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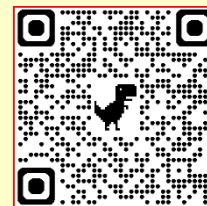
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Evaluation of Tomato Marketing Service Quality through the Integration of SERVQUAL and the PDCA Cycle for Implementing Continuous Improvement Indicators: A Case Study of the Jitomates Cooperative in La Estancia, Chilcuahtla, Hidalgo

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ABSTRACT

Service quality management plays a key role in improving organizational performance and strengthening the competitiveness of cooperatives. However, diagnostic tools must be integrated with continuous improvement procedures that translate service evaluations into measurable actions. This study aimed to develop and implement a management model that integrates SERVQUAL and the Plan-Do-Check-Act (PDCA) cycle to support the implementation of continuous improvement indicators. A case study was conducted at the Jitomates cooperative in La Estancia, Chilcuahtla, Hidalgo, using an adapted SERVQUAL questionnaire administered to 30 participants. The diagnostic assessment represented the initial phase of the proposed model and included the evaluation of instrument reliability, overall service perceptions, dimensional performance, and priority areas for improvement. The questionnaire showed high internal consistency, with a Cronbach's alpha of 0.933. The overall perceived service quality was also high ($M = 4.23$), with Assurance, Reliability, and Empathy identified as the strongest dimensions. Nevertheless, the findings revealed priority areas for improvement related to documentation, infrastructure, logistics, and communication processes. The proposed SERVQUAL-PDCA model provides a structured approach for transforming diagnostic findings into an indicator-based roadmap for continuous improvement. Its application provides a practical foundation for strengthening service management, supporting organizational development, and enhancing the competitiveness of rural cooperatives.

KEY WORDS: Service quality, SERVQUAL, PDCA cycle, Continuous improvement, Agricultural cooperatives

INTRODUCTION

In globalized and changing markets, organizational differentiation depends largely on the experiences provided to customers, whose expectations evolve rapidly. For this reason, service quality management has become an essential strategic pillar, as focusing management efforts on the user experience directly strengthens the institution's competitive advantage and long-term viability (Parasuraman et al., 1988; International Organization for Standardization, 2015).

SERVQUAL is one of the most established methodologies for assessing discrepancies between what users expect and what they actually receive. It is structured around the dimensions of tangibles, reliability, responsiveness, assurance, and empathy (Parasuraman et al., 1988).

In turn, integrating the PDCA framework (Plan, Do, Check, Act) makes it possible to channel these findings into a continuous improvement process, facilitating the design, implementation, monitoring, and adjustment of organizational operations (Dudin et al., 2017; International Organization for Standardization, 2015).

Recent literature confirms the continued relevance of SERVQUAL in agricultural and cooperative settings, where the largest marketing service gaps are often concentrated across the five dimensions evaluated (Rwela, 2023; Bandaru, 2024; Xu et al., 2024; Chau et al., 2024).

The effectiveness of the PDCA cycle in structuring improvement, control, and standardization plans in agro-industrial and cooperative settings is also widely supported (Dudin et al., 2017; Tineo Camizan, 2024; Palacios-Talavera et al., 2024; Tirado Luna et al., 2025). Nevertheless, the systematic review conducted under the SALSA protocol reveals a clear gap in the literature: few studies connect the initial SERVQUAL diagnosis with a comprehensive indicator-based management cycle for marketing services that encompasses planning, implementation, control, and adjustment (Grant and Booth, 2009).

Within the Latin American and Mexican context, both agricultural cooperatives and SMEs engaged in the production and sale of vegetables such as tomatoes need to consolidate their quality management practices. This is essential to meet critical requirements such as honoring agreements on time, responding promptly, providing personalized attention, and maintaining appropriate service conditions (Rwela, 2023; Simba Cantuña and Salazar Tapia, 2025).

The case study examines the marketing service provided by the Jitomates cooperative, located in La Estancia, Chilcuautla, Hidalgo. At the organizational level, the study focuses on identifying potential improvements in service delivery and linking the quality diagnosis with the planning, implementation, and monitoring of actions.

The relevance of this research lies in the need to strengthen the organizational framework through feasible and low-cost methodologies. This approach can support strategic decisions, oversee the measures implemented, and promote competitiveness, sustainable development, customer retention, and local economic progress by providing a higher-value service.

The integration of SERVQUAL and the PDCA cycle provides a comprehensive methodological framework for service management. SERVQUAL enables a rigorous identification and prioritization of discrepancies between user expectations and perceptions, while the

PDCA cycle addresses these gaps through an iterative process of planning, implementation, evaluation, and adjustment.

Consistent with this approach, the study aims to evaluate the quality of the marketing service provided by the Jitomates cooperative, located in La Estancia, Chilcuautla, Hidalgo, by combining SERVQUAL for diagnosis with PDCA for the formulation, monitoring, and standardization of improvement actions. The proposed hypothesis is that this integration will make it possible to identify priority areas for attention and implement indicators focused on customer satisfaction, operational efficiency, and organizational competitiveness.

The main contribution of this study lies in linking SERVQUAL and PDCA as the basis of a model for implementing continuous improvement indicators. In this way, the initial diagnosis ceases to be static information and becomes a direct input for strategic planning, results control, and the cooperative's gradual transformation.

RESEARCH ELABORATIONS

Research design

This applied study follows a mixed-methods approach, with a predominantly quantitative component complemented by qualitative elements for the design of management procedures and tools, and adopts a quasi-experimental design. It uses a single-group pre-post design, with measurements taken before and after the intervention pilot, within a single case study of the Jitomates cooperative.

