THE QUALITY OF AN URBAN PUBLIC TRANSPORT SYSTEM AS PERCEIVED BY THE USERS

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1. INTRODUCTION

The use of Public Transport (P.T.) in urban areas nowadays is not at desirable level since in most of the cases, people prefer to use their own cars, even for small length trips and this fact produces a large number of traffic and associated environmental problems. In many countries, the use of Public Transport is reduced during the last decade due to various reasons (e.g., insufficient Public Transport systems, excessive use of private cars, lack of demand management measures in central areas etc).

Many efforts have been made by the Authorities in order to change the modal split in favor of Public Transport, and to increase the quality of services offered by the P.T. system. These efforts include frequent and more reliable bus services, and also the introduction of bus priority measures, of new environmental friendly vehicles, of passenger information systems, of mini bus services etc. They also include the construction of new infrastructure like metro lines, tram lines, light rail lines etc.

The modernization of the Public Transport system and the improvement of its quality also include the formation of an integrated market-oriented policy and the necessary changes in the existing legislative framework. The quality in the Public Transport domain has to do with a large number of parameters (e.g., comfort, bus frequency, area coverage etc.) and it differs when considering the point of view of the operator and of the Public Transport user.

Many surveys have been conducted in order to identify what people really expect from a public transport system, and which are the main reasons according to their opinion for not using the P.T. system. Quite often, people have been asked, in the framework of such surveys, to define their expectations concerning the quality that a modern P.T. system must offer in order to be competitive with private car.

Finally people have been asked to make recommendations, suggestions and proposals for the necessary quality improvements of the P.T. system. The experience gained so far from various cities in Greece show that, although many measures were implemented in order to promote the use of public transport in urban areas, modal split is not significantly changed over the past years.

The aim of this paper is to examine the quality of urban public transport systems as perceived by the users, taking into account the results of extensive home-based mainly, questionnaire surveys in various cities (e.g., Thessaloniki, Larissa, Trikala, Migdonia). At the same time, the existing public transport systems in these cities, their quality parameters and the measures taken in order to improve P.T. competitiveness are examined and discussed. The overall objective is to relate people needs and preferences with the actual P.T. policies and measures which are implemented and to identify "gaps" between these two parts.

2. CHARACTERISTICS OF THE PUBLIC TRANSPORT SYSTEM IN GREEK CITIES

The first city which was examined is the city of Thessaloniki with a population of around 1 million inhabitants. Public Transport system in the city is operated by the Public Transport Organisation of Thessaloniki (OASTh) which actually is the only urban bus operator in the area. OASTh nowadays daily operates 52 bus lines and possess a fleet of a total number of 488 buses, of which 203 buses are articulated with a capacity of 150 passengers, and the rest 285 buses are common buses with a capacity of 80-100 passengers.

Fares are at the price of almost 0.3 euros with the exceptions of the connection of the city with suburban areas where fares vary from 0.3 to 0.5 euros. The fare collection system is partly based on the use of "printed in advance" tickets and also on the use of special cards. Bus service on weekdays and Saturdays begins at 04:15 and finishes at 01:35 while on Sundays bus service begins later and finishes earlier than the other days.

Scheduled bus frequencies vary from 3-4 minutes at bus lines with high occupancy rates, to 30-45 minutes at bus lines with low occupancy rates. Based on the findings of a study concerning the reformation of the bus system in the city, the commercial speed of buses varies between 7 and 12 km/h for the year 1988 along the central road axes (Egnatia, Tsimiski, Mitropoleos), while in the rest of the city road network the commercial speed varies between 13 and 25 km/h for the same period.

The main terminals at the city center are found at Dikastirion Square, at Eleftherias Square and at the New Railway Station. Recently there has been a plan to remove the Dikastirion Square terminal (which is found next to Egnatia Str., one of the main arterial streets of the city) in order to avoid congestion and environmental impacts in the city center and to implement the measure of buslane in Egnatia Str.

