

Analysis of Intelligent public Transit Service Models by users: A Literature Review

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Keywords— Service quality, Public service, Public transit, Literature review.

Abstract— The urban public transit sector for bus passengers has undergone significant strategic changes, motivated by the issue of qualitative management in its service. It has been noticed in the literature that management models, which consider sustainability, eco-efficiency and human capital, are able to value the business, combined with customer satisfaction, quality, and behavior. This article aims to conduct a bibliographical research with the aim of analyzing concepts related to the quality of public road transit service. The methodology was exploratory and explanatory through a literature review on intelligent public transit service models by users. Based on the proposed constructs, the results pointed to the following trinomial: Quality, Satisfaction, and Behavior. It was possible to identify, through the research, models that indicated that service satisfaction is directly related to quality. Nevertheless, the matter is not merely related to quality, but rather social, environmental and economic behavior. Findings were identified in the literature that pointed to the need to build an Intelligent Management Model for public transit, which are qualitative management methods that adapt to user needs, considering urban, environmental, social, behavioral and economic aspects.

I. INTRODUCTION

Satisfaction and the search for operational performance, translated into competence, has always been propitious to scientific discussion, whether in the academic setting or in the professional scope between companies.

Many studies have shown that service quality affects customer satisfaction, which, in turn, influence behavioral intentions in relation to the service provided, as satisfaction is directly related to service quality, considering aspects such as: speed accessibility, comfort, regularity, punctuality, cleanliness, cost, proximity, and safety (OÑA, ESTÉVEZ, OÑA, 2020).

Conversely, loyalty is directly related to behavioral issues of individuals, whether at the individual or collective level (OÑA, ESTÉVEZ, OÑA 2020).

According to Machado et al. (2018), existing approaches to addressing customer perception data have two key challenges:

- (1) Heterogeneity of perceptions obtained by customers; and
- (2) Simultaneous questioning of attitudes that explain behavioral issues relating to the customer.

According to Machado et al. (2018), the assessment of service quality based on the behavioral

theory relating the customers of urban public transit must address two key challenges in an advanced way. These are:

(1) Related to changes in the environment, such as infrastructure improvements and service management; and

(2) Increased costs relating to car use.

Nevertheless, according to Machado et al. (2018), individual transit policies focus on decision-making by users themselves, aiming to encourage the use of alternative modes of transport on their part, thereby changing the perceptions of these customers about the environment and their judgments regarding different travel options suggested by the companies.

According to Machado et al. (2018), this is generally due to measures that consist essentially of workplace or school travel plans; personalized travel planning and; marketing and travel awareness campaigns to be implemented.

This study aims to discuss which methodologies are researched in the literature on management models, which verify the degree of impact of the quality of urban transport service, with a view to sustainability and eco-efficiency in relation to end users.

The originality of the paper is based on the fact that it seeks management models in the literature that assess qualitative and quantitative, environmental, social, behavioral, economic and financial aspects.

The literature showed gaps on management models that considered variables such as: (v1) speed; (2) regularity; (3) satisfaction; (4) eco-efficiency; (5) behavior etc. Nevertheless, the issue of their impact on the life cycle of the public transit product was not permanent, nor was there a intelligent model that is directly tailored to the needs of its users and allows managers to adapt to new situations, such as issues of mobility, climate, energy scarcity, and change of customer profile, as well as contemplating tax, economic and financial aspects.

Given this, the research problem was proposed, aiming to address the need to identify intelligent public transit service models by users, which could celebrate and pacify a term for peaceful and effective adjustment.

The structure of this article is as follows: (1) Introduction; (2) Foundation; (3) Methodology; (4) Results; and (5) Conclusion.

II. PUBLIC TRANSIT

Da Silva (2018) states that urban public transit is a service that works as an essential process for people's mobility, particularly in large and medium-sized cities in

Brazil. From the 1950s to the 1960s, buses became a means of public transit for the population through the privatization of the vast majority of companies providing public transit services, supported by the concessions law.

According to Gois (2019), the Public Transit System is essential for society as a whole, as it allows people to move around, facilitates access to desired locations, and helps in consumption activities, moving the country's economy. Through public transit, people achieve accessibility to work opportunities and quality of life.

Angnes (2019) portrays that public services are essential for the construction of social, economic and urban mobility. Without access to them, people are severely limited in developing their capabilities and exercising their rights or equal opportunities. Urban public transit in Brazil, as provided in the Federal Constitution, Article 30, item V, is considered an essential public service, as it is defined by society, represented by the constituents.

