

Modelo de mejora de calidad y satisfacción en el transporte público y comercial del cantón Chambo

Model for improving quality and satisfaction in public and commercial transportation in the Chambo canton

Modello per migliorare la qualità e la soddisfazione nel trasporto pubblico e commerciale del cantone di Chambo

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Resumen

La investigación se desarrolla en el ámbito del transporte terrestre en el cantón Chambo, Ecuador, y tiene como objetivo formular un modelo de mejora de la calidad del servicio y la satisfacción de los usuarios del transporte público y comercial, mediante la aplicación de la técnica SERVQUAL. El objetivo de la presente investigación consiste en evaluar la calidad del servicio ofrecido por siete operadoras de transporte público y comercial. Por lo tanto, se plantea el diseño y desarrollo de un modelo orientado al mejoramiento continuo de la calidad en dicho sistema de transporte. El estudio empleó un enfoque metodológico mixto, de tipo descriptivo, de campo y correlacional, combinando técnicas cuantitativas y cualitativas. Se identifican dimensiones que afectan la calidad del servicio y se realiza un diagnóstico mediante la estimación del nivel de satisfacción de los usuarios. Para la recolección de datos se utilizaron entrevistas estructuradas, encuestas y fichas de observación aplicadas a infraestructuras como vías, paradas, unidades vehiculares y la terminal terrestre. La gestión administrativa de las operadoras es principalmente empírica, reflejándose en un índice global de calidad del servicio de -44,20, lo que evidencia una marcada insatisfacción de los usuarios. De manera específica, las dimensiones evaluadas presentan los siguientes puntajes: empatía (-55), fiabilidad (-52), aseguramiento (-48), elementos tangibles (-36) y capacidad de respuesta (-30). A partir de los indicadores obtenidos, se concluye la necesidad de implementar un modelo de mejoramiento de la calidad del servicio de transporte, el cual contempla acciones orientadas a optimizar la gestión administrativa, fortalecer las dimensiones de calidad y atender aspectos técnicos fundamentales.

Palabras clave: Transporte público y comercial; calidad; servicio; satisfacción del usuario; modelo.

Abstract

The research is developed in the field of land transportation in the canton of Chambo, Ecuador, and its objective is to formulate a model to improve service quality and user satisfaction in public and commercial transportation, through the application of the SERVQUAL technique. The objective of this research is to evaluate the quality of service offered by seven public and commercial transportation operators. Therefore, the design and development of a model oriented to the continuous improvement of quality in this transportation system is proposed. The study employed a mixed methodological approach, descriptive, field and correlational, combining quantitative and qualitative techniques. Dimensions affecting service quality were identified and a diagnosis was made by estimating the level of user satisfaction. Structured interviews, surveys and observation sheets applied to infrastructure such as roads, bus stops, vehicle units and the bus terminal were used for data collection. The administrative management of the operators is mainly empirical, reflected in an overall service quality index of -44.20, which shows a marked dissatisfaction among users. Specifically, the dimensions evaluated show the following scores:

empathy (-55), reliability (-52), assurance (-48), tangible elements (-36) and responsiveness (-30). Based on the indicators obtained, it was concluded that there is a need to implement a model for improving the quality of the transportation service, which includes actions aimed at optimizing administrative management, strengthening the quality dimensions, and addressing fundamental technical aspects.

Keywords: Public and commercial transport; quality; service; user satisfaction; model.

Riassunto

La ricerca, condotta nel cantone di Chambo (Ecuador), propone un modello per migliorare la qualità del trasporto pubblico e commerciale e la soddisfazione degli utenti attraverso il metodo SERVQUAL. Lo studio, con approccio misto, descrittivo e correlazionale, valuta sette operatori mediante interviste, questionari e schede di osservazione delle infrastrutture e dei veicoli. L'indice complessivo della qualità del servizio è pari a -44,20, indicando una percezione insoddisfacente. Le criticità principali riguardano empatia (-55), affidabilità (-52), sicurezza (-48), elementi tangibili (-36) e capacità di risposta (-30). Sulla base dei risultati viene proposto un modello integrato che prevede il miglioramento della gestione amministrativa, degli aspetti tecnici e delle dimensioni della qualità, con riferimento ai principi della norma ISO 9001:2015.

Parole chiave: trasporto pubblico e commerciale; qualità; servizio; soddisfazione degli utenti; modello.

Introduction

Currently, the automotive transportation sector in Ecuador is a key pillar of the national economy, not only for its direct impact on employment, but also for its significant contribution to tax collection. Until 2023, this activity generated approximately 114,100 formal jobs, reflecting its relevance as a source of employment at the national level. Likewise, it reported a tax collection of US\$1,608 million in 2023 and US\$1,663 million in 2022, consolidating its position as one of the sectors with the highest fiscal contribution. This economic importance is reinforced by its close ties with technological development, trade and other complementary industries, which makes it a strategic axis for the country's growth and sustainability [1], [2].

Based on the aforementioned elements, the transportation and storage area can be considered a strategic pillar for boosting the national economy. In 2023, this sector contributed 7.55 % to the total Gross Domestic Product (GDP), while, during the period between 2013 and 2023, its average contribution was 7 %, which evidences its sustained relevance in the economic structure of the country [3].

