Relevant Studies to Public Transportation at an International Level

Alexandru BUGHEANU[1]

ABSTRACT

The present study examines the high interest for public transport research at an international level.

The main objective of the current paper is to present a series of effective models of improvement in term of overall quality or efficiency for the public transport system, as well as directly relevant research to the public network transport in Bucharest City.

The key findings of this study is that in order to improve the smooth functioning of a public transport network should be taken into consideration several fundamental issues: the transport operators, the network users and the quality of services.

It is particularly important that one of the main objectives for any public transport operators to be a constant interest for providing quality services, knowing the users' expectations and the continued development of the system in terms of its effectiveness and efficiency.

This paper examines the urban public transport of passengers as one of the effective solutions for reducing urban agglomerations and the extremely high number of private and personal vehicles used every day in large urban areas.

KEYWORDS: *Bucharest, efficiency, environment, impact, public transport.*

JEL CLASSIFICATION: *R40*

INTRODUCTION

Public transport is an area of significant importance in any developed society. Regardless of the degree of development of the private transport or use of personal modes of travel, individuals will not relinquish the use of the public network. The reasons are various and obvious: reduced costs per trip, lower risks of accidents, higher travel speed or extremely high accessibility, are just a few of the most highlights for public transport.

The specialized literature studies intensely the phenomenon of public transportation in various cities in the world, as it is an aspect that has a direct influence on the quality of users's life. The studies have mainly the aim to highlight the negative points of the different systems examined, in order to improve their efficiency and quality of the transport system as a whole.

This is one of the reasons for the following research on the public transport network of the Municipality of Bucharest.

---

[1] Ph.D. Student, Bucharest University of Economic Studies, alex.m.bugheanu@gmail.com

In the following paper will be presented a number of relevant conclusions aimed at public transport systems in general, studies on transport networks in different cities at international level and also research on the public transport network of the Municipality of Bucharest.

1. RESEARCHES RELEVANT FOR PUBLIC TRANSPORT IN BUCHAREST

A comprehensive research was realised by the (Transporters Union Bucharest, 2009) on sustainable public transport in Bucharest.

Sustainable urban public transport is an important part of social and public welfare and is closely connected with the daily life of citizens and social economic development, which is why it must be analyzed carefully.

The study was performed on a sample of 1100 people from all sectors of the city. Among significant results, we present the following: 44% of respondents declared themselves dissatisfied or strongly dissatisfied with the measures of Bucharest General City Hall on public transport. Also, 45% of respondents were dissatisfied or highly discontented about the quality of public transportation in general.

Finally, 35% of the respondents considered pollution a big problem of the public transport network.

Also, among the main problems reported by users have included the following: a deficient management for major boulevards, the lack of route optimization of transport routes and personal and private cars congestion.

Another eloquent study regarding public transport was conducted by (Androniceanu, 2011)**,** who proposes a very interesting and relevant study to the current research of urban transport. The author investigates public transparency in decision-making processes involving local authorities in the Municipality of Bucharest. This study examines the need and importance of citizen involvement in public decision-making, with direct influence on quality of life and every day activities for the participants in the social life.

The *Organisation for Economic Co-operation and Development* (OECD) defines three types of citizen involvement in the decision-making process from the public authorities:
   a) Provision of information to the general public;
   b) Consultation of citizens;
   c) The active participation of citizens in the decision-making process.

Author of the study conducted research to determine at what level these standards are met in Bucharest, analyzing the practical involvement of the community in decisions taken by local authorities.

Among the notable results of the research we consider relevant the following: only 50% of the survey respondents considered themselves informed about the actions and initiatives of public authorities; 46.66% of the participants are not satisfied with how the officials of public institutions facilitates access of information to the general public; only 23.33% of the participants in the study considers that the level of transparency of decision-making has improved after Romania's integration into the European Union in 2007.

This information is relevant for the present study because the public decisions on the public transport system is a category with a strong influence on citizens' lives in Bucharest.

In order to improve the overall quality of services for users, their opinion must be examined carefully by the state representatives, and the easiest way to achieve this and to obtain optimal results is the direct involvement of individuals in the decision-making process.

A very interesting comparison between public and private transport in was made by Linda Steg (Steg, 2003), Professor in the Department of Psychology at the University of Groningen, Netherlands. The author of the study, described from a psychological perspective why individuals tend to use more public transport.

The research was carried out with a study that involved 1803 Dutch respondents.

