Proposed performance assessment Logistics passenger transport: a case study

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Abstract

In the search for increased operational efficiency to the measurement of organizational results focuses on a strategic issue is essential. The preparation of the diagnostic performance of public transportation in the central area of Rio Grande do Sul has the capacity to show in a clear the scenario about the provision of its service by adopting indicators as a tool capable of measuring the performance of each attribute bound to provide the services. The general objective of this study is to evaluate the logistics performance of passenger transport in the central region of Rio Grande do Sul. In order to be possible to achieve the objective was a methodology to diagnose and evaluate the performance of the sector which encompasses the road transportation from the central region of Rio Grande do Sul.

Keywords: Performance evaluation, Logistics, Competitiveness.

1 Introduction

The first regular bus line in Brazil appeared on the streets of Rio de Janeiro having very simple models with capacity for very few passengers. This model, theoretically basic was evolving as long as the urban growing was imposing the necessity of a transportation that could supply the bigger demand of citizens who needed to accomplish their daily tasks. However, as important as the quantity of passengers that can be transported nowadays, is the quality of the services provided by the companies responsible for it. Vasconcellos (2001) explains that this system of movement is a fundamental element in displacement of the labor force in cities, due to the physical separation between the places of work, study, housing, leisure, among others.

The inefficiency of public transportation leads to a series of consequences. According disclosures of the IPEA (Institute of Applied Economic Research) on the day may 25, 2011, in ten years the demand for public transportation in Brazil fell by 30 %. On the other hand, the sale of motorcycles grew 19% and cars 9 %. For Márcio Fortes, Minister of cities, the fascination with the automobile is undeniable; however, it must be an auxiliary, not the main mean of transportation.

The increasing number of cars in the streets pollutes the urban space, cause a greater number of congestion and also of pollutants emission, reflecting negatively on public health. A specific study about the public transportation, which will contribute to improve the quality of the service provided by the responsible companies, may help in slowing down the problems involved with the growing use of individual vehicles exposed previously.

From the issues presented, this study aims to diagnose the logistical performance of passenger transportation in the central region of Rio Grande do Sul, through the rise of information about the means of performance and the basic logistical processes involved in the provision of this service of the companies active in the central region of Rio Grande do Sul. It is intended to develop a system of diagnosis for assessing the performance of the transport of passengers and from the results found, it's intended to present a pre-diagnostic operational-logistic of the companies' performance.

This study was elaborated due to the growing importance of the service sector of urban passenger transportation on the national economy and in the development of cities. The need for an evaluation of the performance of the services offered by operators, the supply of regular services to passengers, operational efficiency and costs which are compatible with the economic reality, adding value to the service provided and the increase in productivity it elaborates a continued effort on the study and application of forms of improvement of its management.

2 Public transportation system

In the 70s, 60% of the population lived in the rural environment. (EMBRAPA, 2006) From this decade on, there was a great growth of the population, and also of the occupation of the cities, overcoming today, more than 200 million from which 80% live in urban areas. The process of the urban expansion areas is not at the same pace of a few decades ago, but its consequences are very visible.

In a large part of the Brazilian urban space the occupation of the cities was made in a disorganized manner and without any planning and presence of the public authorities, in such way that irregular areas were used for the construction of houses and other essential public services were affected, among them, the public transportation. What can be observed today on this service in the majority of the Brazilian cities and "the formation of a tangle of bus lines operating with great waste of time and cost".

One of the solutions to contain the increase of individual vehicles is the investment of the companies responsible for the collective transportation in the infrastructure of the buses, a better definition of routes, extension and frequency of services, for example. However, in order to make these measurements more effective and done in a shorter period, diagnose the current situation of the transport system relying on a prior assessment on the provision of the service and the views of users themselves is of utmost importance.

For Matau (2008) the reality cannot be explained by a simple description from the point of view of the planner, but by different interpretations given by the authors involved. Through the diagnosis, the companies responsible for the improvement can focus on strategic points of maintenance, proposing resolutions with higher dynamicity and aiding in their planning. Galindo (2009) mentions that the success of planning requires an adequate understanding of the object, which includes the understanding of its completeness and systematization of requirements needed to define and achieve a satisfactory condition of the object. Plane (1995) mentions that plans with a shortage of application tools generate only lax policies.