On the other hand, in recent years there has been a substantial growth in the number of vehicles in the country, which has led to an increase in vehicle traffic, noise pollution and polluting emissions from exhaust systems. This trend is reflected in data from the National Institute of Statistics and

Census (INEC), which reports a total of 3,065,967 vehicles registered by 2023, compared to 2,311,960 vehicles registered in 2019, which represents a significant increase in just four years. [4], [5].

In the local context, the total population of the Chambo canton is estimated at [6] The municipality has a population of 11,885 inhabitants, located in a territory that has the characteristic of being enclosed between the rural and urban areas. The Chambo canton has a public and commercial transportation infrastructure that facilitates the development of various daily activities of the population, such as work, education, shopping, health care, among others. Currently, the intra-provincial public transportation service is provided by two operators: the first has 10 active routes, while the second operates 6 routes, with a utilization rate of 39%, since it represents a more accessible option for the community. As for commercial transportation, the canton is home to two cab service companies, with 20 and 15 units respectively.

In addition, there are also two light freight cooperatives, the first with a fleet of 35 vehicles and the second with 59 units. In addition, there is a mixed cargo cooperative in operation, consisting of 10 units, which allows the simultaneous transportation of people and goods in the same vehicle [7]. Currently, the public and commercial transportation system in the Chambo canton presents a serious problem of user dissatisfaction due to the lack of coordination between the operator and the technical part of the transportation system, generating complaints and a bad image of regulated transportation [7]. For this reason, it is necessary to evaluate the quality of service of the 7 public and commercial transport operators, obtaining as a result improvement actions from the administrative part, quality dimensions with respect to the requirements of ISO 9001:2015 and technical aspects that allow users to increase the levels of satisfaction with the service provided through the implementation of the model. In this sense, the model with its implementation would achieve the efficiency of public and commercial transportation in the canton because it allows it to be faster, more satisfactory and safer.

En diversos cantones del país, la calidad en la prestación del servicio de movilidad pública y comercial presenta limitaciones, principalmente por la ausencia de una adecuada planificación y el incremento sostenido del parque automotor particular. Ante esta situación, las autoridades locales se ven en la necesidad de implementar estrategias que permitan optimizar la operatividad y eficiencia del sistema de transporte.

Methodology

The research was developed based on a mixed, descriptive, field and correlational approach, so that both qualitative and quantitative techniques were combined, which allowed to evaluate the research externally and objectively, through data collection methods that allow to process and analyze the information so that the results are attached to reality. In addition, within the research levels were used the bibliographic where several bibliographic sources were used appropriate to

the line of research that allow the support of the information, descriptive where it allows to provide a convenient explanation so that the data collected is properly handled for optimal decision making and finally correlations where it allows the study to know the basic behavior of the object of study to analyze and provide optimal results [8].

Within the framework of the methodology applied for the analysis of service quality and user satisfaction, we evaluated the organizational factors, the quality of service provision to users based on the SERVQUAL

methodology in each operator belonging to the Public and Commercial Transport in Chambo Canton, as well as the technical aspects that complement a quality service in a methodical way. [9].

The data were collected from a specific population at a specific moment in time, for this reason the sample size was determined using the formula for finite populations, ensuring that the results obtained are representative and allow inferences to be made with an acceptable margin of error, as shown below [7]:

$$N = \frac{m}{e^2(m-1) + 1}$$

Where:

N: Sample size

m: Population

e: Admissible precision or error

The sample was calculated from the population of Canton Chambo, which according to INEC data is set at 13208 inhabitants, and applying the corresponding statistical formula determined the size of 272 research sample. The SERVQUAL methodology was used to evaluate the quality of service and satisfaction with the users of public and commercial transportation in the canton.

The data was tabulated and processed in tables and graphs using Excel software. Interviews were conducted with the leaders of the 7 public and commercial transport operators in the canton, and technical data sheets were used to evaluate the infrastructure and vehicles used in the operation, as shown below [10]:

Table 1 shows a breakdown of the modalities and operators of public and commercial transportation with their respective vehicle fleets that cover the mobility needs of Canton Chambo.

Table 1. Public and Commercial Transportation Operators of Canton Chambo.

Modality	Name	No. Units
Public Transportation	Coop. Chambo	21
Public Transportation	Cía. Citransturis	10

Commercial Transportation	Cía. ServiChambo	20
Commercial Transportation	Cía. San Juanito	15
Commercial Transportation	Coop. Rey de los Andes	35
Commercial Transportation	Coop. Reina del Carmen	59
Commercial Transportation	Cía. Avetrix S.A	10
Total		170

Table 2 shows the detailed segregation of the physical infrastructure necessary for the efficient operation of public transportation, including terminal facilities, embarkation and disembarkation stops in technically defined areas with higher demand, which ensure better availability and distribution in the operation.

Table 2. Public transportation station and stops.

No. Stops	Station location and stops
1	Estación Terminal Terrestre Casique Achamba y 27 de Diciembre
2	18 de Marzo y Daniel Parra
3	18 de Marzo y Guido Cuadrado
4	18 de Marzo y Magdalena Dávalos
5	18 de Marzo y Edilberto Bonilla
6	San Juan Evangelista y Magdalena Dávalos
7	Cacique Achamba y Guillermo Cuadrado
8	Cacique Achamba y Oswaldo Echeverría

Table 3 shows the stops assigned to commercial transportation, defined under the technical consideration through which the variables of demand concentration, accessibility and road connectivity are considered in order to improve coverage and guarantee a fluid and adaptable service in the canton.