Bordalo (2016) reminds us that transport is a service that has accompanied mankind since its inception, having grown as an economic activity alongside communication and financial services since the Industrial Revolution. As a result of the Industrial Revolution, public transit appeared almost simultaneously in several cities. The production that used to be carried out in workers' homes is now conducted in factories equipped with special machines and tools, generating the need for workers to be displaced on a daily basis to the factories.

According to Lapa (2019), the need for displacement, encouraged by a culture of individual consumption, allowed the formation of a new road structure marked by the intense flow of private vehicles, resulting in a series of difficulties both in the accessibility of urban services and equipment and in the mobility of city dwellers.

The hypothesis encompasses highways, waterways, airports, and ports – in some cases. Railroads, in turn, may (or may not) be bundled with the provision of the service. If the state (or the private sector) makes use only of the railways available, it falls into the latter case. Conversely, if it is combined with the provision of a freight or passenger rail transit service, it is placed in the first hypothesis (COSTA, 2016).

London was the first city in the world to build underground lines and currently has the world's second longest subway system. Opened in 1863 (LONDON'S TRANSPORT MUSEUM, 2015), the London Underground is over 400 kilometers long, for a population of eight million people, and was a determining factor in its economic and social development. With the London

Underground, there was a connection between the suburbs and the center, allowing the population to live further away from their workplaces, at lower costs. The London Underground system allowed the integration between the city center and the districts, promoting the city's territorial expansion (MARRARA, 2012).

One of the ways to measure results in relation to public transit consists of analyzing the schedule of lines and avoiding problems in public transit through the monitoring system. This system makes it possible to evaluate the system's performance applied in transit and address improvements (MUNIZ et al., 2020; MISHRA).

Muniz et al. (2020) claim that accessibility, as a means to reach the desired destinations for a given person, is the most direct indicator of the effects of a transit system.

The urban public transit system is a public service, under the responsibility of the municipalities, as defined by the Brazilian Constitution (2011), seeking "to organize and provide, directly or under a concession or permit agreement, public services of local interest, including collective transit, which has an essential character," is a key priority service for the population (MARRARA, 2012).

The term urban mobility has been widely debated by several researchers in congresses and events on transit and transport, as well as urban planning, in Brazil and worldwide, as many countries are undergoing major social, economic and even demographic transformations, changing the characteristics of urban space and influencing the circulation of people and vehicles (MISHRA, WELCH and JHA, 2012; ROSE, 2008).

It can be considered that urban mobility is directly linked to people, who play a number of roles – including those of pedestrians, cyclists, drivers, and passengers – to ensure their displacements, considering the dimension of the urban space,

Mobility, for Muniz et al., (2020) can be affected by factors related to age, gender, personal income and factors related to the urban space, such as its organization and the way transport is scaled. The handling of mobility can be understood as a function of the public agencies. In Brazil, however, there is still no effective policy for the treatment of urban mobility, which aims to ensure quality accessibility and movement for all.

Urban mobility goes beyond the conditions of displacement and use of existing transport – it also serves for people's relationships with space, reflecting the cultural characteristics of a society (WELCH and MISHRA, 2013; ROSE, 2008).

To know the mobility index of a region is to understand the amount of urban trips carried out and the distribution of trips between the various modes of transport, and these depend on a country's development level, climate, public policies, and quality of transport. This mobility index is higher if the level of socioeconomic development of the country and the city is also higher. This indicator also depends on state policies and the demands of the population. Conversely, with the evolution of the means of communication, there has been a reduction in the number of displacements (MUNIZ et al., 2020).

Cities must be treated for the benefit of man. Urban transit systems must provide conditions for people to have opportunities to live together in society and with nature. Thus, it is necessary to encourage and raise awareness among the population of the importance of prioritizing the modes of locomotion through buses, pedestrian means and bicycles, while also showing the importance of using one's own vehicle rationally, as it also requires other elements of society.

When discussing public transit, it is worth highlighting two positive aspects of great importance (COSTA, 2016). First, the social issue: public transit is the only motorized mode accessible to the low-income population that offers full security and great comfort. Second, due to its democratic nature, public transit is often the only form of transit for those who do not have cars or who cannot or do not wish to drive, thereby highlighting the great importance of a good service to meet social needs (MUNIZ et al., 2020).

Since the 1990s, commuting patterns have undergone changes, mainly due to labor relations, such as flexible working hours, activities carried out from home, de-concentration of industrial centers, and even the logistical strategies of some companies.

