URBAN TRANSPORT MANAGEMENT AND CUSTOMER PERCEIVED QUALITY: A CASE STUDY IN THE METROPOLITAN AREA OF CAGLIARI, ITALY

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Abstract

Liberalization processes and the threats posed by ever increasing competition have forced public transport companies in Italy to pay a closer attention to their customers, so to enhance loyalty and demand for transport. These customer-targeted strategies have been responsible for some significant changes of otherwise consolidated practices, in an attempt to lure new transit riders and discourage potential competitors from entering local markets. The present study describes the results of an on-board survey implemented within the Cagliari's metropolitan area and aimed at discovering the degree of perceived quality toward the offer of public transport managed by CTM S.p.A, the local transport agency in charge for the planning and management of public mobility around the Sardinian' regional capital. The research focuses on the implementation of an Impact Score methodology which, following the suggestions included in the Transit Cooperative Research Program Report n°47 (1999), assesses the degree of perceived quality with reference to ten core attributes of the public transport. The survey results show a substantial lack of structural problems and a high level of perceived quality, although some attributes need to be addressed if CTM aims to preserve and strengthen the central role so far enjoyed.

Keywords: Public transport quality, Impact Score, Bivariate Correlation Analysis, Customer Satisfaction.

1. INTRODUCTION

Public utilities management in Italy has been traditionally characterized by the presence of several monopolies closed to external competition. However, mainly as a result of changing European regulations, the Italian market underwent some radical adjustment since the early 2000's. Liberalization processes have been implemented quite efficiently in some sectors such as telecommunications and

electricity (Pacifico, 2006), whilst in others the Italian reforms have lagged behind the majority of other Western European countries. The liberalization applied to the local transport sector fall amidst the latter, having resulted in a plethora of publicly owned societies still largely sheltered from the perils of competition.

Furthermore, the funding of local transport agencies has often been based on parameters such as number of km travelled, rather than passengers carried and/or quality of the service provided. These negative elements have originated from the Italian set of rules on local public transport, which has posed an exaggerate focus on the quantitative supply of transport services rather than the efficient satisfaction of the demand. This, in turn, has frequently produced a scarce attention to customers' needs and requirements. In spite of the drawbacks associated to the afore mentioned managerial and funding criteria (namely reduced efficiency, increased operating costs, limited propensity for innovation, lack of quality and so on) some local transit agencies have proved to be able to achieve and sustain important qualitative standards whilst developing sound budgetary policies. The two issues of high qualitative standards and costs rationalization have become increasingly pivotal for local public transport agencies in Italy, given the (albeit slow) shift from a concession to a competitive tendering system.

This study shed some light on the results of an on-board customer satisfaction survey conducted in July 2010 and aimed at discovering the customers' perceived quality of the transport service provided within the Cagliari's metropolitan area. The research has benefited from the application of a modified Impact Score methodology, following the suggestions comprised in the Transit Cooperative Research Program Report 47 (1999). The implementation of this technique has enabled to identify the main qualitative criticalities as perceived by the usual beneficiaries of the local transport service.

2. LITERATURE REVIEW

The public services liberalization process, started off by the EU in the late 1980s, has been characterized by a significant degree of unevenness among the several sectors involved. Air transport and telecommunications (to name a few) have been quickly and fully opened to the market, whilst in other areas the same process has been implemented at slower paces. Despite these differences, it can be affirmed that the deregulation process has radically reshaped companies' structures and managerial approaches to the market among public services operators. Mergers and acquisitions, internationalization and diversification processes and, significantly, some failures have revolutionized a sector once monopolistic and stubbornly close to competition.

Besides strategic issues, the organizational changes have also determined a renovated interest toward customers' needs and expectations, far too long neglected during the monopoly era. Big companies have started competing in order to retain existing clients and acquiring new ones, with policies based on prices, enhanced quality and innovation often used to increase market shares or enter new markets.