Table 3. Commercial Transportation Stops.

Modality	Operator	Location
Cabs	San Juanito	Casique Achamba y 27 de Diciembre
	ServiChambo	18 de Marzo y Magdalena Dávalos
Light Load	Reina del Carmen	18 de Marzo y Guillermo Obando
	Rey de los Andes	18 de Marzo y Magdalena Dávalos
Mixed Load	Avetrix	

Table 4 shows the assigned and authorized public transportation routes considering the points of origin and destination to the different sectors in need and aimed at optimizing geographic coverage, reducing travel times and facilitating essential related services.

Table 4. Public transportation routes.

Nro.	Name of the route
1	Chambo – Riobamba
2	Chambo – Riobamba
3	Chambo – Guayllabamba
4	Chambo – San Francisco
5	Chambo-Daldal

The information collected on site in Tables 2, 3 and 4 above provides evidence of the organization of a transportation system in Chambo County, including the operation, vehicles and infrastructure used.

The information collected in Tables 2, 3 and 4 shows the organization of a transportation system in Chambo Canton, both the operation and the vehicles and infrastructure used. Table 5 presents the modal classification of trips in Chambo Canton, categorized according to the type of transportation used by users, where in detail the corresponding modal percentage is distinguished,

which allows to identify the relative participation of each mode in the mobility matrix of the canton. [7].

Table 5. Classification by mode of travel.

Nro.	Mode of Transportation	Percentage	Total trips
1	Walking	24,2%	6.012 248
2	Bicycle	4,1%	1.018 604
3	By Motorcycle	2;6%	645.944
4	Public Transp.	39,4%	9.788 536
5	Truck	3,9%	968.918
6	Private Vehicle	25,8%	6.409 752

Results

The development of the SERVQUAL methodology consists of 21 problems corresponding to 5 dimensions in which the user's satisfaction with respect to the quality of the service provided is evaluated. The methodology evaluates two variables called perception and expectations in which, using a scale of 1 to 7, 1 for disagreeing, and 7 totally agreeing, it describes based on dimensions: specific elements, reliability of the service, responsiveness, insurance and empathy.

Once the user information is obtained it is grouped after each dimension. Next, the average indicator for each dimension is calculated and then the overall average is calculated. From these average gaps between perception and expectations are determined using the corresponding weight. Table 6 shows the comparison between perception (P) and expectations (E) for users of transport services in relation to the dimension of tangible elements, according to the SERVQUAL model. This dimension evaluates the visible physical aspects of the service, such as infrastructure, condition and cleanliness of the unit, staff presentation, suspension or terminal conditions. The analysis shows a constant negative hole in all items evaluated, affirming that the perceptions of current users are in their hopes. In technical terms, this hole (calculated as $P - E$) reflects the perceived service quality deficit, indicating an overall dissatisfaction with respect to the material components that accompany the provision of transportation services. The resilience of this negative gap indicates the need to implement improvements in the physical infrastructure and

visible resources that support the service in order to adjust users' perceptions of their initial expectations.

Table 6. Ratio of the average between the Perception and Expectation of the Tangible Elements dimension.

Percep. (P)	Score	Expecta (E)	Score	Gap (P-E)
P1	4,4	E1	5,8	-1,4
P2	4,1	E2	6,0	-1,9
P3	4,0	E3	5,8	-1,8
P4	3,9	E4	5,9	-2,0
Prom.	4,1	Prom.	5,9	-1,8

Table 7 shows the comparison between perception (P) and expectations (E) for service users in relation to the service reliability dimension through which focuses on measuring the ability of the service to provide safe, accurate and consistent transportation, i.e., whether the operation as a whole is provided in a timely manner, comply with certain routes, maintain a regular schedule and deliver the service according to the promise. The results reflect that the elements of this entire dimension have a permanent negative hole, indicating that users' expectations retain the opinion that they have received a service that was not really expected. This unfavorable gap reveals a significant level of user dissatisfaction, although the size of this hole may vary among users as shown in the table, as this behavior highlights deficiencies in key aspects such as schedules, regularity, route accuracy and the overall trust that users placed in the system.

Table 7. Ratio of the average between Perception and Expectation of the Service Reliability dimension.

Percep. (P)	Score	Expecta (E)	Score	Gap (P-E)
P1	3,8	E1	6,0	-2,2
P2	3,4	E2	6,1	-2,7

P3	3,5	E3	6,0	-2,5
P4	3,3	E4	6,1	-2,7
Prom.	3,5	Prom.	6,1	-2,5

Table 8 shows the comparison between the perception (P) and expectations (E) for service users in relation to the responsiveness dimension, which focuses on measuring the predisposition and ability of the personnel and the system to provide timely and efficient service in accordance with user needs. The results (P-E) called negative gap reflect the dissatisfaction of the users according to the questionnaire.

Table 8. Relationship of the average between the Perception and Expectation of the Responsiveness dimension.