Therefore, diagnosing the performance of the companies of public transportation is a fundamental tool for the continuous use of vehicles for public transportation, because this study would help to ensure the correct planning of companies, as it helps in the understanding of reality with the view of the passengers and fulfills its role to assist in the subsequent stages of the process. Through the exposure of the reality itself of the public transportation companies can guide their investment in more important issues according to the passengers, offering an equivalent service to the level demanded by them, with no waste of money.

3 Performance and Evaluation Diagnosis

The decision-making within any company, especially in terms of the passenger transportation sector, is previously based on an examination of the current situation of the company and its customers.

To consider the parameters of the relationship between the service provided and the satisfaction of the client the situational analysis is used. The analysis does not always give priority to obviousness, and it often, is to refrain from the internal conditions of organization and the external factors which the passenger transportation service is subject. The indication of the direction to be taken by the company is

often dictated by means of an examination of performance, which comes to operate as an indication for the formulation of new goals and organizational review.

Considering the factors involved in the passengers' transportation, it is needed to emphasize that anyone who defines the growth of a service is the customer, in the event, the passengers. Therefore, the knowledge of the external situation of the situational analysis must pass by the mapping of placements in the view of the passengers.

With the purpose of measuring its actions and parameterize the performance of the company, in addition to be located on the external factors of the passenger transportation service, it can deploy an evaluation and measurement system of its service. The act of measuring involves a series of activities and techniques that aim to quantify variables and attributes of interest from the object to be analyzed, with the goal of improving the understanding of its organizational reality, enabling better decisions and actions to be taken in the future. The measurement is the essence of planning, because it provides a clearer perception of the current aspects of the system. Hnorec (2001) says that "the measures of performance are vital signs of the organization, qualifying and quantifying the way the activities of a process reach its goals, in response to the question: how do you know?".

There are basically two types of measurements: quantitative and qualitative. The quantitative measurement uses the numbers that result from such measurements to make comparisons and keep the records of the assessment of the overall performance. However, in certain situations, the information obtained cannot be quantified. Now, when the strategic focus is to find out what is important to the client and why it is important, the qualitative measures are more efficient. Through this, it gets particularities and individual interpretations, which are useful for a different positioning of the company.

As important as measuring the performance is to evaluate it. According to Siluk (2007): nowadays, managers tend to understand that the measurement of performance gave rise to the assessment of performance and that the assessment is a wide, cyclical and continuous process. A continuous assessment of the performance of the organization allows the achievement of its goals, and entices them to seek the desired results.

The assessment differs from the measurement, because it is based on value and it is imposed standards, specifications, values and judgments, to determine whether the performance meets the needs of the customers or process (SINK AND TUTLLE, 1993). However, in order to be measured on the basis of information, data and facts there is an essential element that precedes the assessment, the performance indicators. For the preparation of a performance indicator (LIMA, 2001) mentions a kind of roadmap to be followed (Figure 1).

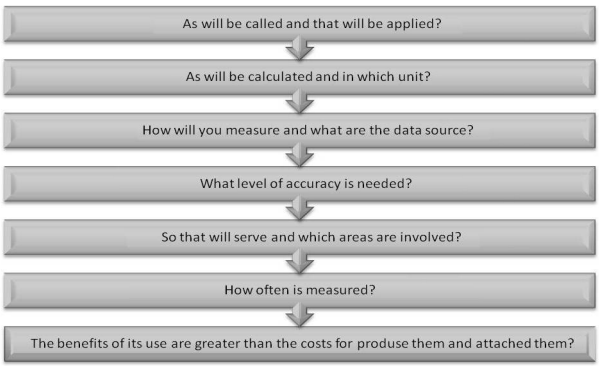

Figure 1: Flow chart for the preparation of performance indicators. Source: Adapted from de Lima ,2001.

Also, the importance of monitoring such information with the use of statistical systems, models of graphs and analysis of series is noteworthy. It is emphasized that the importance of monitoring these information systems using statistical models, graphs and analysis of series.The use of performance indicators, together with the questions of formulation, is the basis for the establishment of an efficient system for evaluation of performance and performance measurement. When defined the constituents of the indicators, they are

the ones that will give support to the subsequent trials set by the system of evaluation. As well as the process of measurement, both qualitative and quantitative, can only be deployed when there are parameters to be analyzed, because the act of measuring implies to quantify variables and attributes of interest of the object, but which need to be previously defined. Therefore, if the decision-making of passenger transportation companies is based on the understanding of the scenario on the point of view of users, which is established by the measurement and evaluation of performance, dependent on the indicators, it is emphasized that this is essential for the recognition of the main demands of the users and thus for the maintenance of a quality service.

