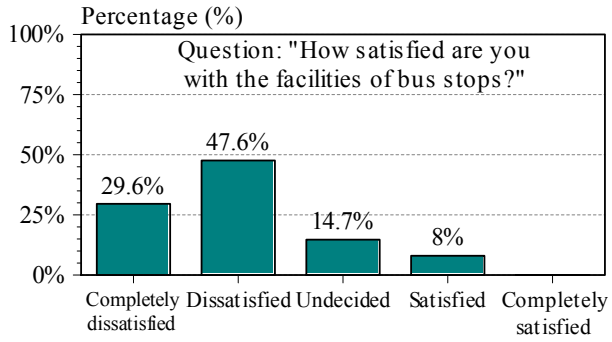
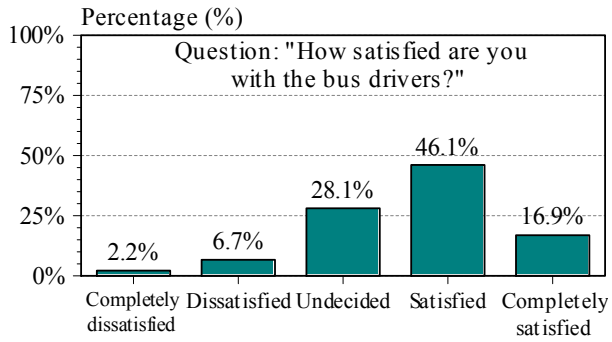


Fig. 6 (cont.): Responses (in the five-point Likert scale) of the commuters to the various statements/questions.









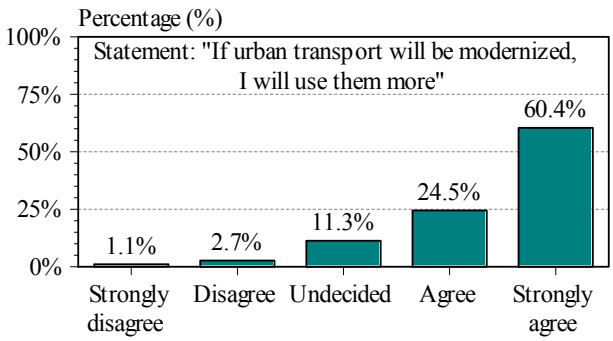
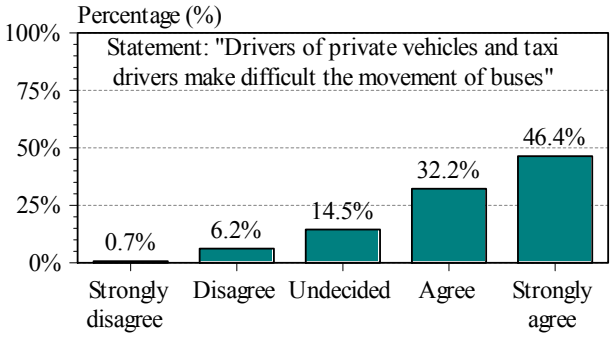


Fig. 6 (cont.): Responses (in the five-point Likert scale) of the commuters to the various statements/questions.



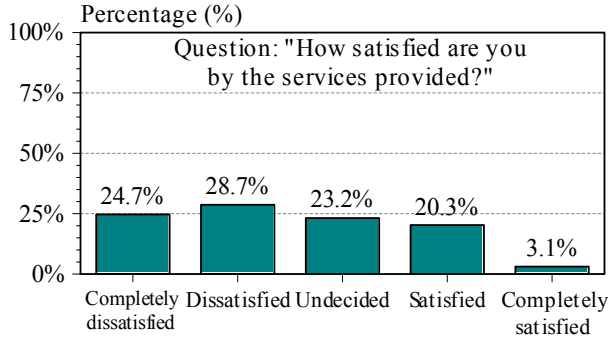


Fig. 6 (cont.): Responses (in the five-point Likert scale) of the commuters to the various statements/questions.

Figure 8 gives a comparative analysis of the modal split of urban mobility at various European cities [37]. Public transport dominates the urban transport realm in Budapest (47%) and Madrid (42%). On the contrary the lowest rates are observed in Amsterdam (20%) and Copenhagen (21%) where the use of non-motorized transport modes is high (about 45%). Low rates of public transport use can also be observed in Dublin (21%) and Thessaloniki (25%) where car is the dominate transport mode in those urban areas (about 55%).