Social efficiency is linked to the evaluation of public transit, which is based on factors such as ease of movement for people, and quality of service, thus being a service that meets basic needs and improves the population's quality of life.

The dependence relation of the poorest people regarding urban public transit can even be classified as inhumane, as they have lower family incomes, but still depend on this resource, increasing the percentage of their salary spent on public transit (COSTA., 2016).

The middle classes had their travel needs met more quickly and efficiently, while sectors that rely on public transit remained subject to poor average circulation conditions. The most direct way of meeting the needs of the middle classes was through the adaptation of the urban space to the life of these social groups. Thus, cities

acquired the contours of middle-class spaces, in which they could exercise their lifestyle comfortably and efficiently (COSTA, 2016).

The automobile then became a means of reproduction for social groups, mainly middle-income groups that, in order to assert themselves, require a set of social, cultural and economic activities, including the acquisition of a motor vehicle, which evidently provides greater mobility. Thus, the public policies implemented prioritized the demands of middle-income social groups to the detriment of the majority of the population that relies on public transit (KIM and ULFARSSON, 2012).

Since the transport policy, particularly in Brazil, is not efficient with regard to public transit, the use of the motorized modal, especially the automobile, is becoming more and more frequent.

It is known that one of the causes of congestion is the flow of trucks that enter the big cities for supply purposes, as well as to follow their routes to ports or other distribution centers. This phenomenon only occurs due to the absence of railways that cut across the entire national territory, as well as the lack of sufficient and adequate waterway transport. Transport is a network, which is why it is impossible to separate urban transit from other transport infrastructure (MISHRA, WELCH and JHA, 2012; COSTA, QUIRINO, & GRANEMANN, 2017).

The functioning of a transport mode, even at the urban level, interferes with all other modes, and the latter interfere with the mobility of cities. The use of an individual vehicle generates traffic. Nevertheless, in order to reduce the use of private vehicles, it is necessary to implement efficient public policies in the field of public transit. The first solution is to invest in subways, so that individual transport can be discouraged – which has not been done in recent decades. It is necessary that urgent investments be made in the construction and expansion of the subway network in large cities (HAQUE, CHIN and DEBNATH, 2013).

According to Machado-León et al. (2017), the profitability of public transit systems requires that the public agent implement a complete diagnosis of the services provided based on the perceptions and expectations of users and invest public resources according to users' needs, perceptions, and satisfaction, as they will be the ones driving government gains. Such gains are not only quantitative, but above all qualitative (MACHADO-LEÓN ET AL. 2017).

According to Oña and Garrido (2017), when a public transit manager conducts a customer satisfaction survey, the goal is to determine the general satisfaction of

these passengers regarding the service provided, as well as their satisfaction with specific aspects such as frequency, speed, comfort, etc.

Thus, it is essential to assess the importance given by customers to each attribute pointed out. Another important perception is to ask directly about this importance and which ones bring advantages and disadvantages to them (OÑA E GARRIDO 2017).

According to Oña and Garrido (2017), the demographic profile and travel behavior are characterized by the following aspects and factors: (1) Gender; (2) Age; (3) Availability of private vehicles and reason for the trip; (4) Frequency; (5) Complementary modes from the starting point to the bus stop; (6) Complementary modes from the bus stop to the destination; and (7) Type of ticket.

Regarding the average values for declared importance and perception rates, according to Oña and Garrido (2017), they represent the following: (1) Information; (2) Punctuality; (3) Transit security; (4) Courtesy driver; (5) Bus interior cleanliness; (6) Bus space; (7) Bus Temperature; (8) Accessibility to/from the bus; (9) Fares; (10) Speed; (11) Frequency of service; (12) Proximity to the starting point/destination; and (13) Overall satisfaction.

III. METHODOLOGY

As for the research method used to prepare the research strategy, an explanatory documentary research was proposed. Based on a bibliometric study, the foundation of this article was validated.

With the knowledge of the concepts offered, the objective of the bibliometric study is validated based on the introduction and development of the problem proposed in this article.

It was mandatory to carry out a survey of articles inherent in the central topic of the research, namely: (1) Service quality; (2) Public service; (3) Public transit; and (4) Literature review, which are in harmony with the proposal of the general objective of the research.

Based on the research design, the bibliographic study was chosen as the research method to validate the research instrument used, as it is intended to apply a bibliometric study aiming to verify the adherence to the criteria and requirements proposed in this dissertation, so that the researcher can build the foundation for the choices of the research strategy.

A new tree of key terms and keywords was created, adjusted according to the previous analysis. Figure 1 presents this last keyword tree.