Yet, the author mentions that there are twelve main factors that determine the condition of the service provided. They are: accessibility, frequency of attendance, travel time, manning, reliability, safety, vehicle characteristics, characteristics of the places where the bus stops are, system of information, connectivity, behavior of operators and condition of routes. Taking into consideration this observation used as a reference for the development of diagnostic and assessment, are proposed in Table 1 the indicators, its definition and scope, and the factors that compose it, interconnected and correlated that will serve as the basis for the evaluation of performance of the sector.

Table 1: Proposal of indicators for the performance assessment of the sector.

INDICATOR	DEFINITION	SUB FACTORS
IA - Accessibility	It refers to the distance travelled by the passenger as well as the comfort until the/from the point of origin/destination of the trip	1.3 Average distance. 1.4 Number of passengers per kilometer.
ID - Availability	It refers to the existence of vehicles circulating in sufficient quantity to meet the demand.	2.1 Deletion of schedules rate.
IR - Speed	It refers to the duration of a trip between the points of origin and destination.	3.1 Total traveling time. 3.2 Average speed.
IT - Treatment	Refers to the care and ways of expression used to passengers by the collaborators of transport companies.	4. 1 Customer satisfaction rate. 4.3 Complaints rate.
IC - Comfort	Refers to the sensation of well being in the points of the shutdown terminals for loading/unloading or during travel.	5.1 Availability of seats. 5.3 Average occupancy rate.
ICON- Reliability	It refers to the degree of certainty of the customers that the vehicle is going to happen in origin and reach the destination of the trip in time.	6.1 Punctuality rate. 6.2 Average waiting time at the bus stop. 6.3 Frequency of breaking downs.
ISEG - Safety	It refers to the incidents and accidents to vehicles and acts of violence within the same and at the point of arrest.	7.1 Accidents with passengers rate.
IMOD - Moderateness	It refers to the value (tariff) that customers pay for carrying out a trip.	8.1 Disbursements with transportation rates

Source: Adapted from Ferraz 2004

Ferraz et al. (2004) says that the accessibility (IA) is linked to the ease of access to the place of embarkation and disembarkation in travel. The availability (ID) is linked to the time interval and the quantity of vehicles. The speed (GO) is related to the time in the interior of the vehicle. The behavior of the operators (IT) is associated with the way of driving and courtesy of operators. The comfort (CI) is linked to the state of preservation, and accommodation of passengers. The characteristics of the bus stops aim for accessibility and comfort of these places.

The reliability (ICON) is correlated with the degree of confidence in timetable of departure and arrival of the vehicles. The security (ISEG) is linked to accidents involving vehicles of collective transport. And finally the moderateness (IMOD), which is related to the amount paid by customers for the service provided. So that this work could serve as a support to the managers in their decision making, and the need for the model to present a general index as a way of viewing the performance of the objective in question, it was decided then, to develop a general indicator of performance of road passenger transportation, called: Index for the Evaluation of Operational Performance (IADO) of Road Passenger Transportation.

The IADO was prepared from eight predicates or selected indicators in the table illustrated above and it will be obtained through a weighted arithmetic average of eight partial indices as the formula highlighted in Equation 1.

IADO = 0,15IA + 0,10ID + 0,08IR +0,15IC + 0,12IT + 0,12ICON + 0,10 ISEG + 0,18 IMOD (1)

Where:

IADO: Assessment of Operational Performance rate;
IA: Accessibility rate;
ID: Availability rate;
IR: Speed rate;
IT: Treatment rate;
CI: Comfort rate;
ICON: Reliability rate;
ISE: Safety rate;
IMOD: Moderateness rate;

It is suggested that the general indicator, called Assessment of Operational Performance Rate (IADO), be calculated monthly or quarterly from the sum of the standardized notes assigned to each indicator, respected the weight of each one, as shown in Equation 1. Exposed the considerations on the indicators, calculation formula and sub factors involved, it is proposed the performance assessment model based on benchmarks of quality of the service provided. Exposto as considerações sobre os indicadores, fórmula de cálculo e subfatores envolvidos propõe-se o modelo de avaliação de desempenho baseado em referenciais de qualidade do serviço prestado.