According to the researcher, environmental issues, social and economic pressure caused by the excessive use of private vehicles can be reduced in five ways:
a) Through technological innovations that improve the efficiency of cars, reducing gas emissions and noise pollution.
b) Using a new road infrastructure through the construction of new roads or adapting the existing ones in accordance with the new number of vehicles. This strategy would relieve urban congestion, but would affect the environmental and social problems.
c) Stimulation of individuals in order to use private cars at different times than peak hours.
d) Stimulation by public authorities for individuals to use public transportation methods by reducing private car use.
e) Legal regulations from the public authorities on the movement of private vehicles with a positive influence on increasing safety requirements and environmental protection.

The study was focused on the ways in which individuals can be motivated to use additional means of public transport. The research method involved the use of a questionnaire applied to a number of 1803 people with Dutch nationality, aged more than 18 years. The average age of respondents was 46 years old, and 64% of respondents is male.

Survey participants rated the level of attractiveness of public transport compared to the use of private cars by evaluating a total of 17 criteria. Among the issues examined were included: travel costs, average speed, comfort, traffic safety, independence and security, and so on.

It was also evaluated the importance of transport in general, the use of private cars and public transport for people participating in the study.

This paper describes in detail the psychological profile of individuals who use public transport and the main reasons why they choose public network.

In these conditions, were observed the following issues: female people, young people, individuals with a low budget and unmarried people-uses private cars less.

Contrariwise, male people, the elderly, those with high incomes, couples or families-uses private cars more.

Almost all aspects of personal car, less safety in traffic have been assessed positively by respondents.

On the other hand, public transport assessments are generally neutral or negative, with the exception of traffic safety.

Therefore, approached from the perspective of individual interests, public transport has a very significant competitor in private or personal cars.

This is why the author considers that public institutions should not increase the use of public transport through a forced reduction (public authorities' new regulation) of using the personal modes of transport, but by stimulating individuals to a selective use of personal vehicles and motivating them to use the public network as often as possible.

In addition, the authorities should examine which modes of transportation are common in favorites of users and encourage the use of those units in particular. Example: in the Netherlands, public transport by rail type is perceived favorably by users in comparison with bus transportation.

Another important conclusion of the research is that there are people who prefer to use private cars due to psychological reasons and cultural implications.

These people experience a sensation of pleasure through the act of driving a vehicle, control, freedom or even superiority over other individuals

For this reason, driving the car personally is rated higher as importance in the personal life of a citizen compared to the public transport system, in the case of individuals with a low frequency of use of the public transport network.

Stimulation by the public authorities of individuals to use public transport is not an easy task to accomplish. Especially for people who frequently use private cars.

Nevertheless, it should be a fundamental goal for any public institution within a major urban area.

2. RESEARCHES RELEVANT FOR PUBLIC TRANSPORT CONTEXT

David A. Hensher (Hensher, 2007) in his complex research on public transport analyzes a series of extremely interesting conclusions related to the new challenges of public transport networks worldwide. Among the most important challenges include the following:
- Public transport steadily loses market share;
- Traffic congestion worsens in major cities at international level;
- Citizens are becoming increasingly informed and expressed their disappointment concerning the management of public administration that fails to adapt the mobility system in accordance with the needs and expectations of users (Hensher, 2007).

In the author's conception of the study, one of the fundamental objectives of any public transport network is to protect the market share held, in the context of the increase ownership by individuals of private cars.

It is obvious that public transport cannot compete private or personal car in terms of comfort, privacy, flexibility or security, but public network has a series of exclusive advantages like: higher travel speed, reduced costs for trips or extremely high availability both in terms of routes and available or diversified schedules.

In support of this conclusion, the author presents a system for measuring the performance for the urban public transport network.

Furthermore, will be presented the main characteristics of this system: system inputs, technical efficiency, economical efficiency, services provided, services used and the overall efficiency of the system.

Any public transport operator should continuously analyze these variables and direct their actions in order to optimise the aspects identified as non-conforming or inappropriately in order to improve the overall condition of the system.

Various authors have studied the topic of urban transport in order to identify problems and possible threats that may affect both quantitatively and qualitatively the smooth functioning of the network. A detailed study was conducted on developing systems and methodologies to increase or improve the quality offered by public transit system in order to meet the high levels of user requirements.