The removal of all terminals from the city center will improve the traffic conditions in this area and will also improve the reliability of the Public Transport system. It is important to mention that, in order to improve the Public Transport system in the city, a metro system of a length 9.2 km will -at first stage- serve the central and eastern part of the city. The construction of the metro system will start within the year 2001. The use of minibuses are also proposed within the framework of the General Transportation Study

mainly for connecting the various residential and commercial zones of the city center with the area of the old city.

Long term plans also include the construction tramways in the city. Finally the introduction of sea cost transportation has been proposed for connecting the central with the eastern part of the conurbation. Bus priority measures have been implemented in the city in order to improve the efficiency of the Public Transport system. More specifically, the introduction of buslanes in the central area of the city (Mitropoleos Str., Tsimiski Str., Vas.Olgas Av.) led to the increase in the speed of buses, which varies from 49% to 219% in the case of Mitropoleos Str., and from 10% to 15% in the case of Vas.Olgas Av. The implementation of buslanes has positively affect the quality of the environment. Recent results in Athens show a significant improvement in the air quality when an extended buslane system was examined in comparison with the “do nothing” scenario.

The use of telematics will also be introduced in OASTh and there is an ongoing project for the use of an automatic vehicle location (AVL) system. It must also be mentioned that a passenger information system was designed for OASTh within the framework of the research project Eurobus in order to improve the attractiveness of the Public Transport system. The variation of the characteristics of the Public Transport system in Thessaloniki during the period 1988-98 is presented in Table 1.

Table 1: Characteristics of the Public Transport system in Thessaloniki (1988-98)

Public Transport system characteristics	1988	1998
Total number of buses	488 (173 articulated)	488 (203 articulated)
Number of bus lines	49	52
Total number of tickets	88.151.460	-
% trips made by bus	36,4%	27,5%
Commercial speed at main central arterial streets	7,0-12,0 km/h	
Commercial speed at the rest of the city road network	13,0-25,0 km/h	16,9 km/h
Average journey time (typical weekday)	-	38 minutes
Extended buslane system	No	Mitropoleos Str., Tsimiski Str., Vas.Olgas Av.
Increase of average bus speed after the implementation of bus lanes	-	from 7,8 to 11,8 km/h at Mitropoleos Str. + 10-15% at Vas.Olgas Av.

The number of tickets for the year 1988 does not represent the total passenger trips because passengers had a free access to buses during the morning peak (05:00-08:00). Passengers who are using buses at that period

are estimated to be 20% of the total tickets. Additionally, free card holders represent a percentage of 15% of the total number of tickets.

Due to the structure of the road network in the city center, most of the bus lines necessarily pass through 3 main roads (Egnatia, Tsimiski, Mitropoleos). In Table 2 the number of bus lines using the above mentioned road axes for the years 1988 and 1998 are presented.

Table 2: Variation of bus lines pass through the main central road axes

Central road axes	number of bus lines in 1988	% of the total bus lines	number of bus lines in 1998	% of the total bus lines
Egnatia (two way st)	34	69,4%	28 - 32*	53,8-61,5%
Tsimiski (one way st)	8	16,3%	12	23,1%
Mitropoleos (one way st)	5	10,2%	8	15,4%

*bus lines in each direction

The average running speed and journey speed for the peak and off peak period for the year 1987 at the main arterial streets of the city are presented in Table 3.

Table 3: Average running speed and journey speed (peak and off peak hours for the year 1987 at the main arterial streets)

	Mean running speed during peak hour (km/h)	Mean running speed during off peak hour (km/h)	Mean journey speed during peak hour (km/h)	Mean journey speed during off peak hour (km/h)
Parts of the Egnatia road axis				
Helexpo-Aristotelous Sq.	14,2	21,3	12,4	17,4
Aristotelous Sq-Dimokratias Sq.	9,2	15,3	8,1	12,9
Parts of Lagada road axis				
Oreokastro - Gefira	24,7	20,6	9,5	20,4
Gefira - Dimokratias Sq.	4,1	33,0	20,4	28,1
Parts of Monastiriou road axis				
Dimokratias Sq.-Railway St.	44,9	65,5	33,8	44,1
Railway Station-EKO refinery	23,1	32,7	21,6	31,8

Three case studies were also taken into account in this paper, as typical examples of small and medium size cities. The first one is Migdonia, which is found in the Thessaloniki greater area, has a population of 5.965 inhabitants (year 1991) and is strongly depended on Thessaloniki. The second one is the city of Trikala, which is found in central Greece and has a population of 44.991 inhabitants (year 1991). The third one is the city of Larissa, also found in central Greece and with a population of 110.116 inhabitants (year 1991).