Research Objective	Thematic Areas	Thematic Sub-Area
What methodologies researched in the literature on management models verify the degree of the impact of urban transit service quality, with a view to sustainability and eco-efficiency.	Service quality	Overall satisfaction
	Public service	Passenger satisfaction
	Public transit	Smart city
		Eco-efficiency

Fig.1: Last Keyword Tree Formation

Source: Adapted from Vieira Neto (2012)

Analyzes were carried out using search engines with the following guiding keywords: (1) Service quality; (2) Public service; (3) Public transportation; (4) Literature revision. Through the analysis, the following Boolean was generated: (TITLE-ABS-KEY (serviçoAND qualidade) AND TITLE-ABS-KEY (públicoAND serviço) AND TITLE-ABS-KEY (público AND transporte)) AND PUBYEAR > 2015 AND (DELETE (SUBJAREA,“COMP”) OR DELETE (SUBJAREA,“MEDI”) OR DELETE (SUBJAREA,“MATH”) OR DELETE (SUBJAREA,“ENER”) OR DELETE (SUBJAREA,“EART “) OR DELETE (SUBJAREA,“PHYS”) OR DELETE (SUBJAREA,“AGRI”) OR DELETE (SUBJAREA,“BIOC”) OR DELETE (SUBJAREA,“CHEM”) OR DELETE (SUBJAREA,“CURAR”) OR DELETE (SUBJAREA,“ENFERMEIRAS”) OR DELETE (SUBJAREA,“CENG”) OR DELETE (

SUBJAREA,“PSYC”) OR DELETE (SUBJAREA,“PHAR”) OR DELETE (SUBJAREA,“IMMU”) OR DELETE (SUBJAREA,“NEUR”) OR DELETE (SUBJAREA,“VETE”)). This originated a group of 1,243 documents, which served as the basis for the preparation of the bibliometrics of this research, carried out from January 2016 to June2021.

Of these, after implementing the filters for refinement, they were selected as the object of study and analysis, considering the following order: most cited, with a greater degree of relevance with adherence to the central subject of the research from the titles and abstracts considering a period of five (5) years of publication; and greatest impact factor.

It should be noted that this table was created based on the Boolean generated, after refinements and filters implemented, within the search engine obtained from the Scopus Base. Due to the refinements caused, the

total number of documents extracted totaled eight thousand, seven hundred and sixty-six (8,766).

It should be noted that the totals presented in the Boolean do not express the final amount of documents used, as filters were implemented that provided a quantity of documents at 1,243, with 619 documents being selected from this sample universe, according to the following strategic selection criteria: (1) Most relevant; (2) Most current; (3) Oldest and; (4) Most cited.

This framework and the general objective of the research primarily sought to find what methodologies researched in the literature on management models verified the degree of the impact of the quality of the collective urban transit service, with a view to sustainability and eco-efficiency, pointing to a satisfaction system for both customers, the company, society, and above all, the validation process of the Smart City concept.

After the preparation of the words concerning the thematic areas of the study, the Boolean logic of the connectives “AND” and “OR” vertically was used as a base factor, establishing the validation of the search of journals in the CAPES database, represented as one of the main means and channels of existing bibliographic data, for the search for scientific knowledge as a basis for academic research.

IV. RESULTS

Specifically on the main issues addressed in the literature, through the analysis of the findings, the development of a hybrid management model based on the studied literature was proposed.

According to Antunes (2017), exploratory research is necessary for the improvement of the subject, and the literature review supports the project. The field research, based on interviews with customers of the company providing the public service, will be integrated so that quantitative and qualitative assessments can be carried out, as well as a reflection on resources and financial investments in improving public transit by bus.

The survey results demonstrate a diagnosis of the quality of the service offered in the municipality of Santos, in the state of São Paulo, Brazil (considered, in general, satisfactory, despite its various infrastructural, logistical and behavioral aspects to be improved), in order to constitute an instrument in the proposition of a mechanisms for mitigating or solving serious urban mobility problems – these mechanisms aim to improve user service and can be used by the public authorities, the granting agent, and the licensees.

Costa, Quirino, & Granemann 2017. This article uses a Multicriteria Constructivist Decision Aid Model (MCDA-C) built in conjunction with specialists from the Graduate Program in Transport at the University of Brasília (UnB). The results show that users are not satisfied with the quality of services provided by the operating companies, in addition to indicating the points that must be prioritized in order to improve the quality of the semi-urban service in the Federal District, Brazil.