4 Methodology

The methodological issue used in the performance of any scientific work consists of the necessary ways for the development of a research, where the methods, in general, seek to ensure the objectivity needed in the treatment of facts, involving truths and local interests, and has as its main purpose to offer solutions to the problems of scientific research. Initially, for this study, information will be raised through a review of the literature related to the activity of passenger transportation, which serves as the basis for the preparation of this work.

Later, primary data will be collected through interviews done by a standard questionnaire developed by the Center for Innovation and Competitiveness (NIC), aiming to identify perceptions and attributes of the performance of the provision of service to the transport of passengers, that at a later time, there will be a descriptive analysis of the performance of passenger transport companies in Central Region of Rio Grande do Sul with the objective of identifying and characterizing their performance.

In order to better characterize the field of study, the city of Santa Maria located in the Central Region of the State of Rio Grande do Sul was adopted for the development of field research that will result in a study of multicase to be contemplated in this project. To Callado et al. (2007), the field of research should be defined on the basis of the accessibility of data, the objectives and the costs for the implementation of the research. At this stage it will be adopted the method of action research. Action research is thus placed by Franco (2005) and is a method of research that combines various techniques of research, where it must be created a collective, participatory and active structure, on the capture of information, therefore requiring the participation of the people involved in the problem investigated.

The choice of the method of action research is due to its characteristics which are: the direct relationship with the practice; the ordered structure; the flexibility and adaptability, without failing to be systematic. Lingdgren et al. (2004) characterized the action research as well as interventional method, which allows the researcher testing hypotheses about the problem in analysis, providing the deployment and access

the changes in real time. In this form of research, the researcher assumes not only the responsibility of assisting with the facts, but also he/she will be able to apply the knowledge. In a third time, having all the information raiser, it will be proposed to elaborate a diagnosis system for assessing the performance of the active companies transportation in the sector, as well as the presentation of a logistical diagnostic and operational performance of these companies.

4.1 Calculation of sample size

For the relevant assessment to the performance of the passengers transportation of the city of Santa Maria it will be used a sampling plan with 95% confidence interval, and maximum margin of error of 5 percentage points (5 %), which is considered the largest variance possible. For the calculation of sample size the following equation will be used:

$$n = \frac{(Z_{\alpha/2})^2 \hat{p}(1-\hat{p})N}{\hat{p}(1-\hat{p})(Z_{\alpha/2})^2 + (N-1)e^2}$$

Where:

$\hat{p} = 0{,}5$ Proportion related to a bigger variance.

e is the tolerable margin of error, in ths case 5%.

$Z_{\alpha/2}$ is the value of the normal distribution, 1,96.

N is the size of the population, in this case 20000.

The target population of the study is constituted by the users of the companies of regular lines of road transportation from the city of Santa Maria. Interviewees were selected at random in different places of the city, among them, the bus stops. After the implementation of the instrument of research and the tabulation of the data, descriptive analysis were performed, which were also analyzed possible relationships between the variables observed in the study, of which they performed as an aid to the spreadsheet of Excel and SPSS software. Subsequently, it was created an indicator to verify the level of performance of road passenger transportation, being this indicator obtained through the relative frequencies of opinions.

5 Public Transportation in the central Region in Rio Grande do Sul

The main responsible companies in the sector of public transportation in Santa Maria are currently part of the Transporters Association of Santa, the ATU. This is a non-profit organization, founded and organized with the objective of the study, co-ordination, protection, representation and recognition of its associates and everything else that relates to the interests of the collectivity that is established.

The ATU is composed by the following companies: Traffic Midwest, Express Mediatrix, Gaboardo Transport, Salgado Filho and Express Our Lady of Sorrows. Each of these companies covers a specific area of the city of Santa Maria and region, and is responsible for the transport of passengers.

One of the innovative measures in public passenger transportation in Santa Maria is the creation of the SIM: Integrated Municipal System. The integrated card works as an advantage in the second trip to the users who use more than one bus in its displacement, within a range from 40 minutes after the landing of the first bus. The discount always occurs in the second bus, and the user has up to 40 minutes after the landing of a bus to the shipment of the second, knowing that the counting is done from the exit of the bus and not from the passage in ratchet. Among the forms of registration there is the Vale Transporters Integrado that is used by workers who receive transportation stipend from the companies they work for. There is also the OI, integrated workman, designed for domestic workers, the CI integrated citizen, designed to any citizen of Santa Maria de and finally the EI, integrated student.