Migdonia, due to its small population size, does not have a Public Transport system, and therefore the connection with other areas is based on the use of the local interurban bus system (known as K.T.E.L.). The main problem –as in most of the cases of small cities– is the connection with major urban centers (e.g., with Thessaloniki). The average bus travel time to Thessaloniki is approximately 35 minutes with a number of 19 daily service routes. The existing Public Transport system needs improvement and the possibility of an extension of the public system of Thessaloniki up to Migdonia is proposed.

In Trikala, there is a bus operator (K.T.E.L.) with 23, mainly old, buses connecting the city center with more than 25 small villages in the greater area (1.834.820 tickets in year 1999). Only a small portion of the city inhabitants prefer to use buses due to a number of reasons including, among others, the following: low bus frequency, expensive fares, small length of trips, lack of traffic demand management measures in the central areas which promote the excessive use of passenger cars, large number of trips made on foot and by the use of two-wheel cycles even though there isn't any adequate infrastructure to support these modes (e.g., bikeways, pedestrian streets).

In Larissa, buses belong to local K.T.E.L. which operates 13 lines, 5 of which are main bus lines serving the Larissa Metropolitan Area. Bus lines are of excessive length and they pass through the city center, thus producing many traffic and associated environmental problems. Problems concern the insufficient connection of discrete land uses (e.g., railway station with interurban bus terminal). There are two bus lanes in the city network but there is need for new ones. The city is surrounded by a number of villages, belonging to Larissa greater area, which are also connected by bus to the city center.

The use of Public Transport system nowadays, expressed as a percentage of the total number of daily trips, is 12.9% in Migdonia, 10.5% in Trikala and 12.3% in Larissa. The respective figure in Thessaloniki is 36.4% (year 1988) and 27.5% (year 1998). Therefore, the use of Public Transport in small and medium size cities is less than half of the respective use in large cities in the country.

This happens due to a variety of reasons, including the level of service of the local Public Transport systems, the usually short distances to be traveled by the citizens, the existence of alternative means of transport like bicycles or walking etc.

3. RESULTS OF THE QUESTIONNAIRE SURVEYS

Having described the characteristics of the Public Transport system in the four examined cities, it is therefore interesting to go through the results of specially designed questionnaire surveys which were conducted in these cities. The aim of these surveys is to identify people's opinions, preferences and proposals concerning the Public Transport system in their areas.

In the case of Thessaloniki the opinion of the city residents about the level of service offered by the Public Transport system during the period 1988-98 is presented in Table 4. These results were based on extensive home based questionnaires surveys carried out in the year 1988 (9237 questionnaires) and in the year 1998 (3326 questionnaires).

Table 4: Level of service of the Public Transport system as considered by the public in Thessaloniki during the period 1988-98

Year / Level of service	1988	1998
Satisfactory	7.2 %	20.4 %
Need for small improvements	19.3 %	18.2 %
Need for substantial improvements	49.2 %	34.1 %
Unacceptable	24.3 %	27.3 %

As shown in this Table, during the period 1988-98 there is an increase in the number of people who believe that the level of service of the Public Transport system is satisfactory or quite satisfactory. On the contrary, the percentage of people using Public Transport is decreasing during the same period as previously mentioned. Even though, it seems that bus priority measures introduced in the city during this period seems that they do not seriously affect modal split in favor of Public Transport.