Cavalcanti, 2017. In order to understand the perceived quality of SEI users, the Barro Integrated Terminal (TI Barro) was chosen as a case study, as it is one of the terminals with the highest demand for passengers, allowing for intermodal integration between buses and subways, in addition to being one of the first terminals opened by RMR, being well known by the population. Through the application of a questionnaire with the users of TI Barro, their dissatisfaction regarding their experiences with the terminal was observed, which can be justified in the analysis the service level of the terminal according to the criteria of the Transit Capacity and Quality of Service Manual, as well as the literature in general. Problems are encountered, mainly, with areas intended for waiting and circulation, frequency of service, total travel time, and comfort. It can then be inferred that the economic benefits of fare integration at the transshipment stations are overlapping, in the planning of systems, with the quality of the operation of the transport system and the terminals.

Tavares (2019). The research was developed by the World Resources Institute Brazil and then applied and made available for this study by Empresa Pública de Transporte e Circulação. The modeling used enabled an analysis of the interrelationships between the quality attributes evaluated in the research (observed variables) and the interrelationships between unobserved variables (latent variables), which represent concepts that cannot be directly measured. The three latent variables evaluated in this study comprised operational characteristics of comfort and health & safety. The results showed that operational characteristics have a direct influence on overall satisfaction, while comfort and health & safety have an indirect influence on satisfaction. We also sought to assess the impact of money spent on public transit, but the observed variable used to represent this concept did not present a significant influence on the general satisfaction of users. In the latent variable of the operational characteristics, the observed variable that had the greatest impact was the one related to the arrival at the final destination without delay. In relation to comfort, the variable observed that had the greatest impact was related to the comfort of the terminals. Finally, in the latent

variable of health & safety, the most relevant aspect is associated with public safety against robbery, theft and aggression on the way and inside buses.

Braz & Nascimento (2020). A qualitative and quantitative research methodology was used, with the application of a questionnaire to one hundred and five (105) volunteers. Bibliographical research was also carried out to ensure a better understanding of the subjects addressed in the study. The results showed that users are under stress and dissatisfied with the public transit service provided in the municipality Anápolis, Goiás. According to them, transport is slow, affecting their quality of life.

The authors (LAU, 2015; MISHRA, COSTA, QUIRINO, & GRANEMANN, 2017) have listed the main characterizing factors that influence the quality of public transit by bus, as presented below, not necessarily in descending order of importance:

- Accessibility – it is associated with the ease of getting to the starting point in public transit and of leaving at the place of arrival, as well as reaching the destination;
- Service frequency – related to the time interval for the passage of public transit vehicles;
- Travel time – time spent inside the vehicles until reaching the destination;
- Capacity – number of passengers inside the vehicles;
- Reliability – the users' degree of certainty that the public transit vehicle will pass by the starting point and arrive at the destination on time;
- Safety – accidents involving vehicles and acts of violence;
- Vehicle characteristics – technology and state of conservation;
- Characteristics of the stopping places – adequate signage, existence of benches for seating, and cover;
- Information system – availability of tables, maps, leaflets with timetables, routes, and indication of stations;
- Connectivity – ease of movement of public transit users between any two places in the city, integration;
- Operator behavior – the attitude of drivers and other employees during the performance of their activities; and
- Road condition – the quality of the running surface.

Public transit has been undergoing a crisis in its pricing and infrastructure model for some time now. During the last decades, cities that have a transport system model had suffered from these situations, reflecting the migration of passengers to other alternative transport schemes, thereby causing an increase in fares. Transport remuneration is exclusively through fares (COSTA, QUIRINO, & GRANEMANN, 2017).

Due to the remuneration model for services, the constant increase in costs and inputs, low productivity of transport and concession of gratuities are the reasons for the increase in the fares, the main effect of which is the withdrawal of lower-income classes from public transit (BRAZ; NASCIMENTO, 2020).

Public transit passengers, even with lower financial conditions, also seek attributes such as reliability, timeliness, accessibility, comfort, convenience, safety and cost (fares) when referring to locomotion – characteristics that are also demanded by those who use other transport options. Public transit users seek use aspects of mobility and favorable service, as they also aim to minimize factors such as excessive travel time or lack of accommodation and comfort (LAU, 2015; MISHRA, WELCH).

In the case of public transit, this further harms environmental conditions, as it involves high levels of concentration of carbon monoxide (CO) in the atmosphere. Another situation is the high rate of noise pollution. Urban growth requires an integration between public transit and development, in order to reduce inequalities in transit, offer transport efficiently and with quality, and contribute to economic development (HAQUE, CHIN and DEBNATH, 2013; KIM and ULFARSSON, 2012).