The intention must not be despised, because it really helps people who live in far neighborhoods in relation to its destination in the city, who need more than a bus. However there is one factor that attenuates the possible benefits, which is the increase in the price of the ticket. It is important to remember that in less than a year the figure rose from R$1.80 to R$ 2.30, an increase of 0.50 cents that generates mistrust among the citizens of Santa Maria.

However, it is emphasized that the quality of public transportation covers a range of factors that go from the situation of the bus to the state of the bus stops, frequency of travel, not just the price of the tickets. For this reason, the realization of a broader analysis of public transportation in Santa Maria is one of the main objectives of this project. For this reason it will count on the elaboration of a research tool, depicting better the view of the main responsible for the growth of companies in the sector, the passengers.

The instrument will approach issues also relevant as the price of the tickets, such as the frequency of trips, the situation of the bus stops, punctuality, number of vehicles on the road, safety in its conduction, the main problems in travel, among others. After the count of the data, a logistical operational diagnosis will be carried out so that companies are able to know clearly the factors that are more sensitive to the eyes of the passengers, as well as to those who are carrying out its duty.

6 Case study

As described in the items above, it is intended to evaluate the logistical performance of passenger transportation in the central area of Rio Grande do Sul, and having this objective a diagnosis was established to verify the profile of those interviewed, and also related data that cooperate to identify the performance of active companies in the sector, focusing on the different services that encompass the transportation of the city of Santa Maria.

6.1 Characterization of users

The characterization of the users count on issues related to gender, age, education, occupation and income, frequency of travel, reason, destination and origin. By calculating the size of the sample by the formula mentioned in the methodology, we interviewed 385 passengers, at different points of the city.

It's visible in Graph I that 62.5% of the people interviewed were women while 37.5% were men. In the second Graph, related to education, it is seen that 78% of the respondents are enrolled in or have not completed the higher education, observing that the majority is at the university and the other levels of education are distributed with similar proportions among themselves.

In the indicator age, in the Graph 3, 73% of the respondents are under 25, followed by 19% which are between the ages of 26 and 40, thus characterizing a very young population. According to the profession, it can be seen in the Graph 4 that 78% of the respondents are students; these proportions are due to the fact that the city is a university center of reference in the state of Rio Grande do Sul, as shown in Figure 2.

One can also identify the users by the frequency of trips, where it was found by the Graph 5 that 69% of the respondents use the transportation daily, followed by 13% who uses it weekly, characterizing a population that makes great use of this mean of transportation. The reason for travel, presented in the Graph 6, is that 69% of the respondents use the transport for reasons of study, followed by 16% who uses it to work.