Percep. (P)	Score	Expecta (E)	Score	Gap (P-E)
P1	4,0	E1	5,9	-1,9
P2	4,1	E2	6,0	-1,9
P3	3,9	E3	6,2	-2,2
P4	4,0	E4	6,1	-2,1
Prom.	4,0	Prom.	6,0	-2,0

Table 9 shows the comparison between perception (P) and expectations (E) for service users in relation to the dimension of Assurance Capacity, which refers to the ability of the personnel to transmit confidence and security in the provision of the service, the results obtained from the general perception and expectation gap as in this case giving negative results indicating dissatisfaction with respect to the users' assessment.

Table 9. Ratio of the average between the Perception and Expectation of the Assurance Capability dimension.

Perce. (P)	Score	Expecta (E)	Score	Gap (P-E)
P1	3,7	E1	6,0	-2,3
P2	3,7	E2	6,0	-1,3
P3	3,6	E3	6,1	-2,5
P4	3,7	E4	6,1	-2,4

Prom.	3,7	Prom.	6,0	-2,4
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Table 10 shows the comparison between perception (P) and expectations (E) for service users in relation to the empathy dimension, which focuses on measuring the degree to which the service is offered with personalized attention, as well as courtesy and understanding of the client, the result of this analysis reflects a negative gap which indicates that users are not being completely satisfied.

Table 10. Relationship of the average between the Perception and Expectation of the Empathy dimension.

Percep. (P)	Score	Expect (E)	Score	Gap (P-E)
P1	3,7	E1	6,0	-2,3
P2	3,7	E2	5,9	-2,2
P3	3,7	E3	6,0	-2,3
P4	3,8	E4	5,9	-2,1
P5	3,6	E5	6,0	-2,4
Prom.	3,7	Prom.	5,9	-2,3

In Figure 1 the analysis reveals a service with heterogeneous performance, through the weights that users have expressed according to their priority for improvement (blue series), as there are other systematic disadvantages (orange series). The size of the negative gaps (-30 to -55) implies user dissatisfaction, suggesting that the problem areas require priority intervention to improve the overall quality of services perceived by users.

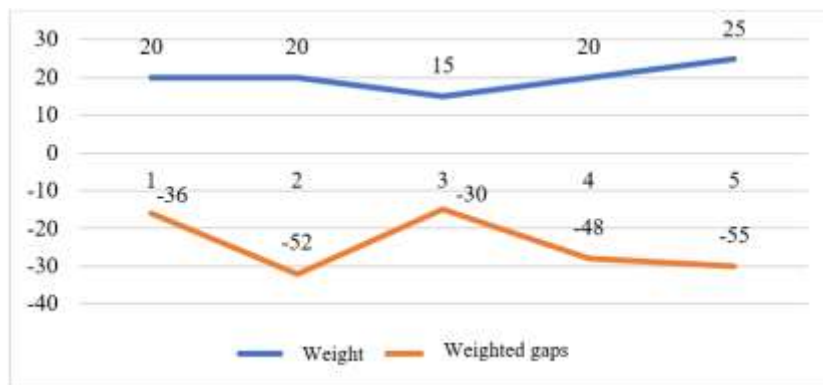


Figure 1. Weighted Gap Analysis and Quality of Service Index.

Table 11 shows the quality of service through the SERVQUAL model, where the negative gaps in all the dimensions evaluated reveal a clear dissatisfaction on the part of the users with respect to the service provided, each one of the dimensions the users have given a weighting (weight), for which, through the set, the weighted gap reaches -221 points, with an average of -44.20, which shows a deficient performance compared to the users' expectations.

Table 11. Weighted gap análisis.

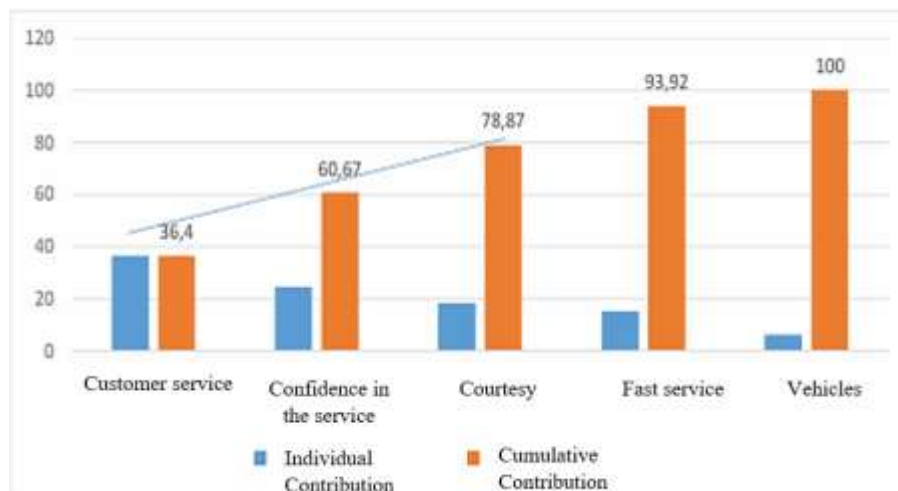
Servqual dimension		Weighti ng	Scores obtained			Weighted scores		
Dimension	Concept	Weight	Perceptio n	Expectatio n	Gap	Perceptio n	Expectation	Gap
E. Tangibles	Appearance of physical facilities, vehicles, equipment and communication materials	20,00	4,1	5,9	-1,8	82,00	118,00	-36
Reliability	Ability to perform the promised service in a reliable and careful manner.	20,00	3,5	6,1	-2,6	70,00	122,00	-52
Response Cap.	Promptness and willingness to collaborate with users	15,00	4,0	6,0	-2,0	60,00	90,00	-30
Underwriting	Knowledge and courtesy	20,00	3,7	6,1	-2,4	74,00	122,00	-48
Empathy	Individualized attention offered by operators to users	25,00	3,7	5,9	-2,2	92,50	147,50	-55
		100						
								-
								44.20