In the study conducted by (Grotenhuis & Wiegmans, 2001), the authors primarily analyzed the importance given by users of information about traveling pattern, schedules or transportation modes provided by the public transport network. The main concept was named: *Integrated Multimodal Travel Information*-IMTI, representing an integrated information system for travelers of different types.

The main advantage of such a system is increasing interest from individuals for the public transport system. Information on travel can be classified into three types: static, dynamic, and real-time information.

Basically, the benefit of a system IMTI occurs when a user is forced to change the means of transport. In this case, real-time information on departure times, arrival, travel time or transit stations must be precise and with a high degree of accessibility.

Among the advantages of implementing a system IMTI type are:
- Time savings: the system processes a very wide range of information-difficult to analyze previously to the trip, and the availability of real time information during the journey.
- Reducing users' effort, who no longer need to worry about establishing a trip program.

Another research conducted by (Balcombe, et al., 2004) in the study on public transport services demand presents an extremely detailed guide on actions to be taken in order to improve a public transport network, guidance document for both national and local public transport operators or researchers interested in this field.

It is also analyzed the behavior of individuals both socially and psychologically. Changes in the behavior of users are due to complex reasons ranging from the variation or replacement of transport modes by the operators or changing the civil status of individuals (child, adult, married people, people with children, retired) to various stages of working life

(fluctuation of employment or study), purchase of personal vehicles or new lifestyles (increased emphasis on business or visiting the various attractions) or an orientation towards environmentally friendly transport.

According to the authors, the most intensively studied factor with influence on the demand for public transport is the cost of the trips. This is one of the most important issues for users because the effects of reducing or increasing tariffs can be observed and analyzed in real-time.

Likewise, (Liu & Jiang, 2012) investigated the importance of implementing a prioritization system for the public transport network - *Public Transportation Priority* (PTC) in Beijing, capital of China, a city with over 19 million inhabitants.

In the analysis period 2003-2011 the use of means of transport in the city of Beijing is presented in the table 1.

Table 1. The use of modes of transport in the city of Beijing

Transport Mode	Year								
	2003	2004	2005	2006	2007	2008	2009	2010	2011
Taxi & others	10.9%	10.4%	10.1%	10.5%	9.9%	9.3%	9.0%	9.7%	10.1%
Car	26.2%	28.1%	29.8%	31.6%	32.6%	33.6%	34%	34.2%	32.7%
Bike	34.7%	32%	30.3%	27.7%	23%	20.3%	18.1%	16.4%	16.3%
Public transport	28.2%	29.5%	29.8%	30.2%	34.5%	36.8%	38.9%	39.7%	40.9%

Source: adapted from (Liu & Jiang, 2012).

After analyzing the data in the previous table, is observed a tendency of increasing use of public transport, which last year exceeded 40% of all the transportation modes.

This is one of the reasons we have to analyze the phenomenon of public transport at an international level because the influences and effects of the transportation system on the users' quality of life are generally available.

Authors of the study investigated the elasticity of demand for public transport, depending on the tariff changes:
a) In these circumstances, in 2011, in the case of decreasing sales prices by 1%, the demand for public transportation would increase with 1.8938%. The result is that the price reduction strategies trips have a direct and immediate effect on increasing attractiveness of service for users.
b) The relationship between demand elasticity of public transport and non-motorized travel modes users is positive and substitution type. Thus, users of bicycles tend to move towards the use of the public transport network in the case of price reduction.
c) The relationship between demand elasticity of public transport and user with personal modes of transport is negative. Frequent users of private cars are not so receptive to reductions of costs relating to travel by public transport.

According to (Nunes & Galvão, 2014), the users of the public transport network can help improving the overall quality of the system. The authors conducted in 2014 a very modern research regarding the use of mobile devices and the Internet by the users of public transport system in order to improve and support the real-time information provided by the transportation network.

Scientists wish to highlight first of all, the significant importance of knowledge from every individual in relation to a particular route or mode of transport.

Secondly, it is important the way in which the transport operator can at the same time can reduce both operational costs and increase the accuracy of the information concerning the transport system.

These matters are possible if users choose to engage actively in providing a continuous feedback about the degree of their satisfaction travels, using mobile devices connected to the Internet.

This research is based on the hypotheses that in the current period, a very large proportion of the users of transport services have access to a mobile device, permanently connected to the internet, and they are able to constantly evaluates the services provided by the public transport network.

According to the authors it is evident that public transport service users wish to have access to real-time updates, regarding the modes of transport, timetables and travel costs. This raises the question whether public transport operators require detailed information on individuals' needs and expectations.