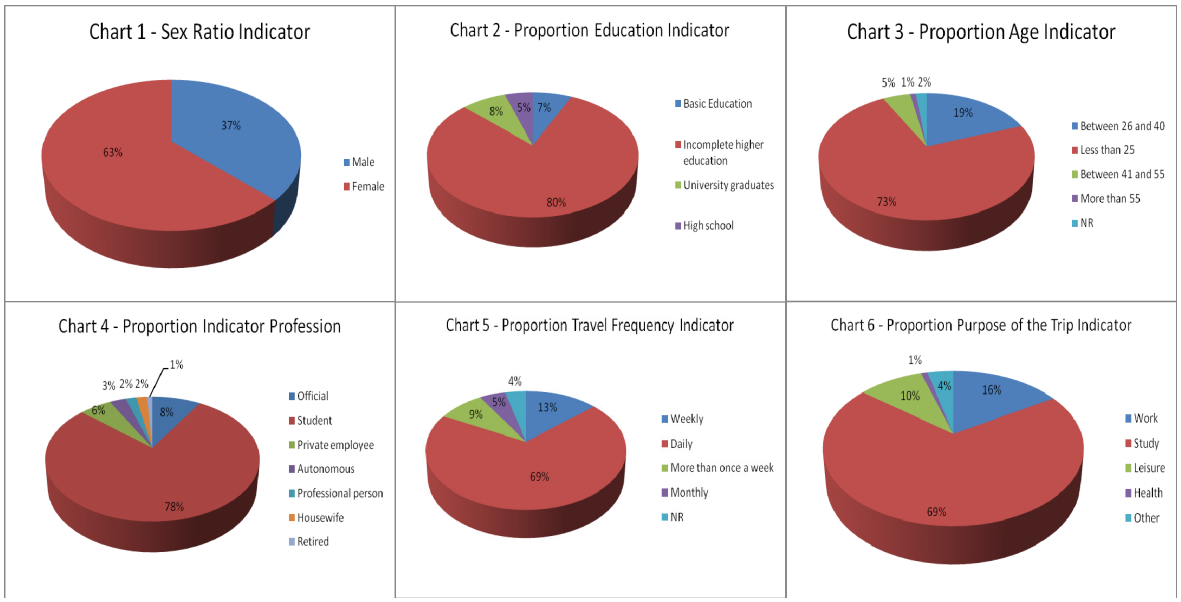

Figure 2: Diagram of the proportion of the characteristics of the users of road passenger transport. Source: Prepared by the authors

It was also found that the majority of the origins and destinations are related with bus lines used by students. The main characteristics of the transportation users in Santa Maria are related to the profession, where the majority is at university, aged up to 25 years old, using the services daily.

6.2 Assessment of road passenger transportation in the central region of Rio Grande do Sul

Through the proposal of performance evaluation suggested by this work and, aiming to show the applicability of the proposed model, it had its application in the sector of road passenger transportation in the central region of Rio Grande do Sul. As it was already mentioned in item 3 of this study, the use of performance indicators, together with the formulation questions, is the basis for the creation of an efficient evaluation system and performance measurement.

From the methodology described above and the way it was defined by diagnosing and evaluating the performance of passenger transportation, the Table 2 represents the indicators used. The suggested method is to find the corresponding rate to each of them respectively, taking into consideration a quantitative combination of the sub factors, which involves an allocation of the concerning weight, as a named form of considering the different degrees of importance in terms of contribution to the overall effect.

From the result above exposed by Table 2, which included the individual depicting rates to each of the eight indicators, some of the assessments can be started regarding the performance of the service of road passengers' transportation of the city of Santa Maria.

The results associated to the objective of this study show a rate of the inefficiency of the sector, the companies and the provision of road passenger transportation services in the central region of Rio Grande do Sul. According to the proposed model the low rate presented in the indicators used IC and IMOD, which show concomitantly the dissatisfaction of the people involved about the lack of action, the deference of the capacity of manning the means used to provide the service and the amount paid by the users of those services, can be warned.

Through the proposed model applied in this case study, indicators that relate to the performance of the point of view favorably in relation to the reality of the service offered were also identified. The indicator IT alludes to the issue that it addresses the education and courtesy given to users of the system, appears

with greater rate, followed by the indicator ICON, which is related to the punctuality of origin and destination of the execution of the services offered to users.

Table 2: The Result of the indicators and their respective performance rates.

Indicators	Weight	Index
IA- Index Accessibility;	15	8,94%
ID – Index of Availability;	10	6,25%
IR - Index of Speed;	8	5,40%
IC – Index of Confort;	15	0,75%
IT- Indice of Treatment;	12	9,45%
ICON -Índice of Realiabity;	12	7,84%
ISEG - Índice of Segurity;	10	8,75%
IMOD – Índex of Modica;	18	1,73%
TOTAL	100	**49,1%**

Even with the primary findings described above and in order to get the overall performance of the sector ready, it was decided to apply the equation of IADO, which was already described in item 3, and whose elaboration is made from the eight predicates or selected indicators and will be obtained by using a weighted average of eight partial indices as formula highlighted in Equation 1.

With the purpose of confirming the evaluated performance, the Contents of Evaluation of the Operational performance (IADO of the road passenger's transportation from the central region of Rio Grande do Sul of 5.78) was found. The result was compared to the regulatory grade shown in Figure 3, this rate with a variance of 0 (zero) to 100 (one hundred) and which is framed in one of the five levels of performance carefully distributed on the basis of a meta-based called minimum performance acceptable. Figure 3 presents the proposed distribution.