3.1 Pareto diagram analysis

The Pareto principle, also known as the 80/20 rule, states that approximately 80% of the results or consequences come from 20% of the most appropriate causes or factors [11]. Used in a general analysis between perception and expectations, this principle allows this principle to determine the aspects that most affect the overall evaluation of the service. In this case, the first three factors (the user, trust and courtesy, cumulatively, 78.87% of the total contributions which are close to 80% of the frontier that characterizes the principle. This indicates that these three aspects reflect the critical core, which determines most of the user's perceptions and expectations. Their improvement significantly affects the quality of services, as the main causes that create most of the identified hole in the treatment of them.

Therefore, focusing on efforts to improve user care, trust and courtesy is an effective and priority strategy, as these dimensions almost all affect customer satisfaction. This approach allows us to optimize resources and maximize the positive impact on the user experience and to adapt to the philosophy of the Pareto principle to prioritize a small percentage of causes generated by most of the effects as shown in Figure 2.

Figure 2 Pareto diagram of the dimensions to be improved.



The diagnosis of the situation of the transport system shows several structural deficiencies in several key areas for effective service management. In the administrative field, operators have poor

management of planning, organization, management and control (PODC) processes that limit the ability to respond and constantly improve. In view of this situation, it is proposed to introduce a model for improving the quality of the model aimed at optimizing the management of the organization.

Regarding human talent management, operators have not adequately developed their staff, which directly affects the quality of the service provided. This failure shows the need to establish formal processes of education, evaluation and professional development that promote institutional strengthening and compliance with standards of care. From a financial point of view, accounting is not controlled by the appropriate technical criteria when making decisions based on reliable data. Therefore, it is advisable to manage the account of technicians that contain digital tools and accounting systems that improve transparency and financial control.

For regulatory entities, such as the National Transport Agency (ANT) and the technical units of transit, land transport and road safety, the existence of a regulatory framework is recognized at both the national and national levels. However, deficiencies among institutional articulation are ongoing. It is proposed to strengthen communication and cooperation between these units to ensure efficient and harmonized supervision. The use of the SERVQUAL model in service quality and delivery showed the dissatisfaction index of -44.20, which reflects a significant gap between the expectations and perception of users. In this situation, the adoption of the model quality improvement model is proposed based on ISO 9001: 2015 principles, which allows standardizing processes and improving user experience.

Finally, the technical aspects of transportation are defined by the road infrastructure, the physical conditions of the passenger terminal, the availability of information for the user, and the condition of the vehicle. This situation denotes an integrated impact on the quality of service, as well as the lack of sufficient mechanisms to inform and manage the user. It is important to develop a wide range of infrastructure intervention activities, and information systems that meet the real needs of the city environment. Together, these findings allow you to create a solid foundation for improving the strategies that are integrated into public management, service quality and sustainability criteria, as shown in Table 12.

Table 12. Diagnostic summary table.

Field	Factor	Current status	Action
Administrative Process	Administrative Process (PODC)	Operators maintain a deficient administration	Propose a service quality improvement model.

Technical Aspects of Transportation	TH Management	Human Resources	Operators do not maintain a proper development of human talent	
	Finance	Accounting	Its financial situation is not adequately managed	It is recommended that you upgrade your financial statement management.
	Regulatory bodies	ANT Technical Unit M, T, and SV	They have a regulatory framework at the local and national level.	Improved communication and mutual work is recommended.
	Quality of Service Delivery	Application of the SERVQUAL Model	Dissatisfaction rate of - 44.20	Propose a service quality improvement model with certain requirements of the ISO 9001:2015 Standard.
	Infrastructure	Road infrastructure Passenger terminal User information Vehicles	Deficiency in all dimensions and no information to the user.	

3.2 Quality of Service Model

Table 13 shows the development of the recommended service quality plan with the proposed actions to improve the quality of public and commercial transport in Chambo canton. It is designed with a technical and operational approach that integrates both organizational management and technical aspects of the service. First, six main areas of intervention are identified: operator management, human talent management, finance, infrastructure, vehicles, and service dimensions evaluated by the SRVQUAL service methodology. Each of these areas describes its current situation, which shows deficiencies, such as empirical administration, lack of training, inadequate financial management, infrastructure, deterioration of the vehicle fleet, and high user dissatisfaction. This diagnosis establishes specific quality objectives, such as professionalizing administrative management, strengthening human capital, ensuring economic sustainability, rehabilitating infrastructure, modernizing the fleet and improving the user experience in dimensions such as empathy, reliability and responsiveness.

