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Assessing the quality of intercity road transportation of passengers: An exploratory study in Brazil

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ABSTRACT

In Brazil, buses represent the main mode of public transportation. However, in recent years intercity and interstate bus companies have been facing a growing competition with other forms of transportation such as bus companies competitors, illegal transportation companies, chartered buses, and, more recently, air companies. In this scenario characterized by growing competition, it is essential to evaluate the quality of road transportation of passengers. In order to contribute to the analysis of this issue, this paper presents a methodological approach to assess the quality of intercity road transportation of passengers, according to the customers' perspective. By conducting a case study in a city of almost 500,000 inhabitants from the interior of Rio de Janeiro, an Importance–Satisfaction Analysis (ISA) and an assignment procedure were used in order to obtain: (i) the main factors (criteria) that influence the quality of service intercity road transportation of passengers, (ii) the importance degree of criteria related to road transportation of passengers, (iii) the satisfaction of the users of road transportation under the considered criteria, (iv) the critical criteria/items, and (v) the categories which best represent the quality of service intercity road transportation according to the passengers' perspective. Finally, several possible corrective actions to improve the quality of services considering each critical item/criterion were highlighted and special recommendations were done for the critical process (ticket sales).

1. Introduction

In Brazil, the road passenger transportation is the most widely used public transportation due to the regularity of the services, the more comprehensive road network, and also due to the cheapest fare. Comparatively, the road passenger transportation predominates over the rail and waterway systems, mainly by the low extension and the lack of efficiency of such systems. And regarding to air transport, despite the route network has been expanded in recent years and air fares have been reduced significantly in some places due to increased competition among airlines, the air fares are still not accessible to most people.

In this context, in a country with continental dimensions like Brazil, the road transportation is essential to the dislocation of the population from a municipality to another, being a highly significant activity to the economic construction and the social development of a nation. Furthermore, Brazil will host the next FIFA World Cup, in 2014, and the next Olympic and Paralympic Games, in 2016. More than ever, the transportation systems – including the road passengers transportation – should be prepared to attend special demands of international and also Brazilian tourists.

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It is also clear that in a scenario characterized by increasing competition and level of consumer demand coupled with the modernization of legislation and consumer protection agencies, the measurement of customer satisfaction is becoming an increasingly important strategy for companies to getting competitive advantages.

This competitive scenario is no different for the intercity road transportation, even in situations where the concession to explore some bus route is unique to a particular company (monopoly condition). On this particular point, it is not uncommon for customers (potential passengers) to choose other forms of transportation due to their dissatisfaction with services provided by bus companies. In particular, intercity bus companies currently share the market with several competitors, the latter being more or less present according to the region of the country, among which there are:

- Clandestine companies consisting of vehicles that carry passengers without permission, license or concession of the government.
- Chartered fleet consisting of buses, minibuses and cars chartered by companies or by interested groups.
- Automobiles, which are no longer restricted to a minority of Brazilians due to the major ease of payment of them.
- Airlines companies seeking to popularize more effectively their services through lower prices and better ways of payment. In this context, Turolla et al. (2008) proposed a model to investigate the competition between the interstate transportation of passengers and air transport of passengers in terms of price. In this study, a sensitivity analysis revealed that the road tickets were sensitive to air fares, indicating the existence of significant interaction among these modes of transportation and also the existence of a potential substitutive effect.

However, the increasing requirements from customers concerning service quality attributes put into check the service provided by intercity bus companies and can further contribute to the proliferation of competitors. The improvement in service quality as a tool for better profitability does not mean only to invest money in advanced technologies, but also to prioritize actions that influence the level of quality perceived by customers, resulting in more attractive services to the users. Therefore, keeping the customer satisfied is probably one of the main ways for building the customer loyalty.

Satisfaction can be defined as an attitude-like judgment following a purchase act or a series of consumer product interactions. Most studies are based on the theory that the confirmation/disconfirmation of preconsumption expectations is the essential determinant of satisfaction. This means that customers have certain service standards in mind before consumption (their expectations), observe service performance and compare it to their standards, and then form satisfaction judgments based on this comparison. The resulting judgment is labeled negative disconfirmation if the service is worse than expected, positive disconfirmation if it is better than expected and simple confirmation if it is as expected (Lovelock and Wirtz, 2007).

According to Kotler and Armstrong (2006) highly satisfied customers make repeat purchases and tell others about their good experiences with the product. On the other hand, dissatisfied customers respond differently. Bad word of mouth often travels farther and faster than good word of mouth. It can quickly damage consumer attitudes about a company and its products. However, most unhappy customers never tell the company about their problem. Therefore, a company should measure customer satisfaction regularly and it should set up systems that encourage customers to complain. In this way, the company can learn how well it is doing and how it can improve.

The importance of measuring customer satisfaction for a public transport service is apparent, even beyond the more immediate marketing purposes that one might advocate. Customer satisfaction is in fact one of the key determinants of personal attitudes towards the service itself. In turn, there seems to be a clear link between attitudes and travel choices, particularly concerning short distance and urban trips, where choices are often less deliberate and the importance of factors such as habits and personal opinions is stronger than for long distance trips (Diana, 2012).

In recent decades, several studies and surveys have been developed in order to improve the public road transportation according to the following main approaches: (i) the identification of the main aspects that influence the quality of public road transportation, (ii) the development of models for assessing the quality of public road transportation, and (iii) the assessment of the quality of public road transportation by the implementation of the evaluation models. Some of the most recent works on these subject are Diana (2012), Diab and El-Geneidy (2012), Medeiros and Nodari (2011), Fujii and Van (2009), ABRATI (2010), Eboli and Mazzulla (2007), Sano et al. (2007), Hu and Jen (2007), Sollohub and Tharanathan (2006), Mishalani et al. (2006), Borchardt et al. (2005), ANTT (2005) and Avineri (2004).

Despite the existence of these studies, it is noted that the aforementioned studies are mostly devoted to the problem of assessing the quality of urban public bus transportation, and they are not able to ensure that the criteria and attributes used to such context are perfectly appropriate and adaptable to assessing the quality of intercity bus transportation of passengers.

In order to contribute to addressing the problem in question, this paper presents a methodological approach to assess the quality of intercity bus transportation of passengers. By means of a pilot study six dimensions of quality (Customer Attendance, Vehicle, Route, Safety/Security, Differential Services and Ticket Fare) and 33 criteria were defined. For a better understanding of the respondents, these criteria were synthesized by conceptual similarity and their writing was improved, resulting in 17 criteria (items). A questionnaire was designed in order to obtain the profile of respondents and their perception about the Degree of Importance of criteria (items) and the Degree of Satisfaction in relation to those items. The questionnaire also sought to capture whether the respondent had used alternative means of transportation and what are the factors that could make him opt for such alternatives. Additionally, it also has an ‘open space’ for constructive criticism and suggestions.

By conducting a case study in a 500,000 inhabitants' city of the countryside of Rio de Janeiro, this paper aimed to answer the following research questions: *"What factors do influence on the quality of services in intercity road transportation of passengers carried by bus? Are customers satisfied with the service provided? What actions can be taken to improve the quality of service?* "In this study, the Importance–Satisfaction Analysis (ISA) identified the most critical criteria which should be prioritized for improvement actions.

In order to classify the service quality provided by the bus company concerning the perception of each passenger, an assignment procedure supported on some thresholds was used. As a result, special attention should be dedicated to items on which passengers were 'dissatisfied' and 'nor satisfied, nor dissatisfied', but also considering items included on 'concentrate here' region. The results of the sorting procedure also report that passengers were predominantly 'nor satisfied, nor dissatisfied'. Those results mean that many efforts must be dedicated to increase the passengers' satisfaction level in order to avoid, for instance, that passengers change the bus company for another one, try the service provided by other means of transportation or by clandestine transportation. Finally, several possible actions were proposed in order to improve the critical processes.