In line with this general trend, local public transport companies have increased their attention on quality and customer satisfaction (Fonseca et al., 2010; Morfoulaki et al., 2007). Developing sound and customer focused approaches in planning and designing public transportation is now considered pivotal in triggering off demand growth phenomena and enhancing customer loyalty both in developed and developing economies (Cunningham et al., 1996; Andeleeb et al., 2007; Ali, 2010). This, in turn, involves the correct identification of those attributes more strongly related to the formation of the perceived transport service quality by current and potential users. Indeed, it has been shown how an enhanced positive perception on public transport might lead (especially infrequent) car users to shift from private to public modes of transport (Steg, 2003). Factors such as perception of service quality and customer satisfaction have been found to profoundly affect the degree of loyalty toward public transportation (Webb, 2010). A happy customer is, unquestionably, less likely to switch to other modes of transport.

Among the attributes linked to overall customer satisfaction, the punctuality/reliability of the service (König, 2002), the quality of information provided both at bus stops and through interactive tools (internet, mails), the kindness and helpfulness of personnel have been highlighted (Eboli and Mazzulla, 2007; 2009). In addition, levels of service (a proxy for quality) more in line with the requirements expressed by the bus passengers have been argued to enhance public transport usage and, potentially, increase the amount of ridership (Beirao and Sansfield Cabral, 2007).

However, as pointed out in some studies (Friman, 2004; Friman and Felleson, 2009), the relationship between satisfaction and quality is far from being perfect, as sometimes the higher the quality of the service provided is the more likely the cases of dissatisfaction are. In spite of the cited literature it has to be noted how there is still a relative limitedness of studies on perceived quality and customer satisfaction. This feature is partly responsible for the lack of a substantial consensus over the main determinants of satisfaction/dissatisfaction in public transport. Furthermore, it reflects the reluctance of several transport companies to make publicly available the results of their internal customer satisfaction analysis.

3. STUDY AREA AND METHODOLOGY APPLIED

The present research is the result of an on-board survey carried out within the Cagliari's metropolitan area between July 14th and July 28th, 2010. The area of study is comprised of 8 communalities spread out on 480 km2 and is home to over 330.000 people, roughly corresponding to 20% of overall Sardinian population. CTM S.p.A., the local transport agency responsible for managing the supply of public transport, has a fleet of 273 buses and 33 trolleys deployed on 29 urban lines and employs around 765 people (bus drivers and administrative personnel)[1].

The survey consisted of a series of direct interviews conducted with on-board customers, whilst the representativity of the data collected was ensured by the design of an appropriate sampling plan for each of the 29 lines which make up the Cagliari's public transport network. The on-board methodology was chosen because of its advantages, namely: the reduction of non-response biases, the possibility to obtain a representative sample of transit riders, the relative likelihood for the surveyor to work in a safe environment and so on.

Overall, this phase resulted in the collection of 1857 valid questionnaires out of 2200 contacts established, with a level of confidence of 95%. The questionnaire was broadly divided into three parts: 1) Socio-demographic analysis (age, education, gender and so on); 2) Origin-Destination patterns; 3) Customer Satisfaction analysis. The part of the questionnaire related to the customer analysis was comprised of an independent variable, the overall degree of satisfaction, and the 10 dependent variables, the attributes investigated (see Table 1). For each of these attributes, the interviewed were asked to provide a vote ranging on a 1 to 10 scale and based on their recent personal experiences.

TABLE 1 - SERVICE QUALITY ATTRIBUTES

Service Attributes	
Proximity of bus stops	Bus drivers' ability to drive safely
Boarding-alighting ease	Bus drivers' behaviours (while on duty)
Service frequency	On-board cleanliness
Service reliability	On-board comfort
Route characteristics	On-board security (against crimes)

Source: Authors' adaptation on TCRP Report 47 (1999)

The authors reckon that a higher number of attributes examined might have provided more comprehensive results, but the on-board nature of the survey and the length of the interviews implied

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[1] www.ctmcagliari.it, accessed on 30 September 2010.

significant time constraints that have led us to focus on the ten above-listed attributes, in view of the applied character of the research. Furthermore, recent studies on public services quality have produced meaningful results regardless of the number of attributes investigated (Lazim and Wahab, 2010). The choice of the attributes to examine has been made considering their coherence with some of the 10 service quality determinants identified within the TCRP Report 47 (1999), namely: *reliability, competence, courtesy, security, tangibles.* Data were collected between 7.00 and 19.30, from Monday to Friday, so to ensure an extensive coverage over the existing mobility patterns in place within the researched area.