Significant improvements in the Public Transport system of Thessaloniki took place during the period 1988-98 (e.g., renewal of the bus fleet, introduction of bus priority measures, changes concerning the operation etc.). These improvements seem to be apprehensible by the public and that is why such results appear in Table 4.

The reduction in Public Transport use during 1988-98 must be explained by the existence of a number of factors, exogenous to the Public Transport system. One of these factors is the private car ownership index which was increased from 177 private cars per 1.000 inhabitants (year 1988) to 253 private cars per 1.000 inhabitants (year 1998) in the city. Another factor is the intense housing development in suburban areas which are found at a long distance from the city.

The new model of urban life, which is associated to the previous two factors, also affect people's attitude towards the Public Transport system. The situation will be improved in favor of the Public Transport when there will be a stabilization in the evolution of these factors (e.g., the private car ownership will reach the average E.U. numbers, land reserved for housing needs will be diminished) and also when new railway Public Transport modes will be introduced in the city.

In Table 5 the necessary improvements for the Public Transport system in Thessaloniki as proposed by the users in the survey of 1998 are presented. Also, in Table 6 the hierarchy of the necessary improvements of the Transport System of Thessaloniki according to the public is presented for the same

year.

Table 5: Necessary improvements for the Public Transport system in Thessaloniki as proposed by the public

Points of improvement	Given priority by the public					
	1st		2nd		3rd	
	Q*	%	Q	%	Q	%
Reduction in travel time	423	16,6	408	16,1	484	19,2
Reduction of waiting time at bus stops	1.174	46,2	610	24,1	247	9,8
Too many passengers on bus	500	19,7	750	29,6	460	18,3
Shorter distance between bus stop and origin/destination	66	2,6	94	3,8	117	4,7
Lack of information at bus stops or inside the bus	74	2,9	133	5,2	175	7
Vehicle condition	24	0,9	76	3	124	4,9
Reduced number of bus transfers	41	1,6	68	2,7	115	4,6
Better personnel behavior	63	2,5	117	4,6	216	8,6
Infrastructure for people with special needs	58	2,3	97	3,8	194	7,7
System for fare collection	14	0,5	42	1,7	68	2,7
Bus priority measures	106	4,2	138	5,4	315	12,5
Total	2.543	100	2.533	100	2.515	100

*Questionnaires

It is important here to notice that more than 46% believe that the first priority in order to improve the quality of the Public Transport system is the reduction of waiting time at bus stops. The reduction of travel time together with the reduction in the number of passengers in every bus appear to be of great importance for the public. Other improvements like the provision of information, the reduced number of transfers, better personnel behavior etc. seems that they are of low priority for the users.

It must be mentioned here that the measures implemented in the city network towards the improvement of the level and the quality of service of the Public Transport system include bus lanes, provision of information at bus stops, new buses and advanced fare collection systems. From these measures, only the bus lanes which practically meet the basic requirements of the public, since they could lead to the reduction of travel time and to the reduction of waiting time at bus stops.

According to the results of a stated preference survey which took place in Thessaloniki in 1994 in the framework of Eurobus project, the most important

reason (Public Transport users) for using Public Transport was the trip cost, while for the non Public Transport users was the time. Responders who were Public Transport users would be prepared to pay up to 0,07 Euros extra on the bus fare to achieve time gains of five minutes on average.

Table 6: Hierarchy of the necessary improvements of the Transport System of Thessaloniki according to the public

Improve-ment points	Given priority by the public									
	1st		2nd		3rd		4th		5th	
	Q*	%	Q	%	Q	%	Q	%	Q	%
Road network	1036	32,6	746	23,5	625	19,7	451	14,4	300	9,6
Pedest. facilities	323	10,2	432	13,6	669	21,1	934	29,8	786	25
Parking facilities	734	23,1	945	29,8	597	18,9	394	12,5	482	15,4
Environ. quality	371	11,7	413	13	581	18,4	796	25,3	976	31,1
P.T. system	712	22,4	639	20,1	693	21,9	565	18	595	18,9
Total	3176	100	3175	100	3165	100	3140	100	3139	100

*Q : Questionnaires

According to the results presented in the above Table, almost one out of five people consider the improvement of the Public Transport system as an essential step towards the overall improvement of the transport system in the city (considering all priorities, from 1st to 5th).