Briefly speaking, this paper is organized as follows: Section 2 presents the theoretical framework related to road transportation by bus and its relationship with the quality of services; Section 3 describes the methodological approach to assess the quality of intercity transportation of passengers by bus, as perceived by the users – the results of the study are presented and some analyses were done; and finally, Section 4 presents the conclusions and the directions for future works.

2. Quality in public bus road transportation

Public bus road transportation is typically characterized as an activity of service. According to Lovelock and Wirtz (2007, p. 15), "services are economic activities offered by one party to another, most commonly employing time-based performances to bring about desired results in recipients themselves or in objects or other assets for which purchases have responsibility. In exchange for their money, time, and effort, service customers expect to obtain value form access to goods, labor, professional skills, facilities, networks, and systems; but they do not normally take ownership of any of the physical elements involved. In this context there are features intrinsic to the provision of public transportation by bus that make it very peculiar, such as:

i. Each trip can be considered as a specific service (heterogeneity), it is influenced by several aspects (weather, traffic conditions, vehicle condition, number of passengers, etc.), making it difficult or nearly impossible to detect and correct faults and problems before they occur and affect the user.
ii. Transportation services cannot be stocked – if passengers do not board in time, they could not always be accommodated at another time and the service is not fully provided. On the other hand, if there's no demand, unused buses' capacity is wasted and the company loses the chance to create value from these assets (services are perishable).
iii. Bus transportation services are provided and consumed in a collective way, and the customers do not always have the same profile and do not share the same preferences and thoughts.
iv. Most of the time the payment is made before the service is provided, which usually does not allow the customer to quit the service, and.
v. Intercity bus transportation of passengers carried by bus is much spatially and temporally dispersed, making more difficult the standardization of activities, supervision and control of personnel.

Adequate service is the minimal level of service that customers will accept, without being dissatisfied (Lovelock et al., 2009; Zeithaml et al., 2006). In legal terms, the Brazilian legislation defines what an "adequate service" is, i.e., what are the minimum quality parameters for the provision of public services. More specifically, the article of the Brazilian Law 8987/95 states that "any route concession or permission presupposes the provision of adequate service to the full satisfaction of users as defined in such law and in the contract."

According to the Brazilian regulation of Interstate and International Road Transportation of Passengers Service (Decree no. 2521/98), a service is adequate if it satisfies the conditions of timeliness, punctuality, regularity, continuity, security, efficiency, generality, courtesy in their supply, and when reasonable fares are available, as set forth in contract (see definitions in Table 1). In addition, the legislation also establishes the rights and obligations of users of bus road transportation.

The understanding of the typical characteristics of the service road passenger transportation and the conditions established by legislation can contribute to the provision of services with a quality level that meets the needs and expectations of the customers (passengers).

One of the most frequently used way to evaluate and rank the quality of services is by measuring the degree of satisfaction of the evaluators (customers, employees or external evaluators) with service performance concerning a set of relevant criteria (Freitas, 2005). End customers of the transportation service (passengers, here called external customers) as well as company employees (internal customers) constitute important elements for measuring and evaluating the service provided. In particular, the organization employees are people better able to detect the "perceived quality" by the passenger resulting from the moment of truth.

According to Albrecht and Bradford (1998), each Moment of Truth is the moment when the customer comes into contact with any aspect of the organization (staff, facilities, telephone/fax, etc.). And, according to the contact he can form his opinion

Table 1
Conditions for the provision of an adequate service.

Necessary conditions for the provision of an adequate service	
Up to date services	It includes the modern equipment, techniques and facilities and their conservation, as well as the improvement and growth on services
Punctuality	Strict compliance with the schedules for the service pre-established in contract
Regularity	Service should be provided according to the legislation, the contract and technical standards, with no interruptions (Brasil, 1995)
Security	Security is the freedom from danger, risks or doubt (Parasuraman et al., 1985). In road bus transportation services it involves the provision of services free of incidents that compromise the physical, financial and personal services (confidentiality) of the passengers, such as automobile accidents, robberies, assaults and disclosure of personal information
Continuity	Supply services in a continuous way
Efficiency	Service should be provided efficiently and it should fully reach the necessity which gave rise to it (Brasil, 1995)
Generality or universality	It relates to the principle of equality or uniformity of users. It means that the public service may be required and used by all people who need it, regardless of their income and wherever the service should be provided or made available (Brasil, 1995)
Courtesy	Courtesy involves politeness, respect, consideration and friendliness of contact personnel (Parasuraman et al., 1985). In road bus transportation services it includes receptionists, telephone operators, motorists, baggage handlers, etc.
Reasonable fares	Fares are considered reasonable when they not restrict the people that most need the transportation service to have access to it (Brasil, 1998). On the other hand, one must consider that, to provide a transportation service according to the required quality standards, there are costs to be accounted for (personal and operating costs, taxes, etc.) companies. Besides, companies must obtain profit in its activity

about the quality of service. Once receiving a service, the client goes through a sequence of *Moments of Truth*, called *Service Cycle*. Thus, through the understanding of this cycle and the moments of truth, any faults that occur can be more easily identified and, by taking corrective/preventive actions, these faults can be avoided in order to provide a better service.

In recent decades, several studies have been conducted in order to identify and analyze the factors that influence the provision of road bus transportation services (Table 2 lists some of these studies).

It is important to note that the aforementioned studies are mostly devoted to the problem of assessing the quality of urban public bus transportation and two points should be highlighted: (i) it is not possible to ensure that the criteria used are perfectly proper and immediately adaptable to the analysis of problem of quality assessment of intercity road bus transportation, and (ii) most studies have considered the information from passengers perceptions, preferences and behavior.

Despite the relevance of the studies reported in Table 2, some limiting aspects reveal the existence of a gap in the scope of the problem in question, as reported below. These aspects are explored by the methodological approach proposed in this paper.

- *Measuring the Importance Degree of the attributes (items) related to road bus transportation as perceived by passengers.* Regarding this issue, ANTT (2005) only considered the percentage of items of importance measured by the frequency of items marked as the most important (the respondents indicated the three most important items out of a twelve items list concerning "bus companies performance", and they also indicated the three most important items out of an eight items list according to "bus stops along the trip" – such procedure minimizes the analysis and interpretation of the importance degree of the items, because the amount of importance was not considered relevant. In the study conducted by ABRATI (2010) the Importance Degree of the attributes was not measured.
- *Use of ordinal scales to measure the Satisfaction Degree on the perspective of passengers.* According to Hair et al. (2006), ordinal scales provide no measure of the actual amount or magnitude in absolute terms, only the order of the values. The numbers utilized in ordinal scales are non-quantitative because they indicate only relative positions in an ordered series. Thus, the researcher cannot perform any arithmetic operations (no sums, averages, multiplication, division, etc.). Then, the procedure used in ABRATI (2010) is not proper to calculate the Average Satisfaction Degree of the respondents. Such procedure is equivalent to calculating the average of the judgments provided by two reviewers for a particular item, whose values have been assigned, respectively, 2 (Dissatisfied) and 5 (Totally Satisfied).
- *No measurement of the passengers' Satisfaction Degree.* Medeiros and Nodari (2011) did not consider passengers satisfaction indicators for assessing the quality in interstate road bus transportation. Specially, they argued that satisfaction surveys for this purpose are very expensive to make. However, not considering the "voice of the customer" it constitutes one of the worst practices in Quality Management Systems (More specifically, such practices violate several principles and requirements of ISO 9001:2008).

3. The methodological approach

The proposed approach started in a study conducted by Freitas et al. (2011) and it focused on assessing the quality of intercity road transportation of passengers, concerning the users' perception. Since the aim of this study is to gather preliminary information in order to provide insights and understandings about a problem, the proposed approach can be characterized as an exploratory research. The exploratory nature comes from the fact that studies on the quality of intercity bus transportation are still incipient in Brazil (the existing studies refer to urban public bus transportation). In addition, the findings of international studies not always can be considered due to the particular realities of different countries.