3.1 Statistical Analysis

Customer satisfaction surveys results can be interpreted by means of several qualitative and quantitative techniques. Among the most popular it is useful to mention: *Multiple Regression Analysis, Factor Analysis, the Impact Score Analysis, Correlation Analysis, and Quadrant Analysis.* All these techniques are characterized by strengths and weaknesses and, ultimately, the choice of one over the others rests solely upon the researcher sensitivity and the particular goals of the analysis. In our case, we have decided to analyse the results gathered using an Impact Score approach (so to highlight the main qualitative criticalities as perceived by the customers) and a correlation analysis (to determine the chief drivers of the overall satisfaction). A brief description of the two methodologies follows.

3.2 The Impact Score Technique

The Impact Score technique, developed by MORPACE International Inc., is a tool for measuring customer satisfaction which has received wide application within the health care and automotive industry. It was successfully applied to the public transportation sector by the Transit Cooperative Research Program in 1999, during a survey involving U.S. public transportation agencies located in Chicago, Albuquerque and Lynchburg. When compared to other quantitative techniques it stands out for its simplicity, besides the straightforwardness of the results. The rationale behind the method is to measure the influence exercised by single attributes on the overall degree of satisfaction "by measuring customers' relative decreases in overall satisfaction, when a recent problem with an attribute is reported" (Transit Cooperative Research Program Report 47, 1999, p. 23). The methodology is divided into three main steps:

- *The calculation of the Gap Score* – Which is the mean difference, expressed on a 1 to 10 scale, between the votes given by the customers who haven't experienced inefficiencies during the last 30 days and the votes given by those who have;

- *The calculation of the Occurrence Rate* – Representing the percentage of passengers sampled who claimed to have experienced some problem in the recent past. This rate provides a measure of the extent of a criticality. In this study, single attributes totalling scores lower than 6 (on the 1 to 10 scale) have been considered critical from a qualitative point of view;

- *The calculation of the Impact Score* – Obtained by multiplying the Gap Score by the Occurrence Rate. It is designed in a way to highlight the width of a criticality rather than the spread between the votes given by the two categories of customers involved.

The higher the Impact Score is the more widespread and/or perceived the inefficiency is. This approach might be particular useful for companies, as it is widely understood that a key policy to increase customer satisfaction indexes and enhanced loyalty is to reduce the frequency and/or gravity of public transport related inefficiencies. In addition, the implementation of this method allows to avoid some of the drawbacks associated to more complex statistical techniques, besides being easily understandable by transit managers and managing directors. This latter feature eases the conversion of the results reached into practical decisions. A demonstration of the calculation process is shown below:

TABLE 2 - EXAMPLE OF IMPACT SCORE CALCULATION

	A Problem Mean Overall Satisfaction Rating	B No Problem Mean Overall Satisfaction Rating	C (B-A=C) Gap Score	D Reported Problem Occurrence Rate	E (C*D=E) Impact Score
Attribute 1	5,5	7,4	1,90	0,645	1,23
Attribute 2	5,4	7,1	1,70	0,578	0,98
Attribute 3	5,6	6,3	0,70	0,622	0,44

Source: Authors' adaptation from TCRP Report 47

To our knowledge, no prior application of the Impact Score technique has been realized in Europe (let alone Italy). Therefore, the contribution that this paper intends to offer regards the testing on an Italian reality of a perceived quality measuring method previously implemented in the USA and Asia (Kim et al., 2005). Furthermore, it is of interest to test the degree of perceived quality related to public mobility within Cagliari, a city that, given its tourist vocation and the goal to strengthen its position as one of the capitals of the Mediterranean, needs a reliable and efficient transportation system to reduce congestion related inefficiencies and keep under control pollution levels (particularly in spring and summer times).

3.3 Correlation Analysis

A bivariate correlation analysis or Pearson's correlation is a statistical technique which tests the strength of the linear relationship between an independent variable (each of the 10 attributes investigated in this study) and a dependent variable (the overall satisfaction toward the public transport service). It is particularly useful to verify the existence of a causal relationship between the two observed variables. The aim of this quantitative analysis within the context of study is to evaluate which, among the 10 attributes investigated, are the main drivers of the customers' levels of satisfaction toward the public urban transport supply in and around Cagliari. When paired with the Impact Scores results, these data should provide a more precise picture of strengths, weaknesses and public views toward the transport service provided. This, in turn, should ease the identification of policies aimed at increasing the quality of service as perceived by the intended recipients of it.