Each objective is accompanied by special improvement activities, such as administrative documents, staff training, transparent accounting, road stops and rehabilitation, vehicle refurbishment and ongoing use of Servqual-based continuous improvement plans. Resources required (people, technically, financially), those responsible for implementation (operators, year, administrative units), performance indicators that allow you to measure progress (e.g., percentage of safe vehicles, level of satisfaction or technical compliance of users) and the frequency of evaluation that changes monthly, semi-annually or under control scheme, such as the Balanced Scorecard.

Table 12. Service Quality Model based on the Servqual Model.

Parameter	Current Situation	Quality Objective	Improvement Actions	Resources	Responsible	Indicators	Frequency Evaluation
Operator Management	Inadequate management of operators	Manage based on the administrative process	Preparation of documents that allow for the monitoring of quality management.	Human, financial	EAD (Senior Management Team)	Model performance	Every 6 months (Balanced Scorecard)
Human Talent Management	Deficiencies in selection, training and motivation	Promote staff participation and training	Continuous training, promotion of appropriate image	Human, financial	EAD (Senior Management Team)	% of personnel trained Job satisfaction index	Every 6 months (Balanced Scorecard)
Finance	Improper management of the financial situation	Strengthen economic and financial management	Implement accounting that reflects real results	Human, financial	EAD (Senior Management Team)	Updated financial statements	Mensual (Balanced Scorecard)
Infrastructure	Stops, tracks and terminals in poor condition or without signage	Safe, accessible and compliant infrastructure	Rehabilitation of roads, implementation of signage, adaptation	Technical, financial	GAD/EAD	Technical compliance report	Semiannual

				of bus stops, etc.					
Vehicles	Fleet in poor technical and comfort conditions	Safe and comfortable units	Periodic fleet renewal and maintenanc e	Technical , financial	Operators	% of vehicles licensed and insured	Semiannual		
Service Dimensions (SERVQUA L)	High dissatisfaction in: Empathy (- 55), Reliability (-52), Assurance (- 48), etc.	Improve user perception in each dimension	Continuous improvement plan according to SERVQUA L (service, courtesy, trust, speed)	Humans, time, technolog y	EAD	User satisfaction level	Every months	6	

3.2.1 Administrative System

The management of transport operators should be focused according to the Rensis Likert system approach. [7], which promotes management based on the creation of joint decisions, cooperative work and the active participation of all hierarchical levels. This model promotes a more inclusive organizational culture, which evaluates the opinions of the staff and an improved institutional connection. In this structure, management is based on the classic functions of administration: planning, organizing, directing and controlling, each clearly defined. Planning establishes goals and strategies; organization effectively distributes tasks and resources; leadership guides and motivates employees to achieve goals; and control allows you to evaluate results and appropriate deviations and ensure quality standards. This model is accompanied by a strategic management of human talent, designed using four main processes: organization (position definition and design), integration (personnel selection, selection and connection of appropriate personnel), maintenance (good workers, safe conditions and positive organizational climate) and development (education, continuing education and professional growth). This integrated approach strengthens operator performance, improves the quality of service provided and promotes direct satisfaction with public and commercial transportation users.

3.2.2 Implementation of ISO 9001:2015

In the proposal to improve public and commercial transport services in Chambo Canton ISO 9001: 2015, the basic requirements were integrated as the structural axis of the management model. These requirements, adapted to the ground transport relations, were used on the basis of the real needs of operators and users, allowing them to control what is focused on complete quality and continuous improvements. The first element was considered the context of the organization

through which internal and external factors affecting the service were analyzed and tools such as DOF analysis were used to identify improvement capabilities. With respect to management, senior management was emphasized through the creation of an organizational culture that focused on quality and user satisfaction. Management system planning incorporated the PHVA cycle as the strategic tool risk for anticipatory and corrective actions.

Aspects such as the distribution of resources, the development of human talent skills, the quality policy and document control communication were strengthened, which facilitates the standardization of the main processes. In relation to operations, procedures were developed to ensure the provision of services that focus on efficiency, availability and security. Performance evaluation was carried out using the SERVQUAL model, which was complemented with analysis tools such as Pareto and causes of effects graphs, which made it possible to measure user perception and satisfaction based on specific and intangible dimensions. Finally, the continuous improvement method was implemented in the implementation of corrective and prophylactic activities, as well as the periodic review of the system, providing permanent feedback and adapting the model to the environment for dynamic purposes. Together, these requirements are a stable methodological basis that supports the efficiency of the proposed model adapted to international quality control standards as shown in Table 14:

Table 13 Application of ISO 9001:2015 standard requirements.

ISO Requirement	9001:2015 Description	Application in the proposed model
Context of the organization	Understanding of the internal and external environment and stakeholders.	SWOT analysis of the operators; identification of internal and external environmental factors.
Leadership	Top management commitment to quality.	Inclusion of senior management in strategic decision making and organizational leadership.
Planning	Identification of risks, opportunities and establishment of objectives.	Use of the PHVA cycle to define strategies and corrective actions.
Support	Resources, competencies, awareness, communication and control of information.	Staff training, role design, internal and external communication of the quality policy.