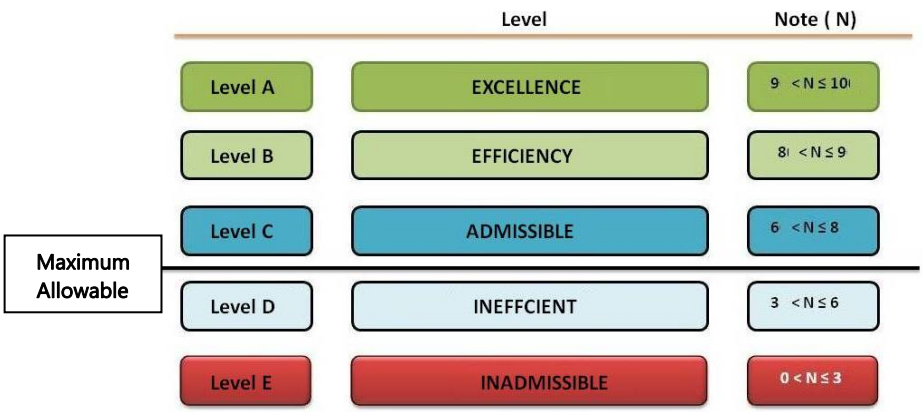

Figure 3: Performance levels distributed. Source: Matheus, 2006.

7 Conclusions

This work aimed to diagnose the logistical performance of passenger transportation in the central region of Rio Grande do Sul, through the rise of information about the way of performance and the basic logistical processes involved in the provision of the passenger transportation service of the active companies in the central region of Rio Grande do Sul. The evaluation of the performance is an essential procedure to control and improve the services offered. The necessity to evaluate the performance of road passenger transportation is seen as extremely important, being its inefficiency the cause of migration for the individual transportation, and generation of advancement in congestion and pollution in urban areas.

In this article, it was suggested a model for the assessment of the logistical performance of road passenger transportation, considering that a criteria for evaluation, by considering a level of significant performance, was adopted. The result presented, the IADO of 5.78, was evaluated as an inefficient rate, being perceived also by the high degree of general dissatisfaction of the users of the service. The determination of the results obtained by the participating companies in the study took place by means of indicators which show the great importance of having them for the critical analysis performed to diagnose and evaluate the passenger's transportation in the central region of Rio Grande do Sul.

It is understood that in order to have improvements in the sector, managers need indices that translate with greater clarity, the quality of services offered to users, and that reflect, in a general way, the economic-financial balance of the system, and this was the objective of this study. It is possible to state that the objectives of this study were achieved; reporting through the proposed model the situation the sector studied is facing, with no intention to exhaust the possibilities for studying in the sector.

References

EMBRAPA.(2006). Migração rural, urbana, agricultura familiar e novas tecnologias: coletânea de artigos revistos. Embrapa Publicações, 2006.

FERRAZ, A. C. C. P., TORRES, I. G. E.(2004) *Transporte Público Urbano*. 2 ed. São Carlos, São Paulo: Rima.

FRANCO, M. A. S. (2005).*Pedagogia da pesquisa-ação*. Educ. Pesqui. [online]. vol.31, n.3,pp. 483- 502.

GALINDO, E. P.(2009). *Análise Comparativa do Entendimento do Transporte como Objeto do Planejamento*. Dissertação de Mestrado em Transportes, Publicação T.DM-001ª/2009, Departamento de Engenharia Civil e Ambiental, Universidade de Brasília, DF, 177p.

LINDGREN, R.; HENFRIDSSON, O.; SCHULTZE, U. (2004). *Design Principles for Competence Management Systems: a Synthesis of an Action Research Study*. MIS Quarterly, v.28, n.3.

MATHEUS, A.P.(2006). *Avaliação da satisfação dos usuários de uma empresa prestadora de serviços públicos.* Pedro Leopoldo, MG. Dissertação (mestrado)- Programa de Pós graduação em Administração, Faculdades Integradas de Pedro Leopoldo.

HRONEC S. M.(2001). *Sinais vitais.* São Paulo: Makron Books.

PLANE, D. A. (1995). *Urban Transportation: Policy Alternatives*. Em HANSON (ed.) The Geography of Urban Transportation. Second Edition. The Guilford Press. NY.

SILUK, J. C. M.(2007) . *Modelo de gestão organizacional com base em um sistema de avaliação de desempenho 2007* (Tese de Doutorado).

SINK, D.; TUTTLE, T. (1993).*The performance management question in the organization of the future. Industrial Management*.

TEDESCO, G. M. I.(2008). *Metodologia para Elaboração do Diagnóstico de um Sistema de Transportes*. Dissertação de Mestrado em Transportes, Publicação T.DM – 001ª/2008. Departamento de Engenharia Civil e Ambiental, Universidade de Brasília, DF, 215p.

VASCONCELLOS, E. A. (2001).*Transporte urbano, transporte e equidade*. Análise das políticas públicas. 2 ed. São Paulo: Anna Blume.