4. RESULTS

The Impact Score methodology has been applied to each of the 29 urban lines investigated between mid and late July 2010. The data analysis was conducted both at disaggregated (individual line and attribute) and aggregate level. The weighting of the criticalities emerged from the questionnaires compiled is shown in Table 3, with *"classes of criticality"* empirically built and based on previous studies conducted by the Transit Cooperative Research Program (1999).

TABLE 3 - IMPACT SCORES AND RELATED CRITICALITIES

Impact Score	Perceived quality
> 1	High criticality
Between 0,65 and 1	Medium – High criticality
Between 0,30 and 0,65	Medium – Low Criticality
< 0,30	No criticality

Source: Authors' adaptation of data included in TCRP Report 47 (1999)

Where Impact Scores:

- 1 indicate the need to intervene urgently in order to address problems no further deferrable;

- Between 0,65 and 1 highlight the presence of relevant qualitative criticalities, potentially in need of some intervention in the short period;

- Between 0,30 and 0,65 signal attributes characterized by good levels of perceived quality;

- < 0,30 show conditions of optimum in the perceived qualitative standards of a particular attribute.

A general representation of the results is shown in Figure 1, where it is evident how, on average, the quality perceived by the customers of the local public transport system is relatively high.
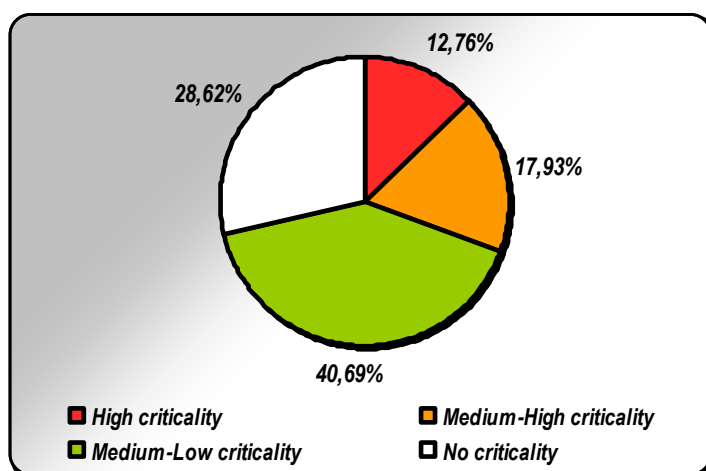

FIGURE 1 - OVERALL PERCEIVED QUALITY IN LOCAL TRANSPORT SYSTEM
Source: Authors' calculations

A more accurate picture emerges from the analysis of the Impact Scores calculated for each of the 10 attributes investigated on the 29 urban lines and grouped for convenience into 6 classes, according to the Levels of Service (LoS) attained during the morning and evening peak hours, 7.00-9.00 and 16.00-19.00 (Table 4):

TABLE 4 - LEVELS OF SERVICE AND CORRESPONDING HEADWAY

Level of Service	Average Headway (min.)	Vehicle-hours
A	> 6	> 6
B	10 - 14	5 - 6
C	15 - 20	3 - 4
D	21 - 30	2,00
E	31 - 60	1,00
F	> 60	< 1

Source: TCRP Report 100 – 2nd Edition (2003)

Table 5 shows the average Impact Scores calculated per attribute on groups of lines characterized by LoS ranging from A to E (no line managed by CTM S.p.A falls within the Level of Service F, with average headways higher than 60 minutes). Red coloured numbers signal critical aspects, for which the implementation of tackling policies is no further deferrable. Light-orange ones give account of slightly less important inefficiencies, in any case deserving high attention. Black coloured numbers show attributes characterized by good to excellent levels of quality perceived by the customers interviewed. The sum of the Impact Scores divided per Level of Service (see Row 12, TOTAL) testify more relevant criticalities for the lines falling within LoS C, closely followed by lines at LoS D and B. Surprisingly

enough, minor problems are revealed among those lines falling within LoS E (with no more than two bus running per hour). This result might well qualify as a "*quality paradox*" (Friman, 2009), where an enhanced quality of the service (a blend of frequency, reliability, number of buses in service on a particular line, routes characteristics and so on) does not seem to have a significant effect on customer satisfaction. At attribute level (see Column 7, TOTAL), we notice relatively high criticalities with reference to the perceived on-board cleanliness, the frequency and the reliability of the service. In particular, it is relevant to note how the on-board cleanliness is the only parameter for which the cumulative Impact Score is higher than 4. The similarity in the cumulative Impact Scores for the service frequency and reliability was expected, since the two attributes have often proved to be strongly intertwined (sometimes confused) in customers' minds.