Table 2
Articles focusing on road bus transportation services.

Research	Contributions
Diab and El-Geneidy (2012)	The authors aims to evaluate the impacts of implementing a combination of strategies, designed to improve the bus transit service, on running time and passenger satisfaction. These strategies include using smart card fare collection, introducing limited stop bus service, implementing reserved bus lanes, using articulated buses, and implementing transit signal priority. Stop-level data and automatic passenger count systems were used. The combination of these strategies has lead to a 10.5% decline in running time along the limited stop service compared to the regular service; the regular route running time has increased by 1% on average compared to the initial time period and that riders are generally satisfied with the service improvements
Diana (2012)	The author shows how satisfaction measures can be exploited to gain insights on the relationship among personal attitudes, transit use and urban context. Nine satisfaction measures of urban transit services were considered and correlations and correspondence analyses were used to show if and how each attribute is related to the levels of use of public transportation, and how the relationship is affected by the urban context. The resulting overall satisfaction levels and frequency of use were not correlated and that the highest satisfaction levels occurred in smaller towns and the lowest ones in metropolitan cities
Medeiros and Nodari (2011)	The focus group technique was used to identify attributes that could contribute to improve the quality of service provided in bus road transportation of passengers, according to the viewpoint and opinion of people linked to the National Land Transportation Agency (ANTT, Brazil), employees of road bus transportation companies and users
ABRATI (2010)	The research was conducted under a contract signed between the Brazilian Association of Companies Passenger Land Transportation (ABRATI, Brazil) and Vox Populi research company in order to monitor the user satisfaction with bus road transportation in intercity, interstate and international routes. The target were users of the routes of member companies who typically travel by bus at least twice a year and that over the past 12 months made the same trip. For data collection, structured questionnaires were applied face-to-face in bus terminals
Fujii and Van (2009)	The paper tested the feasibility of developing mobility management measures to persuade motorcyclists to use more buses for transportation in Ho Chi Minh city (Taiwan). Principal component analysis performed with a set of psychological factors related to various aspects of bus use has resulted in four factors: moral concerns, negative expression, quality perception, and social *status*. The regression of intentions regarding these four factors revealed that the determinants of intention to use of the bus in that city are the perception of quality and moral concerns
Sano et al. (2007)	Focused on the punctuality of bus service, the paper investigated the behavior of passengers at bus stops and analyzed the operating costs of bus companies. Additionally the benefits were estimated on bus passengers and bus company when the punctuality of bus service has been improved
Hu and Jen (2007)	The study investigated the use of Neural Networks and LISREL methodology in research of passengers' behavioral intentions. These two methods were applied to a case of intercity bus transportation in Taiwan. The study showed that LISREL can be a convenient and effective analysis when the causal relationships are known. On the other hand, the neural networks provided a reliable prediction after the appropriated training procedure
Eboli and Mazzulla (2007)	A structural equation model was developed to analyze the impact of the relationship between the consumer's overall satisfaction with public transportation and service quality attributes. The study analyzed the bus service regularly used by students at the University of Calabria to reach the campus from the urban area of Cosenza city (Italy)
Mishalani et al. (2006)	The article presented a study that quantifies the relationship between perceived time and real time experienced by passengers awaiting the arrival of a bus at bus stops. The results indicate that the passengers realize that the waiting time at the bus stop is greater than the actual amount of time waited
Sollohub and Tharanathan (2006)	The article described the research process undertaken with the aim of promoting improvements in the reading of the schedules of the buses timetables. The process involved preliminary research, community participation, graphic design, laboratory testing and survey methods. In the survey, most participants showed preference for aspects developed in the prototypes, offering the agency important production recommendations regarding font sizes, text orientation, graphic display methods, as well as institutional directives concerning data transfer, maps, zone designation, passenger information and telephone contacts
Borchardt et al. (2005)	A diagnostic tool was developed in order to identify potential process improvement of the road bus transportation. In order to construct the data collection instrument, the criteria of excellence ANTP Quality Award, the principles of Lean Thinking and Lean Manufacturing were considered. Case studies in three road transportation companies in Porto Alegre city (Brazil) found that the integration of the value chain of the transportation system is one of the parameters that have the greatest potential for improvement
ANTT (2005)	The research was conducted under a contract signed between the National Land Transportation Agency (ANTT, Brazil) and Datametrica research company to evaluate the user satisfaction with services provided by bus road transportation companies. The evaluation process was conducted in accordance with the procedures and the indices defined by ANTT
Avineri (2004)	The paper investigated the decision-making process for passengers who have to choose a bus route. Questionnaires presented two different formats of alternative bus routes information, buses' headway intervals, and waiting time. The results show evidence to size-biased sampling when subjects are provided with information about buses' headway intervals. By formulation and interpretation of subjects' preferences with the framework of Cumulative Prospect Theory, the value of passengers' reference point may be derived. It was found that such a reference point is much lower than the experienced waiting times reported by subjects

3.1. Modelling the problem

Initially, the elements and procedures that make the modeling of the problem are defined. This step defines the object of study, as well as some key points of the research are appointed.

a. *Object of the problem:* The study was conducted in Campos dos Goytacazes, a city located in northern of Rio de Janeiro state, Brazil. According to IBGE (2011), the estimated population for this city is 463,545 inhabitants. This city stands out economically by the culture of sugar cane, the red ceramic industry and especially by oil exploration in its coast.

However, an increasing number of inhabitants are expected to come to the city due to the installation of large industrial plants. Moreover, the intense transportation of people among the municipalities of North Fluminense region is noted, especially between Campos dos Goytacazes and Macaé, cities that represent 77.5% of the inhabitants of that region.

b. *Relevant criteria:* As previously reported, several studies have identified relevant criteria to assess the quality of urban public transportation by bus, but it is not possible to ensure that such criteria are appropriate to the analysis of the problem in question. In this context, to define the relevant criteria for assessing the quality of road transportation as perceived by the passengers, the following steps were performed:
   - Pilot survey: A unstructured question was applied to the passengers at the bus station of Macaé and Campos dos Goytacazes: "In your opinion, what are the most important attributes to provide intercity road transportation of passengers?" The question was answered by 103 passengers and, after analysis of the similarity of the responses, 33 different criteria were identified. The criteria were grouped into six "Quality Dimensions": Attendance, Vehicle, Route, Passengers safety, Differential services and Tickets fare.
   - Assessing the importance of the Dimensions: Passengers were invited to allocate 100 points to the dimensions in a way that reflects the importance they attach to each dimension. More points should be attached to the most important dimensions. If a dimension is unimportant, the passenger assigns it zero points. If a dimension is twice as important as other dimension, it receives twice as more points. According to the viewpoint of 113 respondents, 'Passengers safety' is the most important dimension. On the other hand, 'Differential Services' is the less important dimension. Table 3 presents the average Importance Degree of each dimension.