In terms of environmental sustainability, it is necessary to have a balanced use of urban space, improve people's quality of life, and improve air quality and energy sustainability. Sustainable development, in turn, comprises the search not only to preserve or compensate for the damage caused, but also to cause the least possible impact on the environment as a result of the provision of public transit services (ANTUNES; ROMEIRO; SIGRIST, 2017).

Conversely, ecological development consists of the awareness of respecting environmental capacity, conservation and recycling of resources, reduction of effluents, and the employment of appropriate technologies for the reuse of natural resources. Thus, associating the public transit service with environmental sustainability would be an alternative to mitigate environmental impacts (LAU, 2015; ZHOU, 2012; SANTOS and SOBRAL, 2014; CAVALCANTI, 2017).

The awareness that natural resources are finite and must be preserved for the maintenance of life and humanity is of fundamental importance for public transit companies, as opposed to the people who are also actively contributing to environmental degradation (SANTOS and SOBRAL, 2014).

The operation of public transit involves driving vehicles along scheduled lines (itineraries), with stops for passengers to embark and disembark. The purpose of controlling the operation is to ensure that trips are carried out according to schedule, prevent fraud or revenue evasion, ensure adequate behavior of transport operators with regard to the treatment of users, fair rates charged for services to users, and finally the gathering of information for the adequate planning of operations. In order to carry out an efficient operational control, it is necessary to have the support of qualified professionals in the field of inspection and an adequate technological system (ANTUNES; ROMEIRO; SIGRIST, 2017).

Many of the technologies used to control the operation of public transit are referred to as Intelligent Transport Systems (ITS). As explained by Ferraz and Torres (2004), the ITS aims to provide safety, improve operational control and transport productivity, and reduce delays, congestion and emission of pollutants in vehicle traffic (HAQUE, CHIN and DEBNATH, 2013).

According to Oña (2021), in order to attract more users to public transit services in an urban and metropolitan context, it is necessary to evaluate and take as a starting point a sustainable mobility approach in cities.

The author further notes that it is crucial and essential to improve our knowledge and perceptions of the quality of services provided, as well as the satisfaction and behavior of traffic intentions from the standpoint of users of private transit (OÑA, 2021).

According to Oña J., (2021) the relationship between service quality, satisfaction and behavioral intentions or loyalty in the domain of public transit become preponderant.

He pointed out, in a hypothesis-based test, that satisfaction with service quality leads to loyalty behavior intentions on the part of users (OÑA, 2021), forming the three hypotheses to be tested as follows:

(1) Service quality has a direct positive effect on satisfaction;

(2) Satisfaction has a direct positive effect on behavioral intentions or loyalty; and

(3) Service quality has an indirect positive effect on behavioral intentions or loyalty.

Nevertheless, according to Oña J., (2021), despite the growing interest in the subject, there is a lack of consensus regarding various aspects studied, citing as examples (1) the difference between service quality and satisfaction; (2) the relationship between behavioral intentions and loyalty; and (3) the mediating effect of satisfaction between service quality and behavioral intentions.

Thus, for the formation of indicators related to quality should be considered attributes of the service provided. For satisfaction, aspects related to user loyalty must be considered (OÑA, 2021). Below, the author describes the factors related to satisfaction and loyalty pointed out in his research as a model proposal:

Table 1: Absolute frequency of keywords

Factors	Description
1	Frequency
2	Proximity
3	Frequency
4	Punctuality
5	Speed
6	Cost
7	Accessibility
8	Intermodality
9	Personal space
10	Temperature
11	Cleanliness
12	Internet
13	Safety
14	Information

Source: Author's own work (2021)