There was another questionnaire survey which took place in 1994, in the eastern part of the Thessaloniki center. The categorization of the sample of this specific survey includes 75% employees in the study area, 13% people passing through the study area, 6% visitors and 6% residents. The 25% of the people stated that they use public transport for their trips (the percentage is in the area of 40% when considering only the visitors). During this survey, shopkeepers have been asked to put on a scale (from one to five, one being their first choice) their preferences considering what is the most important action in order to improve commercial activity in their area. In the following Table 7 these results are presented.

Table 7: Results of the survey concerning the shopkepers in the eastern part of the Thessaloniki city center

	1st priority	2nd priority	3rd priority	4th priority	5th priority
Improvement of the P.T system	22%	17%	4%	31%	21%
Improvement of the environment	20%	18%	10%	18%	28%
Improvement of traffic	14%	28%	34%	16%	11%
Improvement of parking	12%	22%	25%	19%	20%

Improvement of pedestrian facilities	27%	14%	22%	11%	16%
No answer	5%	1%	5%	5%	4%

According to the results presented in the above Table, the second choice of the shopkeepers is the improvement of Public Transport (when considering their first priority). Therefore, it seems that they consider Public Transport as the second basic parameter related to the improvement of the commercial activity in their area (after the improvement of the pedestrian facilities). The provision of parking is of low priority (as their first priority) although the absence of parking places in the city center is more than obvious.

One can say that shopkeepers are in favor of Public Transport and pedestrianization schemes in their areas believing that if someone could provide these two facilities, then an increase in the commercial activity could be expected. When considering the total number of questionnaires (visitors, employees etc.) the improvement of the Public Transport system reaches 21% (again in the second place after the improvement of the conditions for the pedestrians).

It is very interesting to mention at this point that drivers and passengers of private cars have the improvement of the Public Transport system as their first choice (26%) although they are not Public Transport users, while at the same time they have the improvement of the traffic conditions as their last choice (12%). On the contrary, Public Transport users and pedestrians have the improvement of the Public Transport system as their third choice (18%), after the improvement of the environment and parking conditions, although they are Public Transport users.

Concerning the three case studies which were taken into account, as typical examples of small and medium size cities in the country, similar questionnaire surveys were conducted. In Migdonia 1069 questionnaires were completed (April 2000), in Trikala 1396 questionnaires (October 2000) and in Larissa 2938 questionnaires (May-June 1997). The reasons for not using the public transport system in each city are presented in the following Figure 1 (rank in order of preference, “1” being the lowest, “ 9” being the highest).

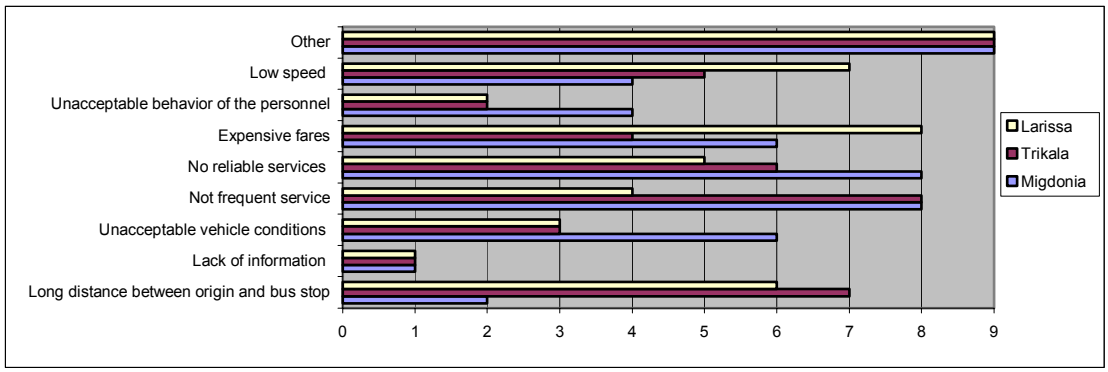

Figure 1: Reasons for not using the public transport system in Larissa, Trikala and Migdonia (ranking 1-9)