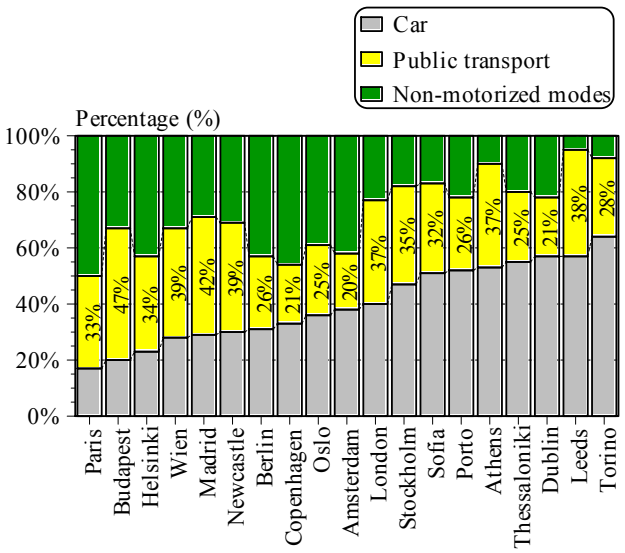


Fig. 8: Modal split of urban mobility at various European cities [37].

5 Exploratory Factor Analysis for the Determination of the Components of Service Quality

An exploratory factor analysis was used in order to identify the components that express the concept of service quality in urban transport. The factor analysis is commonly used in understanding people's response pattern, who complete closed-ended questionnaires (standard responses) and also allows drawing conclusions from a set of variables, by reducing them to a small number of factors, which correspond and include many of the original variables.

Table 2 shows all the factors extractable from the questionnaire survey, along with their eigenvalues, the percentage of variance attributable to each factor and the cumulative variance of the factor and the previous factors. Four principal components are identified, which have eigenvalues>1 and interpret 71.27% of the variance.

Table 2: Factor extraction of SPSS analysis

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.491	39.424	39.424	7.491	39.424	39.424	4.000	21.055	21.055
2	2.467	12.983	52.407	2.467	12.983	52.407	3.373	17.750	38.805
3	2.122	11.170	63.577	2.122	11.170	63.577	3.192	16.798	55.604
4	1.462	7.693	71.270	1.462	7.693	**71.270**	2.977	15.667	**71.270**
5	0.930	4.895	76.166						
6	0.850	4.474	80.639						
7	0.683	3.596	84.235						
8	0.566	2.981	87.216						
9	0.538	2.830	90.046						
10	0.432	2.274	92.320						
11	0.341	1.793	94.113						
12	0.308	1.622	95.735						
13	0.253	1.333	97.068						
14	0.220	1.158	98.226						
15	0.153	0.806	99.032						
16	0.094	0.492	99.524						
17	0.055	0.288	99.813						
18	0.027	0.143	99.956						
19	0.008	0.044	100.000						

Extraction Method: Principal Component Analysis.

Table 3 gives the rectangular matrix of loading of four factors, from which the questions-statements that correspond to each factor arise. According to Table 3, the first factor includes the questions-statements Q5, Q6, Q7, Q8, Q9, Q10 and Q17, the second factor includes the questions-statements Q11, Q12, Q13 and Q18, the third factor includes the questions-statements Q1, Q2, Q3, Q4 and Q16, and finally the fourth factor includes the questions-statements Q14, Q15 and Q19. The clustering of questions-statements, according to the four principal components of factor analysis, make discernible the similar features of questions-statements, that are included in each of the four components, in which it is possible to assign a label depending on the described features (Table 4).

Table 3: The rotated component matrix of SPSS analysis

	Component			
	1	2	3	4
Q1	.149	.047	.703	.124
Q2	.281	.116	.683	-.046
Q3	.124	.357	.541	.167
Q4	-.009	-.030	.663	.020
Q5	.672	.064	.142	.140
Q6	.634	.321	.022	-.067
Q7	.625	.110	.241	.125
Q8	.570	.427	-.056	-.008
Q9	.581	.327	.211	.112
Q10	.504	.090	.216	.267
Q11	.308	.564	.244	.197
Q12	.314	.687	.088	.060
Q13	.087	.807	.065	.053
Q14	.131	.205	.148	.802
Q15	.145	-.001	.052	.844
Q16	.210	.177	.846	.161
Q17	.873	.225	.153	.163
Q18	.288	.865	.133	.094
Q19	.117	.085	.089	.956