Table 2: Absolute frequency of keywords

Modelo Híbrido de Gerenciamento Inteligente de transporte coletivo urbano					
Direcionadores	Fatores	Variáveis Manutenção	Itens	Autores	Fases do ciclo de Vida
(1d) - Comportamento (2d) - Qualidade (3d) - Satisfação	(1f) - Ambiental (2f) - Econômico (3f) - Social	(1vm) - Corretivas (2vm) - Predictivas (3vm) - Preventivas	(1i) - Acessibilidade (2i) - Análises de dados Histórica (3i) - Atendimento (4i) - Cortesia (5i) - Custo (6i) - Espaço individual (7i) - Fidelidade (8i) - Frequência e Horário Inteligente (9i) - Informação (10i) - Intermodalidade (11i) - Internet e mídias sociais (12i) - Lealdade (13i) - Limpeza (14i) - Mobilidade (15i) - Perfil do Cliente por faixa etária (16i) - Pontualidade (17i) - Proximidade (18i) - Segurança (19i) - Simplicidade e Adaptação (20i) - Tarifa ou Preço Inteligente (21i) - Temperatura (22i) - Trajeto ou Rota Inteligente (23i) - Velocidade	de Oña J., 2021; de Oña J., 2021; de Oña J., 2021; de Oña J., Estévez E., de Oña R., 2020; Machado J.L., de Oña R., Diez-Mesa F., de Oña J., 2018; Dell'Olio L., Ibeas A., De Oña J., De Oña R., 2017; Machado-León J.L., de Oña R., Baouni T., de Oña J., 2017; de Oña J., de Oña R., Garrido C., 2017; Diez-Mesa F., De Oña R., De Oña J., 2016; de Oña J., de Oña R., López G., 2016; Machado-León J.L., de Oña R., de Oña J., 2016; Hernandez S., Monzon A., de Oña R., 2016; de Oña J., de Oña R., Eboli L., Mazzulla G., 2016.	(1fcv) - Planejamento (2fcv) - Construção (3fcv) - Uso e Manutenção (4fcv) - Descarte e Retrofit

Drivers	Factors	Maintenance Variables	Items	Authors	Lifecycle Stages	
(1d) – Behavior	(1f) - Environmental	(1vm) – Corrective	(1i) – Accessibility	de Oña J.,2021; de Oña J., 2021; de Oña J., 2021; de Oña J., Estévez E., de Oña R., 2020; Machado J.L., de Oña R., Diez-Mesa F., de Oña ., 2018; DeII'Olio L., Ibeas A, De Oña J., De Oña .,, 2017; Machado-León J.L., de Oña R., Baouni T., de Oña J., 2017; de Oña J., de Oña R., Garrido C., 2017; Diez-Mesa F., De Oña R., De Oña J.,2016; de Oña J., de Oña	(1fcv) – Planning	
			(2i) – Historical Data Analysis			
(2d) – Quality	(2f) – Economic	(2vm) – Predictive	(3i) – Service			(2fcv) – Construction
			(4i) – Courtesy			
(3d) – Satisfaction	(3f) – Social	(3vm) – Preventive	(5i) – Cost			(3fcv) – Use and Maintenance
			(6i) – Personal Space			
			(7i) – Loyalty			
			(8i) – Frequency and Intelligent Schedule			(4fcv) – Disposal and Retrofitting
			(9i) – Information			
			(10i) – Intermodality			
			(11i) – Internet and social media			
			(12i) – Loyalty			
			(13i) – Cleanliness			
			(14i) – Mobility			
			(15i) – Customer profile by age range			
			(16i) – Punctuality			
			(17i) – Proximity			
			(18i) – Safety			
			(19i) – Simplicity and Adaptation			
			(20i) – Fare or Intelligent Pricing			

			(21i) – Temperature	R., López G.,	
			(22i) – Trip or Intelligent Route	2016;	
			(23i) – Speed	Machado-León J.L., de Oña R., de Oña J., 2016; Hernández S., Monzon A., de Oña R., 2016; de Oña J., de Oña R., Eboli L. Mazzulla G., 2016.	

Source: Author's own work (2021)

V. CONCLUSIONS

Initially, a gap was identified in the research on the identified models of urban public transit management, in which a proposal for a Hybrid Intelligent Management Model was prepared based on the literature.

In the literature, no model was identified that could qualitatively and quantitatively measure the degree of impact of the guidelines on the lifecycle stages of the urban transport product.

Another absence was a discussion of models that could deepen the subject, considering environmental, social, behavioral, economic and financial needs, both for managers and for the business owners and users.

A serious criticism should be made regarding management that exclusively focuses on profits, satisfying the users' desires, or even meeting the efficiency of the process. We noticed relevant issues in the literature, but they did not envision this subject in general.

In this sense, we observed the need to build a model that could adapt not only to customers, but also to the management method, and to business owners. For this purpose, the following trinomial was developed: (1) Business Owner; (2) Manager; and (3) Client. It has the following structure: (1) Satisfaction by base; (2) Quality by order; and (3) Result by purpose (with a qualitative and quantitative breakdown).

The idea arose in putting the name "intelligent model" to be truly manageable at the qualitative and quantitative level, i.e., adaptable and built through trial and error. This has remained a constant in the literature, as a competitive advantage is characterized by being competent – such competence does not involve only managing, but also providing an excellent service that caters to the desires of the collective.