In these conditions, such details can be obtained in an efficient manner by using feedback from daily users.

Regarding the research of information through different studies conducted by transporting operators of on user requirements we observed a number of possible ways:
a) Methods of collecting information from passengers inside the modes of transportation. These methods are generally expensive and time consuming.
b) Questioning of passengers. This method is carried out on a sample of individuals in comparison with the total number of daily users of the network, and the results are extrapolated to a mass significantly higher mass of individuals, taking into account a coefficient of error of the study.
c) A method in which the study respondents have only a passive role in the research. In this method, the users provide answers only to the questions suggested and only at times when they are questioned, without having the chance to present their personal point of view.

The authors suggest using a type of crowd-sourcing methods to collect collective information. The main components of the proposed strategy are presented in the following paragraphs.

First component is the availability and willingness of the passengers from the public transport network to be involved voluntary in the study.

Another component is represented by the use of mobile devices connected to an Internet network.

The final part and the most important one is a web platform dedicated for collecting the information. This platform will address two distinct categories of individuals: representatives of the public transport system, to collect and analyze the information

received. The second component of the platform will be represented by the transport network users, who have the task to transmit the real-time information.

Under these circumstances the role of public transport users is extremely important.

The main premise on which this strategy is based is the accessibility of users to a wide scale of mobile devices connected to the internet. Individuals are able in this case to receive and send information in real time, at any time and in any location.

Basically, passengers must assume their availability to provide real-time information regarding the quality of transport services, but also to validate the information provided by other users in order to certify their value for the transport operators.

Moreover, an increased attention should be paid to structuring the relevant information.

The main challenge for the implementing a project of this type is how much data and information received from passengers can be administered by the web platform.

Thus, the authors propose that the information should be structured after a series of criteria.

First of all, time and location, so that information be considered relevant and useful to the other participants in the transport process, first it must being complete. Example: for a traffic incident, is necessary to specify the location and time of happening.

Also, in case of overcrowding during peak periods, it is necessary that the information submitted to be as detailed as possible to increase their relevance to other users.

Secondly, information must be submitted in real time, to facilitate the decision making processes of other users. Thirdly, distribution of information on a series of categories on distinct aspects of the transport network: possible urban congestions, traffic incidents, failure to compliance with the hourly schedules, transportation modes problems, etc.

The final component of the project is to stimulate and to motivate public transport users in order to participate in this project.

In order to promote receiving feedback from users, public transport operators should not just wait voluntary initiatives from the users.

It is appropriate to identify a number of ways to stimulate positive the passengers in order to obtain long-term opinions from them.

In this way, individuals who have actively participated in the campaign of gathering information may be rewarded under different methods: discounts on individual subscriptions for public transportation; various discount vouchers to purchase new subscriptions or tickets; vouchers that can be used at different operator partners, etc.

Researchers have realized through the present case study a prototype of a mobile service that enables the exchange of information between users of public transport and an online platform owned by transport operators.

This platform was implemented and tested in London, United Kingdom. Using an application installed on mobile devices connected to the internet, passengers can provide

information about their present location, transport routes or personal opinions regarding the quality of services provided by the transport operator.

Also a very important aspect of the platform is the fact that users can communicate with each other and offer reviews of the transport modes or evaluate the overall quality of the trip.

In order to stimulate the passengers' participation, the public transport operator implemented a promotional points system based on the number and quality of responses/feedback from individuals, points which can be used to purchase various rewards.

The prototype model used by the authors proved the willingness of the system users to provide feedback on the overall functioning of the public transport system.

In the future the researchers wish a long-term cooperation with the transport operator representatives in order to achieve a large-scale platform of accumulation of data and information on the quality of services provided to individuals.

(Tennoy & Oksenholt, 2014), analyzed the direct consequences in terms of transport and environment in the event of developing 12,500 new jobs in the region Bjorvika, near the *Central Station* of transport in Oslo, in comparison with the layout of the new jobs in downtown Oslo.

The research was conducted under a project developed by the *National Norwegian Agency of Transport.*

The main objective of the study was to identify and analyses the implications on the use of private cars and public transport usage for various alternative in the case of developing new jobs.

A second objective was that the current investigation should represents a relevant study for other public administrations or urban developers in different cities at international level.