The six "Dimensions of Quality" have been split into criteria (items) regarding the criteria defined in the previous steps. The writing of the items has been improved in order to be better understandable by the respondents in future researches. The criteria assigned to each dimension were: **Attendance** (degree of courtesy of staff, fast and organized queues, staff appearance and ease of purchasing tickets), **Vehicle** (vehicle condition, bathroom existence, air conditioning existence, vehicle cleanliness and accessibility to disabled people), **Route** (departure time as scheduled, variety of departure times, appropriate travel time, quantity of stops along the route), **Security** (security devices suitable for use and respect the traffic laws), **Differential Services** (existence of differential services such as water, newspaper and blanket) and **Ticket Fare** (cost-benefit ratio, i.e., the amount paid in relation to the service offered).

c. *Scales of measurement:* A combination of the graphic rating scale and the itemized rating scale was used to measure the importance degree of the criteria (items) and the passengers' satisfaction degree concerning each criterion. The importance responses vary from 'Extremely unimportant (value 0)' to 'Extremely important (value 10). Similarly, the satisfaction responses vary from 'Extremely dissatisfied (value 0)' to 'Extremely satisfied (value 10)'. According to Parasuraman et al. (2004), the resulting scale gains the benefits of both types of scales: an itemized rating scale should be easier to respond to and more meaningful from the respondent's perspective and a graphic rating scale allows detection of fine shades of differences in attitudes.

d. *Questionnaire design*: The questionnaire designed to assess the quality of intercity passenger road transportation was composed of three blocks of questions: In Block I multi-category structured questions were defined to obtain responses concerning gender, marital status, education level, type of passenger, motive for travel, frequency of travel. Unstructured questions were defined to know the respondents' age, family income and quantity of dependents. In Block II questions were designed for measuring respondents' perceptions regarding the Importance degree of the criteria (items) and the Satisfaction Degree in terms of each criterion. Block III was composed of two questions designed to argue the respondents whether they had used non authorized transportation (illegal transportation) and what are the factors that could make them opt for non authorized transportation. An extra space was designed to obtain comments and suggestions.

e. *Importance–Satisfaction Analysis (ISA):* ISA is similar to the Importance-Performance Analysis (IPA) proposed by Martilla and James (1977) and it was used to identify the most critical criteria (items). The only difference between the tests is that IPA considers the perception of respondents regarding the performance of the object under study and ISA considers the satisfaction of respondents. More specifically, ISA is based on the construction of a two-dimensional graph that considers the Importance Degree of the criteria and the respondents' Satisfaction Degree on each criterion (Importance Degree versus Satisfaction Degree), which identifies four quadrants:

Table 3
Average importance degree of the dimensions.

Quality dimensions	Average importance degree
Attendance	16.0
Vehicle	19.3
Route	18.3
Passengers security	21.2
Differential services	7.0
Ticket fare	18.2

"Concentrate here" denotes an area where items are important and also where the passengers' satisfaction degrees are low. Concentrating improvement actions in this area would produce maximum results.

"Keep up the good work" represents the area where items are important and where the passenger's satisfaction degrees are high. On this quadrant, the organizations should maintain the present action strategies.

"Low priority" denotes the area in which the criteria are not considered so important and the satisfaction of respondents against the criteria is considered low and not considered a priority for implementation of improvement actions.

"Possible overkill" represents the area where respondents' satisfaction degrees are high, but these are not considered as important. This quadrant suggests that efforts toward these items can be reduced.

More specifically, for each item *i*, the Average Importance Degree $\mu(I^i)$ and the Average Satisfaction Degree $\mu(S^i)$ must be calculated from the set of expressions (1):

$$\begin{cases} \mu(I^i) = \sum_{\alpha=1}^{n} \mu(I_\alpha^i) \Big/ n \\ \mu(S^i) = \sum_{\alpha=1}^{n} \mu(S_\alpha^i) \Big/ n \end{cases} \tag{1}$$

where I_α^i is the importance degree of item i according to the perspective of the α-respondent; S_α^i is the Satisfaction Degree of item i according to the perspective of the α-respondent; *n* is the total number of respondents.

Additionally, it is necessary to calculate the Global Importance Degree, denoted by $\mu(I)$, and the Global Satisfaction Degree, denoted by $\mu(S)$ In practical terms, $\mu(I)$ and $\mu(S)$ constitute the intersection between the Average Importance Degree axis and the Average Satisfaction Degree axis. The translated axis makes the analysis more rigorous – a more strict comparison among the criteria (items) is conducted because it no more considers as vertex just the average value of the 0–10 scale (Fig. 1 illustrates the corresponding two-dimensional graph) $\mu(I)$ and $\mu(S)$ are obtained from the set of expressions (2):

$$\begin{cases} \mu(I) = \sum_{i=1}^{m} \mu(I_i) \Big/ m \\ \mu(S) = \sum_{i=1}^{m} \mu(S_i) \Big/ m \end{cases} \tag{2}$$

However, some items could belong firmly to "low priority" quadrant, while others could belong to "low priority" quadrant but very close to "concentrate here" quadrant boundary, while others could fall close to the intersection of the four axes. Since the traditional ISA does not distinguish items assigned into the same quadrant and borderline items may fail to offer correct managerial decisions, researchers may be reporting findings erroneously.

In order to deal with this problem, Tarrant and Smith (2002) framework was used to make ISA more sensitive to the variance of the responses (and also to the quantity of respondents). For each item, the standard error (SE) was calculated for both the satisfaction and the importance values. Adding the SE to the data points on the I–S graph, a confidence interval with

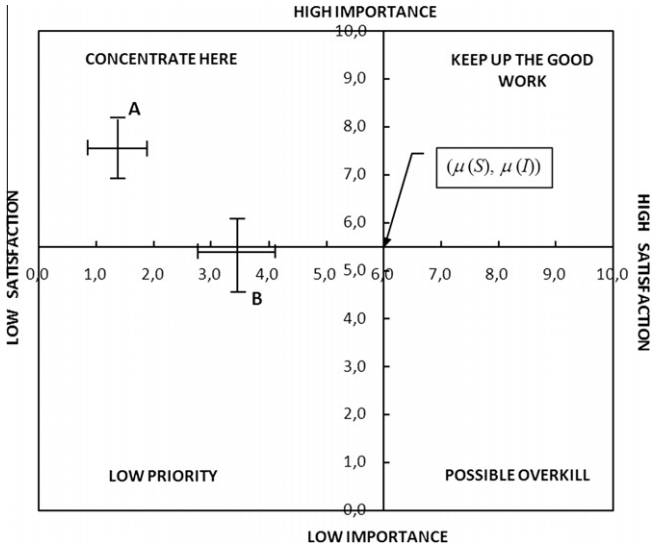

Fig. 1. Bi-dimensional graph of the modified ISA.

the mean value in the centre and two SE bars was created. The SE bars extend horizontally (for satisfaction values) and vertically (for importance values) in both positive and negative values of the mean (see Fig. 1).

The confidence intervals (CIs) were calculated by means of Eqs. (3) and (4). If the CI values are fully inserted in one quadrant, such as item "A" in Fig. 1, it is according to the management objectives with confidence and the mean value of the I–S graph is a true reflection of the preference and needs of the passenger population. On the other hand, if a confidence interval value of an item overlays one of the axes, as with item "B" in Fig. 1, the researcher cannot assure that the item is assigned exactly to a single quadrant.

$$CI = \mu(I^i) \pm s(I^i)/\sqrt{n} \tag{3}$$

$$CI = \mu(S^i) \pm s(S^i)/\sqrt{n} \tag{4}$$

For each item i, $s(I^i)$ and $s(S^i)$ represent the standard deviation based on a sample of Importance Degrees and Satisfaction Degrees values, respectively; n is the quantity of respondents.

f. *Service Quality Indices and Sorting Procedure*. These indices allow the assessment of service quality by considering the Importance Degree of the items and the Satisfaction Degree on each item as perceived by passengers. It is important to assess the Service Quality Index for each item, denoted by SQIi, the Service Quality according to each passenger α, denoted by SQIα and the index of overall service quality, denoted by SQI. These indices are obtained from the set of expressions (5):

$$\begin{cases} SQI_\alpha = \sum_{i-1}^{m} (I_\alpha^i \cdot S_\alpha^i) \Big/ \sum_{i-1}^{m} I_\alpha^i \\ SQI_i = \sum_{\alpha-1}^{n} (I_\alpha^i \cdot S_\alpha^i) \Big/ \sum_{\alpha-1}^{n} I_\alpha^i \\ SQI = \sum_{i-1}^{m} [\mu(I_i) \cdot \mu(S_i)] \Big/ \sum_{i-1}^{m} \mu(I_i) \end{cases} \tag{5}$$

The multiple criteria sorting/classification problem is a decision problem which besides evaluating a finite set $\overline{X} = \{X_1, X_2, \ldots, X_m\}$ of alternatives (or actions) concerning a set of criteria, it also requires to assign these alternatives to one of the predefined categories $(C_1, C_2, \ldots, C_t)$ (Roy, 1985). The assignment of an alternative X_i to one of the categories should rely on the comparison of the intrinsic value of X_i to specific reference points that define each category (and not on the comparison of X_i to other alternatives). Roughly speaking, this kind of problem occurs when service companies are evaluated concerning a set of criteria and, according to their performances, these companies are qualified into some specific categories.