Concerning the reasons for which people do not use the public transport system in the existing situation in the three cities, “lack of information” together with the “unacceptable behavior” of the personnel of the public transport system is of low priority in all cases. On the contrary, the reason “other” (e.g., possession and use of passenger car) is proved to be an important factor. It must be pointed out that priorities in these cities have to do with the fact that the organization of the Public Transport system at first needs improvement at its basic components. For example many areas in these cities are not currently served by the Public Transport system.

The proposals for the improvement of the public transport system in the three case studies (rank in order of preference, “1” being the lowest, “9” being the highest) as expressed in the questionnaires are presented in the following Figure 2.

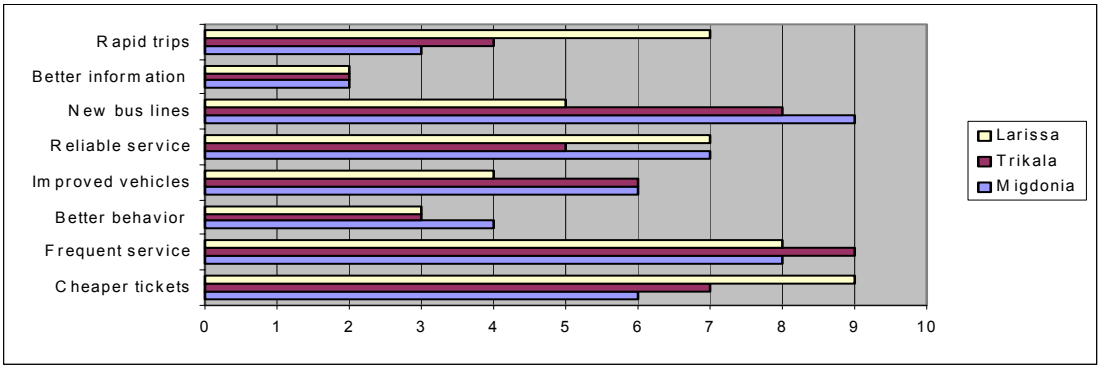

Figure 2: Proposals for the improvement of the public transport system (ranking 1-9)

The proposals “cheaper fares”, “frequent service” and “new bus lines” appear to be at a high priority in all three case studies. What is important here to see is the fact that in small and medium size cities, cost plays an important role in people’s preference for choosing a transport mode and the same applies to the factor of “frequent services” and “new bus lines”. This can be explained because in these cities, buses usually serve the villages in the greater city area, thus producing larger trips duration and lower frequencies.

4. CONCLUSIONS

The introduction of bus lanes in Thessaloniki led to an overall improvement of the bus system operation. The need for the extension of this measure is essential and feasibility studies were made for other arterial streets in the city. The reformation of the bus network is a precondition for these future plans. Therefore emphasis is mainly given to bus priority measures, something that people seems to prefer, in the sense that they ask for reduced waiting time at the bus stops and also for reduced travel time.

Other measures like the provision of information at bus stops or the use of advanced payment systems play a less important role, according to the public, in the effort to improve the quality of public transport system. Other parameters like the introduction of new technologies for buses like small electric buses, or compressed natural gas (CNG) buses which result to an overall improvement of the air quality of the city also seems that they are not of so great importance for the public.

Shopkeepers in large cities like Thessaloniki, seems to believe that improved Public Transport systems together with properly designed pedestrianization schemes could led to an increase in the commercial activity in their areas.

Finally, in smaller cities people pay attention to the cost of travel, to the frequency and to the new bus lines. Proposed or implemented measures in these cities include the introduction of bus priority measures and the introduction of new lines served by midi buses. These measures seem to satisfy people's demands at a great proportion. Reduction in fares is not a possible option for the bus operators in these cities since they usually face economical problems even with the existing level of fares.

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