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

Table 4: Factors that compose the concept of perceived, by passengers, quality of services of public transport of the city of Thessaloniki

Factor	Statement/Question	Cronbach's alpha
1–Service organization	Q1, Q2, Q3, Q4, Q16	0.750
2–Rolling stock	Q5, Q6, Q7, Q8, Q9, Q10, Q17	0.811
3–Bus stops	Q11, Q12, Q13, Q18	0.805
4–Drivers	Q14, Q15, Q19	0.867

Therefore, a safe conclusion can be made, that the service quality on urban transport is a relation between appropriate scheduling and excellent organization of routes, cleanliness and air-

conditioning-ventilation of the rolling stock, updating and informing the commuters, efficiency and comfort of the facilities (inside the bus and at bus stops as well) and safety and security. Also taking into account that 84.9% of the interviewees responded that improving the service quality will lead to an increase of the level of service use of OASTH; a clear definition of the concept of service quality is particularly important and useful as it was resulted from factor analysis of principal components.

The evaluation of the reliability of factor analysis and the four obtained principal components is effected via Cronbach's alpha (α) [38], [39], (Table 4). Cronbach's alpha ranges between 0 and 1. The larger the value of coefficient α is, more reliable and objective the components resulted from factor analysis are. It has been shown that coefficient values bigger than 0.70 ensure the reliability of factor analysis [35], [40]. However, components with Cronbach's alpha between 0.55 and 0.60 are often accepted as marginally reliable [41], [42]. In our analysis, for all factors the Cronbach's alpha has values greater than 0.75.

6 Conclusion

To make public transport more attractive, public transport companies should be keen to ensure a high quality of service for their public transport system. Improving of perceived by users service quality of urban transport is important for the attractiveness and thus the increase of frequency of their usage, which could lead to an increased traffic volume, economic improvement and significant reduction of total GHG emissions due to urban transport.

The perceived by passengers quality of service offered by urban public transport, as a resultant, consists of four components which were identified by questionnaire survey and exploratory factor analysis as follows: service organization, rolling stock (buses) equipment, bus stops facilities and equipment, drivers capabilities and behaviour. Therefore service quality improvement should focus on policies that aim to improve each of the above components so as to be perceived by passengers.

Priority should be given in the facilities and equipment of bus stops, because passengers state their major dissatisfaction concerning those factors. Bus stop areas are the first and last images of this public transport mode and influence the passengers' perception of the service quality.

Urban public transport system sustainability footprint is a vital element of modern city ability to be competitive in terms of economy, environment and social cohesion [43], [44]. Reducing air pollutants from road transport sector requires change of modal share in favor of public transport modes, walking and cycling [45]. Municipality authorities and stakeholders worldwide organize surveys to extract and rate the commuters' attitudes of usage and opinions to public transport, in order to evaluate and improve its level of service with various conclusions [46], [47], [48], [49], [50], [51].

This study presented specific elements of the public bus usage in the city of Thessaloniki, Greece. The results of this study can help stakeholders and decision makers to improve the quality of urban public transport services and sustainability level of the city.

References:

[1] World Bank, *Word Bank Indicators*. Retrieved from: http://data.worldbank.org/indicator.

[2] Profillidis V., *Railway Management and Engineering - 4th Edition*, Ashgate, 2014.

[3] Profillidis V., Botzoris G., Galanis A., Environmental effects and externalities from the transport sector and sustainable transportation planning - A review, *International Journal of Energy Economics and Policy*, Vol.4, No.4, 2014, pp. 621-635.

[4] Barabino B., Deiana E., On the attributes and influencing factors of end-users quality perceptions in urban transport: an exploratory analysis, *Procedia-Social and Behavioural Sciences*, Vol.87, 2013, pp. 18-30.

[5] Barabino B., Deiana E., Tilocca P., Measuring service quality in urban bus transport: A modified SERVQUAL approach, *International Journal of Quality and Service Sciences*, Vol.4, No.3, 2012, pp. 238-252.

[6] QUATTRO 2008. *Quality Approach in Tendering Urban Public Transport Operations*, Research Project co-financed by the European Commission under the Transport RTD Programme of the EU's 4th Framework Programme for Research, Technological Development and Demonstration, 2008, pp. 8-10.