ELECTRE TRI method (Yu, 1992) is the most widely used Multiple Criteria Decision Aiding (MCDA) sorting method and it is based on the outranking relations approach. In order to deal with imprecision and uncertainty concerning the evaluation of alternatives, ELECTRE TRI considers indifference and preference thresholds which constitute the intra-criterion preferential information. However, according to Mousseau et al. (2000), assigning a value to these thresholds is a difficult practical problem. Furthermore, the assessment of service quality in road transportation of passengers involves the collection of multiple evaluators' (passengers) perception.

In order to assign the perception of each passenger concerning the service quality provided by the bus company, an assignment procedure supported on the scales of measurement and on some thresholds which delimit seven categories is proposed. Table 4 presents the categories, the value thresholds and the respective concepts which represent each category. For example, if $SQI_i = 8.2$, $SQI_\alpha = 4.5$ and $SQI = 7.5$, it means respectively that passengers were 'very satisfied' with the service provided on item i, passenger α is 'dissatisfied' with the overall service provided and, all passengers were 'satisfied' with the overall service provided.

3.2. Data collection

The bus company has the concession to explore routes to several cities of Rio de Janeiro State and to others Brazilian States. In this sense, 209 passengers of a particular route between Campos dos Goytacazes and one of the cities of northern

Table 4
Categories, thresholds and concepts.

Categories	Value thresholds	Concepts
C_1	$9.00 \leqslant SQI_i, SQI_\alpha, SQI \leqslant 10.00$	(A) Extremely satisfied
C_2	$8.00 \leqslant SQI_i, SQI_\alpha, SQI < 9.00$	(B) Very satisfied
C_3	$7.00 \leqslant SQI_i, SQI_\alpha, SQI < 8.00$	(C) Satisfied
C_4	$5.00 \leqslant SQI_i, SQI_\alpha, SQI < 7.00$	(D) Nor satisfied, nor dissatisfied
C_5	$4.00 \leqslant SQI_i, SQI_\alpha, SQI < 5.00$	(E) Dissatisfied
C_6	$3.00 \leqslant SQI_i, SQI_\alpha, SQI < 4.00$	(F) Very dissatisfied
C_7	$0.00 \leqslant SQI_i, SQI_\alpha, SQI < 3.00$	(G) Extremely dissatisfied

Rio de Janeiro have taken apart of the study. This route is 110 km long and the trip is performed solely by the company without bus stops in other cities for embarkation/disembarkation of passengers.

However, several buses chartered by people who work in one of the cities everyday make the same route. Departures and arrivals are scheduled in the beginning and in the end of the day (the bus company itself charts buses to cover this route). Clandestine transportation of people is performed all day long by vans, minibuses and even by automobiles – possible passengers are approached near the bus stations. Such route has been operated by an airline company for a few years.

Passengers were approached near the departure hall and also during the trip. In both cases, the researchers explained the objectives of the study and asked the passengers to answer the questionnaire. As in previous data collect, a convenience sampling technique was used, i.e., a nonprobability sampling technique that attempts to obtain a sample of convenient elements and that can be used in exploratory research. The selection of the sample units is left primarily to the interviewer (Malhotra, 2007). The respondent's name was optional information. Once collected, the data were tabulated on spreadsheets to perform tests which results are presented below.

3.3. Data analysis and results

Table 5 shows that most of the respondents were female (63.2%) – a result strongly influenced by the greater interest of this gender on this study. Regarding marital status, 59.3% of the respondents were married. In terms of age, 60.3% of the respondents were 26–45 years old, and the average age was approximately 36 years old. The sample of the respondents was predominantly composed of workers (72%), and there were students (19.1%), elderly (6.7%) and disabled people (1.9%). With regard to the purpose of the trip, the predominance of the working class (77%) was identified.

The analysis has also revealed that most of the respondents (62.7%) used the service offered by the bus company three or four times a week. Considering the number of dependents reported, the per capita income was 1364.88 *reais* (amount approximately equivalent to US$ 800.00). Additionally, 28.7% of the respondents said they had traveled by unauthorized transportation (cars, vans, buses, etc.) mainly due to lower price (35.5%) and to the shortest travel time (29.0%).

Table 6 shows the results obtained after the application of the sets of equations (1) and (2) and the Tarrant–Smith framework (a 95% confidence interval was used to set the SE for the mean importance and performance values of each item, despite of the use of a nonprobability sampling technique). For each item, it was calculated: the standard error (S.E.) for both the importance and performance values, the Average Satisfaction Degree ($\mu(S^i)$), the confidence interval for the Average Satisfaction Degree, the Average Importance Degree ($\mu(I^i)$), the confidence interval for the Average Importance Degree, the result of Tarrant–Smith framework (TSf), the Global Importance Degree ($\mu(I)$), the Global Satisfaction Degree ($\mu(S)$), the overall service Quality index (SQI), the Service Quality Index (SQI_i), and the correspondent sorting result.

The ISA graph is presented in Fig. 2. Each item is represented by its Importance Degree and Satisfaction Degree and corresponding to the ordered pair ($\mu(S^i)$, $\mu(I^i)$) The intersection of the axes corresponded to the ordered pair consisting of the Global Satisfaction Degree and the Global Importance Degree. The analysis for each quadrant is presented.

- *"Keep up the good work" Quadrant:* Passengers consider that the importance of the service quality is high and their satisfaction level with the bus company performance is also high concerning items I_4 (vehicle condition) and I_7 (vehicle cleanliness). Tarrant–Smith framework suggests that special attention must be dedicated to items I_5 (existence of bathroom), I_9 (security devices suitable for use) and I_{11} (ease of purchasing tickets). Although these items are very close to the boundary of this quadrant or belonging to "possible overkill" quadrant, in a conservative attitude, the bus company must act to maintain current action strategies concerning those items.

Table 5
Characteristics of the respondents.

	Responses of each response category (%)						
Gender	Female (63.2)	Male (36.8)					
Marital status	Single (27.3)	Married (59.3)	Divorced (10.5)	Widowed (2.9)			
Passenger	Student (19.1)	Worker (72.3)	Elderly (6.7)	Disabled people (1.9)			
Age (years)	15–25 (17.7)	26–35 (40.2)	36–45 (20.1)	46–60 (15.3)	>61 (6.7)		
Family Income (R$)	Up to 500 (0.5)	501–1000 (8.1)	1001–2000 (20.6)	2001–3000 (30.6)	3001–4000 (19.1)	4001–5000 (9.6)	>5001 (11.5)
Family Income Per Capita (R$)	Up to 500 (9.6)	501–1000 (41.1)	1001–2000 (34.9)	2001–3000 (8.6)	3001–4000 (3.4)	4001–5000 (1.4)	>5001 (1.0)
Motive of trip	Study (7.7)	Work (77.0)	Entertainment (10.0)	Other (5.3)			
Frequency of trip (times per week)	Rarely (21.5)	Up to 2 times (12.0)	3–4 times (62.7)	5–7 times (3.8)			
Did you already use unauthorized transportation?	No (71.3)	Yes (28.7)					
Reason for using unauthorized transportation	Price (35.5)	Safety (12.9)	Different Route (8.1)	Duration (29.0)	Time flexibility (12.9)	Other (1.6)	

Table 6
Results of Importance–Satisfaction Analysis.