TABLE 5 - AVERAGE IMPACT SCORES PER LEVEL OF SERVICE AND ATTRIBUTES INVESTIGATED

	A	B	C	D	E	TOTAL
Proximity of bus stops	0,299	0,437	0,773	0,382	0,458	2,349
Boarding-alighting ease	0,326	0,238	0,46	0,217	0,146	1,387
Service frequency	0,393	0,7	0,963	0,733	0,662	3,451
Service reliability	0,555	0,784	1,033	0,681	0,21	3,263
Route characteristics	0,161	0,156	0,187	0,116	0,659	1,279
Bus drivers' ability to drive safely	0,481	0,502	0,46	0,604	0,308	2,355
Bus drivers' behaviours (while on duty)	0,558	0,486	0,511	0,517	0,339	2,411
On-board cleanliness	0,801	0,836	0,909	1,034	0,61	4,19
On-board comfort	0,592	0,326	0,427	0,491	0,292	2,128
On-board security (against crimes)	0,413	0,555	0,58	0,57	0,147	2,265
TOTAL	4,579	5,02	6,303	5,345	3,831	

Source: Authors' calculations

The remaining 7 attributes are qualitatively appropriate to users' expectations, with peaks of excellence achieved with relation to the routes characteristics and the facility to board-alight the vehicles. The former point of excellence does not surprise, since Figure 2 (see Page 12) illustrates a more than satisfactory geographical coverage guaranteed over the metropolitan area. The latter can be explained with the low overall age of the bus fleet available[2].

The data analysis conducted at disaggregated level highlights two impact scores with values higher than 1: the service reliability for buses with average headways comprised between 15 and 20 minutes and the on-board cleanliness for buses with average headways between 21 and 30 minutes. On-board

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[2] 70% of CTM's bus fleet has been renovated in July 2010, with the arrival of 171 new buses. This has brought down the overall average age of the bus fleet to less than 2 years, one of the youngest in Italy.

cleanliness turns out to be the most critical attribute in 3 out of the five LoS considered (see Table 5). This result is somehow surprising as, given the negative relationship between bus age and perceived cleanliness, we might have expected other attributes to be perceived as qualitatively deficient. It could be tentatively argued that, given the recentness of the new fleet, some customers might have been biased in their judgements by the memory of the old buses still in use just few weeks before the survey was taken. However, further studies are needed to come to more definitive conclusions.
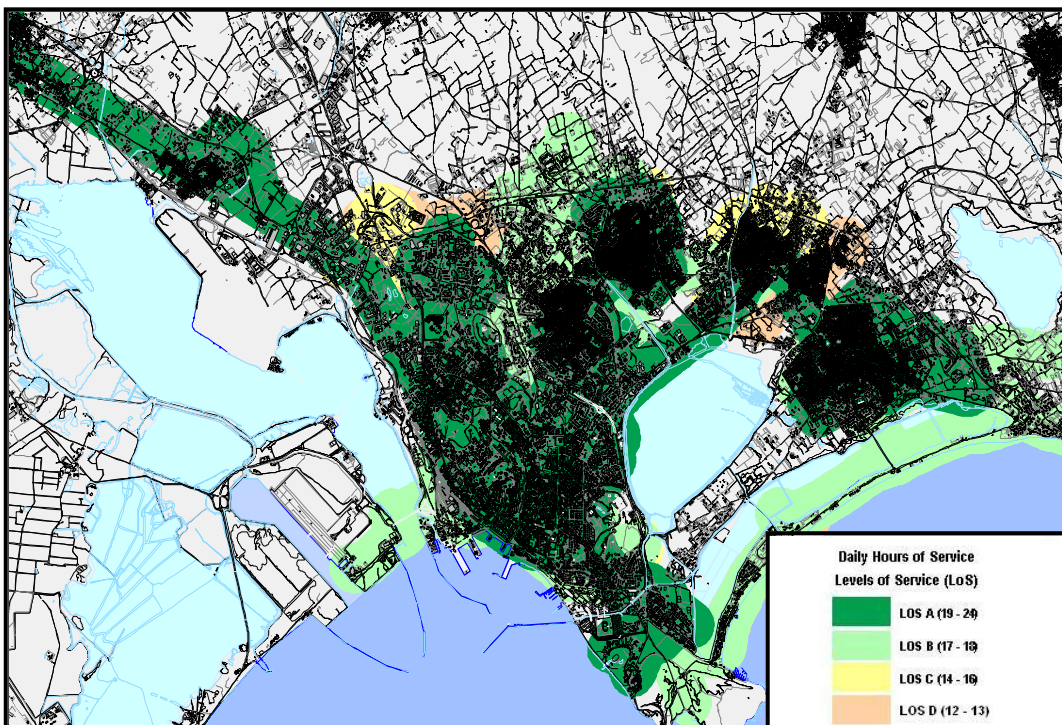