[7] Silcock D.T., Measures of operational performance for urban bus services, *Traffic Engineering and Control*, Vol.22, No.12, 1981, pp. 645-648.

[8] Pullen W.T., Definition and measurement of quality of service for local public transport management, *Transport Reviews*, Vol.13, No.3, 1993, pp. 247-64.

[9] Friman M., Edvardsson B., Gärling T., Frequency of negative critical incidents and satisfaction with public transport services, *Journal of Retailing and Consumer Services*, Vol.8, No.2, 2001, pp. 95-104.

[10] Stradling S.G., Anable J., Carreno, M., Performance, importance and user disgruntlement: a six-step method for measuring satisfaction with travel modes, *Transportation Research-Part A*, Vol.41, No.1, 2007, pp. 98-106.

[11] Krizek K.J., El-Geneidy A., Segmenting preferences and habits of transit users and non-users, *Journal of Public Transportation*, Vol.10, No.3, 2007, pp. 71-94.

[12] Fellesson M., Friman M., Perceived satisfaction with public transport service in nine European cities, *Journal of the Transportation Research Forum*, Vol.47, No.3, 2008, pp. 93-103.

[13] Eboli L., Mazzulla G., Service quality attributes affecting customer satisfaction for bus transit, *Journal of Public Transportation*, Vol.10, No.3, 2007, pp. 21-34.

[14] Eboli L., Mazzulla G., A new customer satisfaction index for evaluating transit service quality, *Journal of Public Transportation*, Vol.12, No.3, 2009, pp. 21-37.

[15] Eboli L., Mazzulla G., A methodology for evaluating transit service quality based on subjective and objective measures from the passenger's point of view, *Transport Policy*, Vol.18, No.1, 2011, pp. 172-181.

[16] Agarwal R., Public Transportation and customer satisfaction: the case of Indian Railways, *Global Business Review*, Vol.9, 2008, pp. 257-272.

[17] Tyrinopoulos Y., Antoniou C., Public transit user satisfaction: variability and policy implications, *Transport Policy*, Vol.15, No.4, 2008, pp. 260-272.

[18] Budiono A., *Customer Satisfaction in public bus transport*, Master Thesis, Karlstad University, Sweden, 2009.

[19] Wu R.Z., Zhai D.D., Xi E.C., Li L., Evaluation model of satisfaction degree for urban public transit service, *Journal of Traffic and Transportation Engineering*, Vol.9, No.4, 2009, pp. 65-70.

[20] Ji J., Gao X., Analysis of people's satisfaction with public transportation in Beijing, *Habitat International*, Vol.34, 2010, pp. 464-470.

[21] Dell'Olio L., Ibeas A., Cecín, P., Modelling user perception of bus transit quality, *Transport Policy*, Vol.17, No.6, 2010, pp. 388-397.

[22] Stefanis V., Botzoris G. Evaluation and analysis of perceived service quality dimensions of urban public transport, *International Journal of Engineering Research and Industrial Applications*, Vol.7, No.1, 2014, pp. 33-45.

[23] Redman L., Friman M., Gärling T., Hartig T., Quality attributes of public transport that attract car users: a research review, *Transport Policy*, Vol.25, 2013, pp. 119-127.

[24] Paulley N., Balcombe R., Mackett R., Titheridge H., Preston J.M., Wardman M.R., Shires J.D., White, P., The demand for public transport: The effects of fares, quality of service, income and car ownership, *Transport Policy*, Vol.13, No.4, 2006, pp. 295-306.

[25] Beirão G., Sarsfield Cabral J.A., Understanding attitudes towards public transport and private car: a qualitative study, *Transport Policy*, Vol.14, No.6, 2007, pp. 478-89.

[26] Hafezi M.H., Ismail A., Bus scheduling model for adjustment headway of bus carriers, *Applied Mechanics and Materials*, Vol.97-98, 2011, pp. 911-915.

[27] Tyrinopoulos Y., Aifadopoulou, G., A complete methodology for the quality control of passenger services in the public transport business, *European Transport*, Vol. 38, 2008, pp. 1-16.

[28] Wang S.M., Feng C.M., Hsieh C.H., Stakeholder perspective on urban transport system service quality, *Total Quality Management*, Vol.21, No.11, 2010, pp. 1103-1119.