	Satisfaction				Importance					
	$\mu(S^i)$	S.E.	$(\mu(S^i)_{inf}, \mu(S^i)_{sup})$	TSf	$\mu(I^i)$	S.E.	$(\mu(I^i)_{inf}, \mu(I^i)_{sup})$	TSf	SQI_i	
I_1	6.049	0.214	5.835, 6.263	–	7.784	0.159	7.626, 7.943	–	6.122	D
I_2	3.227	0.264	2.962, 3.491	–	9.053	0.113	8.940, 9.166	–	3.197	E
I_3	7.565	0.252	7.312, 7.817	–	3.936	0.353	3.583, 4.290	–	7.524	C
I_4	7.259	0.191	7.068, 7.450	–	9.358	0.080	9.279, 9.438	–	7.262	C
I_5	7.662	0.223	7.440, 7.885	–	7.006	**0.265**	**6.741, 7.271**	**X**	7.755	C
I_6	6.779	0.300	6.479, 7.080	–	5.711	0.310	5.401, 6.022	–	6.980	D
I_7	7.751	0.172	7.579, 7.923	–	8.465	0.161	8.304, 8.626	–	7.777	C
I_8	3.497	0.208	3.289, 3.705	–	8.852	0.166	8.686, 9.019	–	3.505	E
I_9	7.447	0.230	7.218, 7.677	–	6.910	**0.324**	**6.586, 7.234**	**X**	7.416	C
I_{10}	4.407	0.246	4.161, 4.653	–	8.878	0.168	8.709, 9.046	–	4.405	E
I_{11}	8.554	0.198	8.355, 8.752	–	6.927	**0.212**	**6.715, 7.139**	**X**	8.472	B
I_{12}	5.112	0.248	4.865, 5.360	–	8.242	0.164	8.078, 8.405	–	5.120	D
I_{13}	8.216	0.185	8.032, 8.401	–	6.340	0.214	6.126, 6.554	–	8.146	B
I_{14}	6.811	0.200	6.612, 7.011	–	6.194	0.188	6.006, 6.382	–	6.797	D
I_{15}	6.136	**0.320**	**5.815, 6.456**	X	5.911	0.314	5.597, 6.224	–	6.170	D
I_{16}	6.277	**0.388**	**5.889, 6.665**	X	3.140	0.306	2.834, 3.447	–	5.936	D
I_{17}	5.512	0.302	5.210, 5.814	–	8.072	0.199	7.873, 8.271	–	5.542	D
$\mu(S)$ = 6.368				$\mu(I)$ = **7.105**				SQI = 6.207		

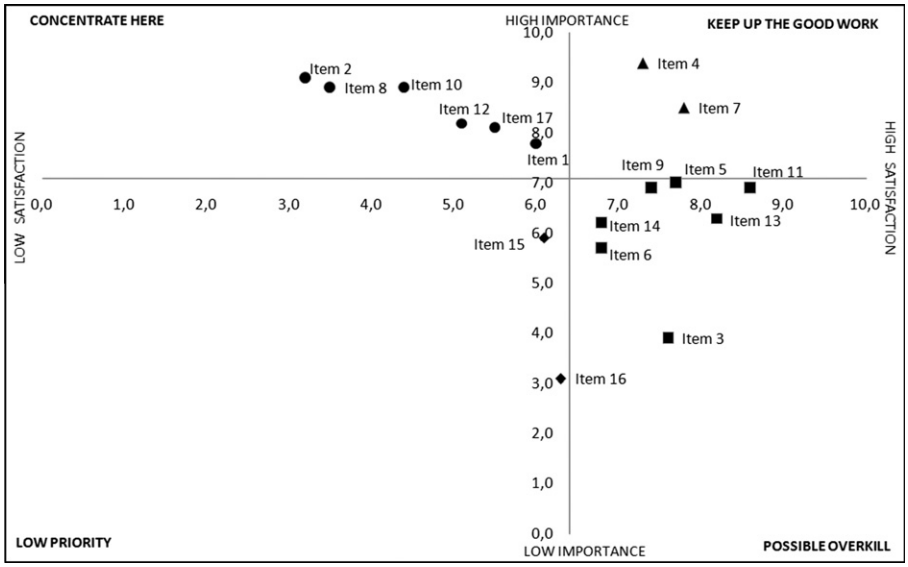

Fig. 2. Graph of the Importance–Satisfaction Analysis. Source: Search Results.

- *"Possible overkill" quadrant:* Items belonging to this quadrant are characterized by presenting Average Importance Degree less than the Global Importance Degree, presenting, however, Average Satisfaction Degree greater than the Global Satisfaction Degree. In other words, this quadrant contains items that provide satisfaction to the passengers, but they are not as important as other items. According to passengers, the items that belong to this quadrant are I_3, I_6, I_9, I_{11}, I_{13}, I_{14}, especially the first (the passengers consider that the appearance of employees is not much important to quality in transportation services by intercity bus). It was found that users did not consider air conditioning (I_6) very important. In particular, it's a puzzling result because the municipalities' temperatures are high during most of the year. However, as this study was conducted in winter and when there was an outbreak of the H1N1 virus (it was commonly called "swine flu"), the respondents, possibly fearing the contagion due to the closed environment with poor ventilation, may be assigned less importance to the existence of air-conditioned in buses. Certainly this item should be observed in other studies. Regarding item I_{11}, passengers can purchase tickets at the ticket booths, by phone or by website (at the latter two forms, payment may be made by using credit card or debit card, being necessary to take the tickets at least thirty minutes before the scheduled departure). At the tickets booths passengers can also use transportation vouchers as payment mode.

- *"Low priority" Quadrant:* An item belongs to this quadrant when the Average Importance Degree is lower than the Global Importance Degree and the Average Satisfaction Degree is also lower than the Global Satisfaction Degree. Despite the items I_{15} (number of stops along the route) and I_{16} (existence of differentiated services) belong to this quadrant, Tarrant–Smith framework suggests that it is not possible to assume this result. However, I_{16} was considered the less important among all the items evaluated in this study. One can understand that passengers do not consider important to have stops along the route.
- *"Concentrate here" Quadrant:* The items arranged on this quadrant have greater Average Importance Degree than the Global Importance Degree and the Average Satisfaction Degree are also greater than the Global Satisfaction Degree. Such items are critical and should be prioritized by the company in order to carry out actions to improve the quality of services provided. In this study, the following items were assigned to this quadrant, arranged in ascending of critical order: I_1, I_{17}, I_{12}, I_{10}, I_8 and I_2. Table 7 summarizes the analysis for these items.

It is important to emphasize that special attention should be devoted to items I_{17} (cost-benefit ratio), I_{12} (Departure time of the bus as scheduled) and I_2 (fast and organized queues). It is believed that these items are well related to two main reasons for using unauthorized (illegal) transportation: price and duration of the route, as shown in Table 4. However, a more careful analysis of the most critical items shows that the main problem concerns the process of selling tickets, as evidenced by the following facts:

i. Many passengers buy tickets moments before the scheduled departure. On the one hand passengers cannot purchase tickets quickly due to the formation of large queues, on the other hand, the company is not interested in starting the trip with unoccupied seats.
ii. Long queues often generate excessive waiting times, if there are not enough attendants at the ticket booths. In addition, there may be an increase in customer complaints with the attendants that can lose control over unwanted arguments in some cases.
iii. Passengers who have bought the bus tickets online or by phone have to withdraw them at the same row (single row) as other customers. Such procedures of buying tickets do not bring any advantage for those customers and they still contribute to hinder the process of purchasing tickets at the bus station.
iv. Passengers who purchase tickets in advance and passengers who arrive at the terminal in advance become upset with the waiting time, so they get off the vehicle and keep waiting for the departure standing up outside the bus.
v. Passengers who arrive just a few minutes before the departure of the bus and have to place their bags at the baggage accommodations also contribute to the delay for the beginning of the trip.
vi. The final count (or recount) of the passengers is only done when everyone is supposed to be seated, and.