Operation	Planning, design, control and service delivery.	Documented procedure for the provision of public and commercial transportation services.
Performance evaluation	Monitoring, measurement, analysis and evaluation.	Application of the SERVQUAL method, satisfaction indicators, use of tools such as Pareto and Cause-Effect.
Improvement	Actions to continuously improve the management system.	Implementation of continuous improvement actions and systematic reviews of the model.

3.2.3 Technical Aspect

In the context of the technical diagnosis of the operators and the public and commercial transport system in the canton of Chambo, a variety of critical elements were identified, which directly and negatively influence the quality of service provided to users. Depending on this, improvements developed in accordance with the technical rules and quality management principles developed. One of the most appropriate aspects discovered was the condition of the ground terminal infrastructure, which causes physical restrictions, structural deterioration and obvious maintenance deficiency. This situation not only reduces user comfort, but also presents an action and safety risk. An integrated terminal rehabilitation, using universal technical safety, availability and comfort standards, is proposed as a corrective measure to transform this space into a functional and dignified transit point for citizens.

Regarding operating contracts and permits, there was evidence that there are no specific performance indicators that allow the quality of the service offered by the operators. This failure prevents the development of control and improvement mechanisms. Therefore, it is proposed to include contractual clauses with technical and quality indicators, which can be reviewed and serve as a basis for a requirement for permanent improvements by the regulatory units. Another critical component was poor user information characterized by low markings and ineffective communication on routes, charts and frequencies. This information disadvantage creates uncertainty and dissatisfaction among passengers. The proposed solution is to introduce a widely visible signage system, complemented by digital information platforms and physical signs at

devices and stops, which would facilitate the user's travel experience and improve the perception of the service.

When it comes to the condition of the road network, a significant deterioration in the routes used by public and commercial transportation, which affects both road safety and regularity of service. It is proposed to establish a preventive road maintenance plan led by the municipalities to keep the circulation routes in optimal circumstances and ensure greater fluidity in the transfer of units.

In terms of stopping design and circumstances, minor ergonomic infrastructure without coverage with low access and lack of safety criteria was observed. To correct this problem, the total transformation of stops containing elements such as ceiling, lighting, access for people with reduced mobility and appropriate furniture increase in accordance with the principles of general availability.

Finally, the technical conditions of the vehicles were diagnosed that a large part of the parking lots were old and with technical and safety disadvantages. This situation affects both service and compliance with minimum quality standards. Therefore, it is advisable to promote the vehicle fleet recovery process, which complies with current technical rules and ensures that all vehicles go through the technical report (RTV) of the vehicle allow properly centers, summarized as shown in Table 15.

Table 14. Technical Quality Model.

Technical Evaluated	Aspect	Current Problem Detected	Situation / Improvement Proposal
Land Infrastructure	Terminal	Limited, deteriorated or inadequately maintained infrastructure	Limited, deteriorated or inadequately maintained infrastructure Rehabilitate and adapt the terminal to meet technical standards of safety, accessibility and comfort.
Contracts and permits	operating	No specific improvement indicators are included in current contracts.	No specific improvement indicators are included in current contracts.

User information	Lack of clear signage, poor route and frequency information	Implement visible signage and dynamic information systems at stops, units and digital platforms.
Condition of the road network	Roads in poor condition, without regular preventive maintenance	Establish a preventive road maintenance plan by the municipal government to improve the flow of services
Design and conditions of stops	Poor ergonomic design and poor accessibility	Redesign stops with universal accessibility, comfort and safety criteria for all users.
Technical conditions of the vehicles	Aging vehicle fleet with technical and safety problems	Renew the fleet according to current regulations, and ensure compliance with RTV in authorized centers.

4. Discussion

In this regard, the study developed by [12] analyzes the quality of the urban transportation service in the city of Ambato from the user's perspective. The research is based on a qualitative approach with a deductive, descriptive and correlational orientation, applying an objective analysis. For this purpose, we worked with a representative sample of 384 users of the transportation system, using a combination of analytical and synthetic methods. The results obtained made it possible to identify the level of user satisfaction in relation to various variables: service offered, accessibility, information, time, customer service, comfort, safety and environmental impact.

The findings show that, in the eight variables evaluated, the level of satisfaction does not exceed 4 points on a scale of 10, which reflects a high degree of dissatisfaction with the urban bus transportation service in the city of Ambato. As an immediate measure, the study proposes the reprogramming of existing routes, the expansion of service coverage, a technical analysis of the available vehicle fleet, the adaptation and improvement of road infrastructure, the strengthening of traffic signaling, as well as the requirement that transport operators correct the deficiencies identified in the quality of the service they offer.

Similarly, the study developed by [13] addresses the transportation situation in the city of Cuenca, Ecuador, focusing specifically on the evaluation of user satisfaction with the vehicle registration service. The research includes a detailed analysis of the possible linear associations linked to user

satisfaction. The results obtained reveal that factors such as service quality, user expectations and communication efficiency are significantly correlated with the level of satisfaction perceived by users of the vehicle registration process. Along the same lines,[14] developed a comparative study on the satisfaction of users of mass public transportation in the city of Cuenca, focusing on bus and streetcar services. In their analysis, the authors identify key variables such as the management of cleanliness in the units, as well as the perception of users in terms of comfort, safety and punctuality in arrival and departure times. The application of surveys made it possible to establish the level of user satisfaction with both modes of transport, providing a comprehensive view of their travel experience.