FIGURE 2 - LEVELS OF SERVICE WITHIN THE CAGLIARI'S METROPOLITAN AREA
Source: Authors' calculation

On the other hand, the low values related to route characteristics and ease of boarding-alighting are confirmed and, again, easily explainable with the spatial and temporal coverage provided within the metropolitan area (see again Figure 2) and the average age of the fleet operated by CTM SpA (new buses are designed to be more user's friendly than old ones).

Once discovered the qualitative perception expressed by the customers, it is interesting to verify which of the ten attributes investigated are more influential in shaping the just mentioned qualitative perception. In other words, it is pertinent to determine the drivers of satisfaction among the local public transport users in an around Cagliari. This stage of the research process has been implemented by calculating the degree of correlation existing between the independent variables (the 10 attributes investigated) and the dependent one (the overall satisfaction). Unfortunately, financial and temporal

constraints have not allowed the extension of the analysis to the whole urban routes network, forcing us to focus on those lines which, in terms of passengers carried, can be considered more important. From the analysis of Figure 3 it emerges that the attribute more strongly linked to the degree of overall satisfaction is represented by the perceived on-board comfort, followed by the drivers' ability and their kindness-helpfulness when on duty.
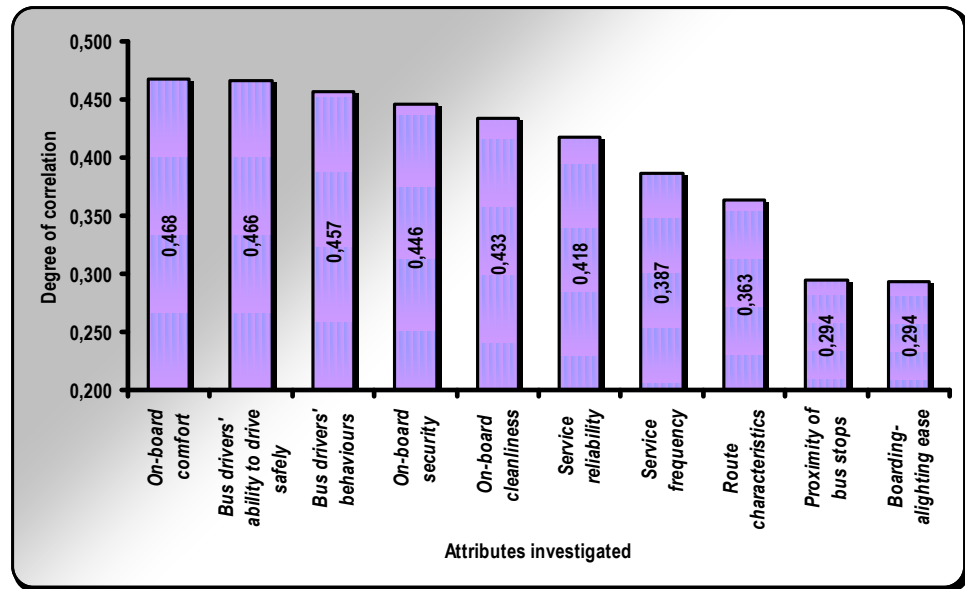

FIGURE 3 - DRIVERS OF OVERALL SATISFACTION
Source: Authors' calculations

The concurrent analysis of the causal relationship between these three attributes and the degree of satisfaction (the correlation indexes), as well as the low criticalities perceived among the customers studied (the Impact Score results), explains to a large extent the overall high level of satisfaction expressed toward the local public transport in Cagliari.