Table 7
Analysis of the critical items. Source: Search Results.

Critical Items ("Concentrate Here" quadrant)
• **I_1 (Degree of courtesy of the staff)** – this item refers to the ability of employees to deal with customers, being polite and courteous during the service, disseminating information and solving problems. The study showed that passengers are generally dissatisfied with the attendance provided by the employees. Many respondents reported the lack of availability and of pro-activity for solving difficulties encountered during the service. In order to improve the capacity and ability of employees, the company could offer training to the employees. The training may involve changes in behavior and attitudes and, therefore, the company can require employees to change their attitudes regarding the interactions with customers
• **I_{17} (cost-benefit ratio)** – this item is understood as the relationship between the amount paid and the service which was provided. It is evaluated based on the passenger's perception and expectation about the level of service. Note that to improve the passenger satisfaction in relation to this item it is not enough that the company reduces the value of the ticket fare. It is necessary to improve items considered important by passengers (or other items which importance has not been perceived), i.e., to improve the level of service
• **I_{12} (Departure time as scheduled)** – Passengers were very dissatisfied with the company on this item. Several aspects that provide the delay of the bus departure were identified: delay of the buses to arrive at the bus station, delay to put the baggage inside the bus, delay of passengers to get on the bus and the excessive waiting of the driver for late passengers
• **I_{10} (Respect to the traffic laws)** – Many passengers said they did not feel safe during the trip. Drivers behave recklessly constantly exceeding the speed limit and passing vehicles not according to the road traffic regulations. To avoid accidents and not to endanger the safety of passengers, bus drivers must have a great degree of responsibility and of awareness. The company must provide training the drivers to practice defensive driving, and give them psychological support, because they deal every day with the stress in traffic and are exposed to exhausting work due to the often rigorous workload. The road dates from 1970s, has single lane throughout its length and is always under repair. Despite the repairs done in recent years, these factors and the significant traffic increase may influence the way of driving. More specifically, these factors may induce drivers to make overtaking in inadequate and inappropriate conditions, and also exceed the speed limits to recover the time spent in traffic jams - though these factors do not justify such actions
• **I_8 (Accessibility to disabled people)** – the buses are modern but not adapted to permit the use by people with disabilities or reduced mobility. In order to help these people, the fleet should be adapted installing devices such as ramps, lifts, adapted toilets, *wheelchair-box* and reserved space for service dogs. With the provision of such equipments, the disabled people do not depend on the cooperation of others to getting into the bus
• **I_2 (Fast and organized queues)** – this item was marked by users as the lower degree of satisfaction and greater degree of importance. Particularly, this item is inherent in the process of selling tickets, a process that impacts the degree of the user satisfaction concerning various other items. Because of this, the next section will show a more detailed study of the case

vii. Drivers in delay can be induced to commit irregularities in traffic (forced overtaking, going over the speed limit, etc.) in order to make up for the time.

Considering the results of the sorting procedure in Table 7, special attention should be dedicated to items on which passengers were 'dissatisfied' with the service provided on items (I_2, I_8, I_{10}) and with items on which passengers were 'nor satisfied, nor dissatisfied', but they were also included on 'concentrate here' region (I_1, I_{12}, I_{17}). The results of the sorting procedure also report that there were 192 'nor satisfied, nor dissatisfied' passengers. (There were only 13 'satisfied' passengers, 2 'dissatisfied' and also 2 'very dissatisfied'). Despite the few number of 'dissatisfied passengers, passengers were predominantly 'nor satisfied, nor dissatisfied'. These results mean many efforts must be dedicated to increase the passengers' satisfaction level in order to avoid, for instance, that passengers change the bus company for another one, try the service provided by other means of transportation or by clandestine transportation companies.

Several possible actions can be implemented in order to improve the critical processes, such as: study of queue models for the process of selling tickets throughout the day and at particular periods; training of service employees in the offices; priority of withdrawal of tickets to passengers who bought tickets by means of internet or phone; creation of specific booth to passengers who want to purchase tickets in advance; to bring forward the arrival of the buses to the boarding terminals (it is also necessary to investigate the reasons for the delays on the departure of the buses from the garage). Although the analysis of the impact and consequences of these actions to improve the quality of transportation services by bus are not in the scope of the present work, it is very possible that positive results are achieved if these actions are actually implemented.

4. Conclusions and recommendations

It's unquestionable the importance of road transportation of passengers by bus for the development of a country. Associated with others transportation systems (air, rail and waterways), the road passenger transportation constitutes an important element in the transportation matrix.

All over the world, many studies have been conducted in order to analyze problems related to road transportation of passengers. In general, these studies focus on the analysis of urban road transportation of passengers and follow two main directions: studies involving technical and operational characteristics, and studies that seek to assess the quality of services as perceived by the users. Both aspects are important and in many subjects, they are interrelated. For instance, it is possible that the timetable of the bus departure is technically adjusted and operated, but if this does not meet users' needs, they probably will seek alternative transportation (other bus companies, illegal transportation, other transportation systems, etc.). On the other hand, the fully meet of the customers' needs not considering the operating costs and the resource constraints can bring unintended consequences to the bus companies.

While the expansion and the resulting increasing popularity of air transportation in Brazil bring benefits to consumers, some bus companies have lost market share in the face of recurring promotions and low tickets fares offered by some airlines companies. In particular, in certain regions of the country this situation tends to be accentuated in the coming years, necessitating the search for competitive advantages to prevent the reduction of the quantity of passengers who use bus transportation.

This article is part of the second subject above mentioned. Desiring to contribute to discussions on the scope of the problem in question, a methodological approach to assess the quality of intercity bus transportation of passengers by bus was presented. By conducting an exploratory case study, it was possible to obtain relevant results for analysis and management of services provided by the bus company, such as: the identification of the characteristics of the respondents (passengers who took part of the survey); the identification of the main factors (criteria) that influence the quality of intercity bus transportation service of passengers; the assessment of the importance degree of criteria related to road transportation of passengers by intercity bus, as perceived by the users; the assessment of the satisfaction degree of users of intercity bus transportation with the services provided, according to the set of criteria, and; the identification of the critical criteria (items) that must be analyzed in order to improve services.

Importance–Satisfaction Analysis was used to classify items according to their priority, especially for items classified in "Concentrate here" quadrant. Items assigned to this quadrant were analyzed and the negative impacts on service quality were highlighted. Sorting procedures were also implemented in order to assign service quality indexes into one of predefined categories which represent levels of satisfaction. After the interpretation of results and observations, it was found that the main problem refers to the process of selling tickets. Some possible corrective actions to improve the quality of services regarding each critical item (criterion) were also commented. Further, there are some aspects that should be pointed out:

– The results refer to an exploratory study conducted from a sample of passengers of a particular bus company and they should not be generalized to the study of other companies. This restriction is based on the possibility of factors that may influence the results, such as: company size, type of vehicle (bus), cultural and socio-economic characteristics of the respondent and route extension. In particular, in terms of the extent of the route, it is believed that shorter routes (probably not interstate ones) are more subject to competition from charter and illegal fleets. On the other hand, it is believed that the users' perception on longer distance routes are totally different from those who travel on short routes, the situation portrayed in the study.