In comparison with other methodologies used to evaluate the satisfaction of users of urban bus transportation services, several authors propose, as a first step, the identification of determining factors. These include quantitative variables such as waiting time, on-board travel time and fare cost, as well as qualitative aspects that correspond to service dimensions, such as the way the bus is driven, the treatment offered to the user and the physical conditions of the vehicle. In order to gather relevant information, satisfaction surveys were designed and applied to capture users' perceptions regarding the quality of these factors. From the analysis of the results obtained, it is inferred that qualitative elements have a greater influence on user satisfaction than purely operational ones. Consequently, it is suggested that public land transportation companies can redefine and manage their quality guidelines, thus strengthening their institutional image and social perception. [15].

Similarly, several studies show that it is feasible to carry out a comprehensive analysis of the quality of service and the level of user satisfaction in public bus transportation, especially in those systems that have shown operational and administrative deficiencies. These shortcomings are often associated with the absence of adequate structural planning, which has resulted in a service characterized by slowness, high levels of pollution and poor safety. To address this problem, a methodological approach based on a descriptive analysis is implemented, complemented with the application of surveys and the development of an exploratory factor analysis, in order to identify the main variables that affect the user's perception [16].

Consequently, it is essential to guarantee quality service in public transport companies, since this directly influences user satisfaction and strategic aspects of organizational management. In this context, studies oriented to the evaluation of transport quality contribute significantly to the field of administration and business. This is evidenced by [17], who developed a quantitative research based on a sample of 1,296 service users, using an instrument designed to identify the attributes that have the greatest impact on customer satisfaction. The methodology employed was Servperf (Service Performance), complemented with exploratory factor analysis (EFA) and multiple linear

regression techniques. The attributes evaluated in the study included key service dimensions such as: tangibles, reliability, responsiveness, security and empathy. Similarly,[18] developed a study aimed at evaluating the level of satisfaction of university students in relation to various aspects of the quality of urban public transport service. For this purpose, they implemented a perception survey composed of 13 items, designed to measure multiple dimensions of the service offered.

On the other hand, several authors argue that it is feasible to identify the relationship between the quality of internal customer service and its different dimensions, with the level of job satisfaction. For this purpose, the Servqual model is applied, complemented with descriptive and correlational analysis methods. This methodology makes it possible to examine factors such as reliability, responsiveness, security, empathy and tangible aspects, in relation to the job satisfaction variable. The study was conducted on a population of 98 participants, all of them drivers. [19]. Likewise, the study developed by [20] uses the Servqual model to evaluate the quality of service and the level of satisfaction of cab service users in the city of Sucre, Bolivia. To this end, the five fundamental dimensions established by the model are considered: tangibility, reliability, responsiveness, security and empathy, which allow for a comprehensive analysis of the user's perception of the service received.

The result of the perceived quality index showed negative values in each of the dimensions evaluated as well as in the overall level of service, which evidences the existence of important deficiencies in the provision of cab service. This negative assessment reflects a considerable gap between users' expectations and the actual quality of the service received. Finally, the incorporation of new technologies, such as the use of mobile applications oriented to the transportation of university students in Jalisco, Mexico, is currently being investigated with the aim of identifying the factors that affect their level of satisfaction. In this context, the study developed by [21] The study uses a total of 144 valid responses and applies partial least squares structural equation modeling (PLS-SEM), using SmartPLS 3 software to validate the proposed model. This type of research provides relevant and up-to-date input for both marketing managers and academics by enabling a better understanding of the behavior of mobile application users in the transportation sector.

Conclusiones

- This research showed that the systematic and continuous evaluation of service quality by public and commercial transportation operators is a key component for operational improvement. Through the application of the SERVQUAL methodology, critical dimensions of dissatisfaction were identified, such as empathy, reliability and tangible elements that allow focusing corrective

actions in a prioritized and efficient manner. This direct feedback contributes not only to user loyalty, but also to a potential increase in service demand.

- The results of the study reflect the notorious gap between the hopes and perceptions of public and commercial transportation users in Canton Chambo with an overall quality index of -44.20 points, according to SERVQUAL methodology. This result shows widespread frustration, highlighted as the most critical dimensions: empathy (-55), reliability (-52), safe (-48), tangible elements (-36) and responsiveness (-30).
- The proposed analysis made it possible to develop a comprehensive diagnostic methodology that can be replicated by other operators. This tool combines the user's perception with a technical and organizational assessment, providing concrete inputs for decision-making. In particular, deficiencies within the administrative system were addressed, such as the absence of structured leadership, poorly defined processes and limited decision-making levels, proposing an organizational model based on ISO 9001:2015 principles.
- In addition, the model developed is not limited only to administrative aspects, but also incorporates improvements of a technical and operational nature. Among the main ones are: the rehabilitation of the bus terminal, the redesign of stops with universal accessibility criteria, the implementation of clear and updated signage, and the scheduling of preventive maintenance on the road network. These interventions contribute significantly to a comprehensive improvement of the user experience, raising the perception of quality throughout the transportation system.

Author Contributions

All authors contributed significantly to the preparation of the article.

Conflict of interest

The authors declare that there is no conflict of interest of any nature with the present research.

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