[29] Galanis A., Eliou N., Evaluation of the pedestrian infrastructure using walkability indicators, *WSEAS Transactions on Environment and Development*, Vol.7, No.12, 2011, pp. 385-394.

[30] Galanis A., Eliou N., Grading methodology of the pedestrian urban road environment, *WSEAS Transactions on Environment and Development*, Vol.7, No.6, 2011, pp. 157-166.

[31] Hanna J.B., Drea J.T., Understanding and predicting passenger rail travel: an empirical study, *Transportation Journal*, Vol.38, No.1, 1998, pp. 38-46.

[32] Drea J.T., Hanna J.B., Niche marketing in intrastate passenger rail transportation, *Transportation Journal*, Vol.39, No.3, 2000, pp. 33-43.

[33] Nathanail E., Measuring the quality of service for passengers on the Hellenic Railways, *Transportation Research - Part A*, Vol.42, No.1, 2008, pp. 48-66.

[34] Prasad M.D., Shekhar B.R., Impact of Service Quality Management (SQM) practices on Indian railways-A study of South Central Railways, *International Journal of Business & Management*, Vol.5, No.9, 2010, pp. 139-146.

[35] Johnson R., Wichern D., *Multivariate statistical analysis - 3rd Edition*, Prentice-Hall, Englewood Cliffs, NJ, 1992.

[36] Friman M., Fellesson M., Service supply and customer satisfaction in public transportation: the quality paradox, *Journal of Public Transportation*, Vol.12, No.4, 2009, pp. 57-69.

[37] European Platform on Mobility Management. *TEMS: The EPOMM Modal Split Tool*, Retrieved from: http://www.epomm.eu/tems/index.phtml

[38] Cronbach L.J., Coefficient Alpha and the internal structure of test, *Psychometrika*, Vol.16, No.3, 1951, pp. 297-300.

[39] Zinbarg R., Revelle W., Yovel I., Li, W., Cronbach's α, Revelle's β, and McDonald's ω_H: their relations with each other and two alternative conceptualizations of reliability, *Psychometrika*, Vol.70, No.1, 2005, pp. 123-133.

[40] Nunnally J.C., *Psychometric Theory-2nd Edition*, McGraw-Hill, New York, 1978.

[41] Hair J.F., Anderson R.E., Tatham R.L., Black W.C., *Multivariate data analysis-5th Edition*, Upper Saddle River, NJ: Prentice Hall, 1998.

[42] Andaleeb S., Haq M.R., Reforming innercity bus transportation in a developing country: a passenger-driven model, *Journal of Public Transportation*, Vol.10, No.1, 2007, pp. 1-25.

[43] Banister D., The sustainable mobility paradigm, *Transport Policy*, Vol.15, No.2, 2008, pp. 73-80.

[44] Banister D., Watson S., Wood C., Sustainable cities: transport, energy, and urban form, *Environment and Planning B: Planning and Design*, Vol.24, No.1, 1997, pp. 125-143.

[45] Ribeiro P., Rodrigues D.S., Taniguchi E., Comparing standard and low-cost tools for gradient evaluation along potential cycling paths, *WSEAS Transactions on Environment and Development*, Vol.11, No.4, 2015, pp. 29-40.

[46] Litman T., *Evaluating Public Transit Benefits and Costs - Best Practices Guidebook*, Victoria Transport Policy Institute, 2015.

[47] American Public Transportation Association (APTA): *A Profile of Public Transportation Passenger Demographics and Travel Characteristics Reported in On-Board Surveys*, Washington DC, 2007.

[48] Gaunt M., Rye. T., Allen S. Public acceptability of road user charging: the case of Edinburgh and the 2005 referendum, *Transport Reviews*, Vol.27, No1, 2007, pp. 85-102.

[49] Ubbels B., Poppeliers R., Stroeker N., van Haeften M., *Quality of public transport in times of expenditure reductions: what is important to the public transport user?*, Proceedings of the 39th European Transport Conference, October 2011, Glasgow, Scotland.

[50] University of Wisconsin – Madison, *On-Board Campus Bus Survey*, University of Wisconsin – Madison, Department of Transportation Services, 2012. http://transportation.wisc.edu/files/2012_BusSurveyResults.pdf

[51] Scherer M., Dziekan K., Bus or rail: an approach to explain the psychological rail factor, *Journal of Public Transportation*, Vol.15, No.1, 2012, pp. 75-94.