Regarding, the methodology used the study involved identifying the differences in terms of urban traffic volume, traffic behaviors and consequences of public transport in the conditions of distribution of jobs in the suburban region, Bjorvika, in comparison with the distribution in Oslo city center, a city with a stable population of around 600,000 inhabitants.

The authors used statistical data provided by the *Norwegian National Institute of Statistics* on the National Census of 2009 referring to the behavior of individuals in terms of public transport. The study was conducted on a sample of 1065 individuals that used different methods of transportation to get to their jobs located in Oslo.

The city of Oslo have been divided into five major geographical areas as follows: Oslo West, East, South, the area near the city center (inner city) and downtown. Each zone was analyzed individually.

Following the research was obtained the following general information:
- The market share held by the public transport network is 39%;
- Travels with personal or private cars represent 36%;
- Travels to work without using a mode of transportation-"pedestrians" represent18%;
- Journeys by bicycle represents 7% of the total trips.

Subsequently, were calculated the average distances travelled by individuals to reach their jobs in the region Bjorvika, located near the Central Station in Oslo, and compared to the distances covered to the workplaces in downtown Oslo (see Table 2).

Table 2. Average distances travelled with public transport or private/personal cars

Average length of trips	Number of kilometers	Oslo City centre	Oslo, average
Per workplace (car)	386	3.7	12
Per workplace (public transport)	446	21.2	11.4

Source: adapted from (Tennoy & Oksenholt, 2014).

In these circumstances the authors were able to calculate the possible effects for the location of the new jobs in both alternatives (see Table 3).

Therefore, in terms of the integration of new jobs in the region Bjorvika, can be avoided:
- Approximately 1.7 million car trips to downtown Oslo;
- About an additional 24 million kilometers traveled annually by vehicles that would pass through the city Oslo;
- Over 2800 tons of annual CO_2 emissions;
- A power consumption of about 4GWh per year.

Table 3. Consequences and effects on urban transport

Saved/Prevented	Per day	Per year (230 work days)
Car trips	7300	1.7 million
Traffic volumes (km)	104000	24 million
CO_2	12 tonnes	2800 tonnes
NOX	0 kg	5 tonnes
NO_2	7 kg	1.5 tonnes
Energy use	18 MWh	4 GWh

Source: adapted from (Tennoy & Oksenholt, 2014).

In conclusion, the assumptions concerning the arrangement of workplaces in the near the Central Station of Transport are much more favorable in comparison with their location in a manner similar to present at the time of completion of the research–Oslo downtown.

CONCLUSIONS

The findings of this paper demonstrate that increasing global use of private cars generate a very diverse range of issues with negative impact on the environment, both at social and economic level.

Furthermore, the aspects related to the urban environment are in close connection with the quality of life of individuals, which is why public authorities should pay extra attention to ensure services at the highest levels of quality.

In this circumstances, an efficient public transport passengers system is one of the solutions to reduce urban congestion and the extremely high number of private cars.

However, public transport must be able to attract in addition to the „captive users" a significant share of the classics private car users.

Thus, it is necessary that the services provided by transporting operators to be at a very high-level in terms of quality and efficiency.

REFERENCES

Androniceanu, A. (2011). Transparency of the Romanian Local Public Administration. *Administration and Public Management* , 33-45.

Balcombe, R., R.Mackett, Paulley, N., Preston, J., Shires, J., Titheridge, H., et al. (2004). *The demand for public transport: a practical guide.* TRL Limited.

Grotenhuis, J.-W., & Wiegmans, B. W. (2001). The desired quality of integrated multimodal travel information in public transport: Customer needs for time and effort savings. *Transport Policy* , 27-38.

Hensher, D. A. (2007). *Bus Transport: Economics, Policy and Planning.* Oxford, United Kingdom: Elsevier Ltd.

Liu, M., & Jiang, Y. (2012). An Elastic Analysis on Urban Public Transport Priority in Beijing. *Procedia - Social and Behavioral Sciences* (43), 79-85.

Nunes, A. A., & Galvão, T. (2014). Urban public transport service co-creation: leveraging passenger's knowledge to enhance travel experience. *Procedia. Social and Behavioral Sciences* , 577-585.

Steg, L. (2003). Can public transport compete with the private car? *IATSS RESEARCH, 27* (2), 27-35.

Tennoy, A., & Oksenholt, K. V. (2014). Transport effects and environmental consequences of central workplace location. *Transportation Research Procedia* , 14-24.

Transporters Union Bucharest. (2009). Sustainable public transport in Bucharest. Bucharest.