Thus, the errors would represent the preventive and corrective factors, as well as predictive hits, establishing values, principles, and external and internal factors in business decisions.

Regarding the selection of items, the existing models were analyzed, with the issue of satisfaction, quality and behavior persisting in all of them. Regarding satisfaction, this driver favors the choice between public transit at the individual level, this satisfaction always being accompanied by quality and behavior.

As for the general objective of this research, which focused on the search for intelligent models related to the public transit service – pointing out the degree of impact of the variables of satisfaction, quality, and behavioral aspects of customers – it fully satisfied, with no finding identified that pointed to such a premise.

Regarding quality, the vast majority of items contribute to increasing customer and user satisfaction of urban public transit. To increase the satisfaction indicator, it is important to understand which of these items increases and decreases as a function of customer behavior towards the service provided, as well as environmental, social and economic issues.

In this sense, the research identified gaps that indicated that customers choose public transit while considering environmental, social and economic aspects, with environmental aspects relating to the need for renewable energy and the use of recyclable materials.

As for the social aspect, it was noticed that customers now define the choice while considering not only comfort and quality, but also other preponderant factors, such as intelligent paths and the design of transit systems that meet their collective choices, preferences, and trends. Companies must be aware of changes in each generation, and there is a need to create models that

consider this aspect. One example is the third generation, providing greater mobility to persons with disabilities, effectively meeting their needs, etc.

Customers in a worldwide contexts are not concerned only with the price, but also consider social and environmental, alongside comfort and quality. Here in Brazil, pricing is still the leading factor due to the economic crisis that marred the country for decades.

Another perception was that, based on the findings, the concept of eco-efficiency and smart cities was identified. This translates into a new trend in the form of management. Looking at the service from the standpoint of resources, integrating quality and satisfaction, can direct the customer's behavior. Companies now want to know not only why customers choose their services, but also take time to understand which parameters and factors lead to this decision.

Regarding the objective of the research, it was fully satisfied, as the authors carried out a bibliographical analysis on the main concepts studied, based on the established constructs, which pointed to these three guidelines: (1) Satisfaction; (2) Quality; and (3) Behavior.

Regarding satisfaction, customers need to feel safe, happy, and satisfied, not only having a request fulfilled, but also feeling pleasure in the form, conduct and purpose of the service provided while considering professional, traditional, innovative and artisanal aspects, without neglecting items deemed relevant for this purpose. That involves meeting what is expected through one's latent desire.

As for quality, the goal is to identify that all items have maximum safety, good taste, flexibility, and comfort, as a basis for satisfaction. Quality represents the essence of the service itself, offering excellence in its execution. Competence is strongly linked to quality, which is the accumulation of skill over time. This points to the need to understand the lifecycle of the service provided, based on the resources used in this process, whether they are material (structural capital) or immaterial (intellectual capital), as well as the human, environmental and social resources inherent in this macro process.

Competence is now directly related to competitive advantage, as the company becomes increasingly competitive based on its competences.

Finally, regarding behavior, customers have a strong inclination to be listened to, served and considered as participants in this process. Thus, it is important to have customers as allies and partners, providing them with daily platforms for redesigning satisfaction and quality, not only of what they hope to have as a service, but also pointing to

a social vision of this process. This is translated in the smart city concept.

Adaptable routes that include environmental, social and economic aspects, routes that are evaluated in compliance with not only a reduction in consumption, but also the quality of this reduction, with a reading of new renewable energies, compromise models that consider resources that are recyclable and less aggressive to the environment.

The scientific contribution of this study lies in proposing a hybrid management model that uses current guidelines, in its 23 items, with a view of the life cycle of the public transit service.

Therefore, the practical contribution can be identified over time in the appreciation of satisfaction, quality, and the understanding of the customer's behavior towards the service provided, with the cost and its reduction demonstrating efficiency in conducting the business.

Another perception pointed by the survey was the need to create new business trends to explore this market, opening up the current model of companies to explore a limited sector or territory and creating alternative routes that facilitate, improve and adapt to the real needs of users.

As for the limitations of this research, they involve the lack of presentation of a literature that determines the degree of impact of the satisfaction, quality and behavior guidelines in relation to the Intelligent public transit service, based on the lifecycle of the products.

Proposals are made for new research that indicate the degree of impact of each item of the guidelines based on the product's lifecycle, as contained in the Intelligent public transit model proposed in this research, identifying the reason for each one of them. Such research should also point out the main advantages and disadvantages at the qualitative and quantitative level.

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