The importance of these three factors confirms the results of a research conducted by Fellesson and Friman (2008) on nine European cities and showing the importance of on-board comfort and personnel's behaviours while on duty in shaping the overall degree of satisfaction-dissatisfaction. In line with previous researches (Smith and Clarke, 2000), it is also shown how safety feelings from crime are important in customers minds, significantly affecting the prospective ridership demand. This latter aspect was found to be particularly important among female customers, some of whom claimed to avoid using buses at night because of the fear of possible threats or dangers while waiting for the buses and, to a minor extent, on-board of the vehicles.

Interestingly enough, the five leading attributes in influencing the overall satisfaction are all related to feelings perceived inside the vehicles, signalling that the perception of quality is more dependent on views matured on-board of the vehicles rather than thoughts and beliefs developed whilst outside. On average, no strong correlations have been recorded between attributes and perceived quality, but just moderate ones. In addition, it is evident that the overall assessment of the efficiency of the local transport system is pretty evenly distributed among different attributes.

Finally, we have determined the statistical significance of the correlation indexes obtained, so to verify whether the linear relationships discovered between our dependent and independent variables were causal or not. Given the hypothesis of a positive relationship between vote given to the single attribute and overall satisfaction toward the local public transport, a one-tailed chi-square test of statistical significance has been conducted (<0.025). The results, divided per lines investigated, comprehensive of degrees of freedom (n-2), statistical significance and non-significance are illustrated in Table 6.

It is important to note that, with the sole exception of line number 5, the results obtained for the 9 remaining lines are generally characterized by statistical significance. This result is certainly meaningful, as indicates the existence of a causal relationship between single attribute investigated and overall perceived quality.

TABLE 6 - STATISTICAL SIGNIFICANCE OF THE CORRELATION INDEXES CALCULATED

LINES	DEGREES OF FREEDOM	STATISTICAL SIGNIFICANCE	STATISTICAL NON SIGNIFICANCE
1	168	10	-
3	123	10	-
5	18	3	7
6	84	9	1
8	127	10	-
9	128	8	2
30	54	8	2
31	68	8	2
M	212	10	-
PF	63	10	-
QS	107	9	1

Source: Authors' calculations

5. DISCUSSIONS

This research has been envisaged with a twofold aim: to determine the users' perceived quality of the local transport service and to isolate the main drivers of overall satisfaction with regards to the supply of transport. With reference to the perceived quality, the results gathered through the Impact Score

technique seem to suggest the substantial good quality of the service provided, despite some criticalities recorded in relation to the levels of on-board cleanliness and the frequency and reliability of the service.

When analysing the main drivers of satisfaction we discovered a predominance of on-board perceived attributes. On the other hand, features such as routes characteristics, proximity of bus stops and boarding and alighting ease do not reveal a significant linear relation with the customers' overall degree of satisfaction. The fact that the latter three characteristics are characterized by a low level of perceived qualitative criticality might suggest the presence of an indirect relationship between quality of the service and customer perception of it (*quality paradox).*

Despite the interesting results, this study suffers from a major limitation: the geographically circumscribed area upon which the survey has been realized, which does not allow for a generalization of its findings. Furthermore, practical reasons have limited the number of attributes investigated and the overall scope of the research.

Future research might, therefore, be realized on a wider area and be based on higher numbers of attributes. The simultaneous realization of the survey within several Euro Mediterranean cities (preferably sharing a common maritime vocation) should provide some useful insights on possible common qualitative criticalities in the supply of local public transport and in the attributes more strongly perceived by the riders. Furthermore, the development of transport policies in line with the results might contribute to the increase of modal shift phenomena (from private vehicles to collective transport) and the consequent reduction of congestion and pollution related problems. The economic, social and environmental benefits of such phenomena will be clearly felt among the communities invested by them.

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