- The road transportation of passengers by bus must be continuously monitored in order to verify if they are being provided appropriately and efficiently, according to standards, criteria, indicators and parameters which define service quality. The proposed approach is expected to provide relevant information for government authorities about the quality of services provided by bus companies and to indicate if they have (or not) economical, technical or practical attributes to provide service according to the required standards of quality. According to the results, the process of concession of a bus company can be reevaluated and specific decisions can be made according to the legislation which establishes rules to concession and the permission for providing bus transportation services. Besides identifying the need for improving the quality of services of the company involved, the resulting analysis may indicate the need for termination of the concession and/or opening the bidding process. Hopefully all those situations will be able to contribute effectively to increase the competitiveness of the sector and provide better services to society.
- Approaches supported on capturing opinions, preferences and customer' requirements are essential for the implementation and development of a quality management system in organizations seeking competitiveness and customer satisfaction. However, due to the large extent of the Brazilian road network and also due to the large number of companies and road routes, researches for assessing the quality of road passenger transportation all over the country are generally expensive, mainly because they are performed by personal interviews. In particular, this specific situation may hinder the use of methodological approach.
- On the other hand, the impact of that restriction can be reduced by the development of a "Site of Road Transportation" that allows passengers to evaluate the quality of road transportation by means of *Internet*. Selecting basic information corresponding to the route (Bus company, distance covered, time and date of travel), and prior filling personal information, the passenger may have access to an online data collection tool that incorporates the proposed approach which will enable him/her to evaluate specifically the service transportation. Operational difficulties regarding the inclusion of all bus companies and routes in the system, and also the need to "popularize" the use of the site will be overcome with the improvement of the site and continuous information. In particular, the "popularization" of the site for evaluation purposes can be increased through special incentives such as prizes to be awarded to passengers who have made assessments (upon presenting the original ticket) and/or by implementing a bonus system (similar to the airlines miles programs). In addition, the development and use of the site may become an important database and provide valuable information about the bus transportation of passengers.

Finally, not wishing to exhaust the discussion of the problem of assessing the quality of bus transportation of passengers – which is broad and diverse – the continuation of this study is directed to the following areas: investigation of the actions suggested to the companies in order to improve critical items (many studies may arise from the implication of this part); assessment of the quality of services provided by the company analyzed in other cities, incorporating the study of long distance routes, and using the proposed approach for assessing quality of services provided by other bus companies.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.tra.2013.01.042. These data include Google maps of the most important areas described in this article.

References

ABRATI, 2010. Quantitative Research on the Satisfaction of Users of Road Transportation in Intercity Lines, Interstate and International. Research Commissioned to Vox Populi, 79p (in Portuguese). <http://www.abrati.org.br/uploads/arquivos/126-Relatorio_Abrati.pdf> (accessed 05.04.11).

Albrecht, K., Bradford, L.J., 1998. The service advantage. Richard D. Irwin, Inc., New York.

ANTT, 2005. Survey Assessment of User Satisfaction of Services of Ground Transportation Companies: Report of Road Passenger Transportation. Report Commissioned from the Telemarketing Datametrica Research and Consulting. Recife, 76p (in Portuguese). <http://www.antt.gov.br/ouvidoria/pesquisa_satisfacao/relatorios.asp> (accessed 05.04.11).

Avineri, E., 2004. A cumulative prospect theory approach to passengers behavior modeling: waiting time paradox revisited. Intelligent Transportation Systems (8), 195–204.

Borchardt, M., Pereira, G.M., Coelho, A.S., 2005. Avaliação do potencial de melhoria dos processos de empresas de transporte rodoviário urbano: estudo de caso em três empresas de Porto Alegre – RS. Transportes 13 (2), 5–20 (in Portuguese).

Brasil, 1995. Law No. 8987 of February 13, 1995. The Law which Provides for the Concession and Allowed the Provision of Public Services Provided in Art. 175 of the Constitution and Other Provisions (in Portuguese).

Brasil, 1998. Decree No. 2521 of March 20, 1998. On the Farm with Permission and Authorization of Dual and Road Transportation of Passengers and Other Measures (in Portuguese).

Diab, E.I., El-Geneidy, A.M., 2012. Understanding the impacts of a combination of service improvement strategies on bus running time and passenger's perception. Transportation Research Part A 46, 614–625.

Diana, M., 2012. Measuring the satisfaction of multimodal travelers for local transit services in different urban contexts. Transportation Research Part A 46, 1–11.

Eboli, L., Mazzulla, G., 2007. Service quality attributes affecting customer satisfaction for bus transit. Journal of Public Transportation 10 (3), 21–34.

Freitas, A.L.P., Reis Filho, C.A.C., Rodrigues, F.R., 2011. Avaliação da qualidade do transporte rodoviário intermunicipal de passageiros: uma abordagem exploratória. Transportes 19, 49–61 (in Portuguese).
Freitas, A.L.P., 2005. Service quality in the context of competitivity. Produção Online 5 (1), 1–23 (in Portuguese).
Fujii, S., Van, H.T., 2009. Psychological determinants of the intention to use the bus in Ho Chi Minh City. Journal of Public Transportation 12 (1), 97–110.
Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., Tatham, R.L., 2006. Multivariate data analysis, sixth ed. Pearson Prentice Hall, New Jersey.
Hu, K.C., Jen, W., 2007. Passengers' Behavioral Intentions for intercity bus service in Taiwan: application and comparison of the LISREL and neural networks. Journal of the Eastern Asia Society for Transportation Studies 7, 486–498.
IBGE, 2011. IBGE Cities. Population Estimation for Municipalities. <http://www.ibge.gov.br/cidadesat/> (accessed 05.04.11).
Kotler, P., Armstrong, G., 2006. Principles of Marketing, 11th ed. Pearson Prentice Hall.
Lovelock, C.H., Wirtz, J., 2007. Services Marketing: People, Technology and Strategy, sixth ed. Pearson Prentice Hall, pp. 648.
Lovelock, C.H., Wirtz, J., Peng, P.C.Y., 2009. Essential of Services Marketing. Pearson Prentice Hall, pp. 569.
Malhotra, N.K., 2007. Marketing research: an applied orientation. Pearson Prentice Hall, Inc.
Martilla, J.A., James, J.C., 1977. Importance-performance analysis. Journal of Marketing 41 (1), 77–79.
Medeiros, F.S., Nodari, C.T., 2011. Identification and analysis of attributes to write performance indicators for the interstate road transportation of passengers. ANTT Magazine 3 (1), 12p (in Portuguese).
Mishalani, R.G., Mccord, M.M., Wirtz, J., 2006. Passenger wait time perceptions at bus stops: empirical results and evaluating impact on real-time bus arrival information. Journal of Public Transportation 9 (2), 89–106.
Mousseau, V., Slowinski, R., Zielniewicz, P., 2000. A user-oriented implementation of the ELECTRE-TRI method integrating preference elicitation support. Computers and Operations Research 27, 757–777.
Parasuraman, A., Zeithaml, V.A., Berry, L., 1985. The conceptual model of service quality and its implications for future research. Journal of Marketing 49 (4), 41–50.
Parasuraman, A., Grewal, D., Krishnan, R., 2004. Marketing research. Houghton Mifflin Company, pp. 643.
Roy, B., 1985. Méthodologie Multicritère d'Aide à la Décision. Ed. Economica, Paris.
Sano, K., Suga, Y., Wisetjindawat, W., Raothanachonkun, P., 2007. The study on the benefits of improving local bus service punctuality. Journal of the Eastern Asia Society for Transportation Studies 7, 1575–1583.
Sollohub, D., Tharanathan, A., 2006. A multidisciplinary approach toward improving bus schedule readability. Journal of Public Transportation 9 (4), 61–86.
Tarrant, M.A., Smith, E.K., 2002. The use of a modified importance-performance framework to examine visitor satisfaction with attributes of outdoor recreation settings. Managing Leisure 7, 69–82.
Turolla, F.A., Vassallo, M.D., Oliveira, A.V.M., 2008. Intermodal competition in the Brazilian interstate travel market. Journal of Economic Analysis 23 (1), 21–33.
Yu, W., 1992. ELECTRE TRI – Aspects Methodologiques et Guide d'Utilisation. Document du LAMSADE. Université de Paris–Dauphine, Paris.
Zeithaml, V.A., Bitner, M.J., Gremler, D.D., 2006. Services Marketing: Integrating Customer Focus Across the Firm, fourth ed. McGraw-Hill, Irwin, pp. 708.