This design responds to the organizational problem by making it possible to diagnose the current quality of the marketing service, implement structured improvements, and evaluate their impact. It is particularly suitable for small rural organizations with limited resources (Rwela, 2023; Xu et al., 2024). Because the scope centers on marketing service management, activities such as collection, selection, delivery, invoicing, and after-sales service are considered only when they affect the user experience and the organization's indicators.

Study variables

Intervention variable: The SERVQUAL-PDCA methodological framework for service management, operationalized through gap diagnosis, action planning, pilot implementation, indicator monitoring, and the adjustment or standardization of procedures.

Dimensions of analysis: The five dimensions of the SERVQUAL model, namely reliability, responsiveness, assurance, empathy, and tangibles, used to organize the measurement of service expectations and perceptions.

Outcome variables: Service quality gaps between expectations and perceptions, the customer satisfaction index, and operational marketing indicators, including the percentage of orders fulfilled on time, average response time to incidents or complaints, rate of recurring complaints, variability in prices obtained, and margin for member producers.

The study is aligned with ISO 9001:2015 by incorporating the PDCA cycle as a continuous improvement tool and adapting its process approach to marketing service management (International Organization for Standardization, 2015).

Methodological basis for the integration

The theoretical and methodological basis of the proposal was established through a systematic literature review based on the

SALSA protocol. According to Grant and Booth (2009), this tool was used exclusively to identify the points of convergence, advantages, and limitations of SERVQUAL and PDCA, without treating it as an additional intervention methodology for the cooperative.

Search: Academic databases were consulted, including Scopus, Web of Science, Google Scholar, Redalyc, SciELO, and Latin American institutional repositories. The Boolean search strings combined terms such as “SERVQUAL” AND (“cooperativa agrícola” OR “agricultural cooperative” OR FPO OR “farmer producer organization” OR AMCOS OR “servicio de comercialización agrícola” OR agribusiness) AND (calidad OR satisfacción OR gap OR brecha); and “PDCA” OR “ciclo de Deming” OR PHVA AND (agroindustria OR cooperativa OR “mejora continua” OR “calidad de servicio” OR PyME rural). The period was limited to 2016-2026 to ensure the currency of the evidence. More than 30 relevant studies

were identified.

Appraisal: The inclusion criteria comprised empirical or case studies applying SERVQUAL or PDCA in agricultural cooperatives, FPOs, rural SMEs, or marketing and agro-industrial services; peer-reviewed articles or theses with methodological rigor; and the availability of clear quantitative or qualitative results. Exclusion criteria comprised reviews without primary data, studies published before 2016, and studies without a context applicable to SMEs or cooperatives.

Synthesis and Analysis: The findings were synthesized in thematic tables covering the studies reviewed, their limitations, and the tools used. The analysis identified patterns supporting the integration of SERVQUAL and PDCA within the methodological framework proposed for service management in the La Estancia case.

Table 1 presents a representative subset of 20 studies selected for their direct relationship with the research problem.

Table 1. Synthesized report of the studies reviewed (2017-2026)

No.	Author(s), year, and publication type	Study objective	Scope / Context	Main results	Relevance to the present study
1	Stefano (2025), preprint	Develop a Fuzzy SERVQUAL framework for knowledge management in agricultural cooperatives	Agricultural cooperatives; conceptual proposal	Proposes diagnosing gaps in knowledge management processes through a fuzzy adaptation of SERVQUAL	Retained as a conceptual precedent; it does not constitute peer-reviewed empirical evidence
2	Shanmuga Priya et al. (2025)	Evaluate service quality gaps in producer organizations using SERVQUAL	Farmer Producer Organizations in Tamil Nadu, India (n = 240 members)	Lower-grade organizations showed larger gaps in tangibles, reliability, and empathy	Supports the use of SERVQUAL to prioritize service dimensions in rural organizations
3	Rwela (2023)	Evaluate service quality and farmer satisfaction in agricultural marketing cooperative societies	AMCOS in the Mvomero and Kilombero districts, Tanzania (n = 189)	Tangibles received the lowest rating, and the overall satisfaction index was 54%	Provides evidence on service gaps and satisfaction indicators in marketing cooperatives
4	Bandaru (2024)	Measure service quality and farmer satisfaction in e-NAM using SERVQUAL	Electronic agricultural markets in Telangana and Odisha, India (n = 241)	Satisfaction was primarily associated with assurance, reliability, and tangibles	Shows the applicability of SERVQUAL to an agricultural marketing service
5	Xu et al. (2024)	Evaluate the internal service quality of cooperatives using SERVQUAL and IPA	Farmer cooperatives, China	The overall evaluation was negative, and IPA identified priority service aspects	Supports the use of gaps and prioritization to guide improvement actions
6	Msuya (2025)	Evaluate perceptions of service quality in rural cooperative societies	AMCOS in Kaliua District, Tanzania (n = 239)	Reliability showed the largest gap, and all dimensions had negative values	Reinforces the importance of fulfilling commitments in relationships with members
7	Manzano (2024)	Analyze service quality and perceived value as predictors of satisfaction	Cooperative members in the Philippines (n = 361)	Service quality and perceived value were associated with member satisfaction	Links service management with satisfaction, retention, and loyalty

No.	Author(s), year, and publication type	Study objective	Scope / Context	Main results	Relevance to the present study
8	Dudin et al. (2017)	Analyze the PDCA cycle as a continuous improvement tool in agro-industrial processes	Agro-industrial sector	The study presents the cycle as a structure for organizing quality improvement and competitiveness	Provides the basis for using PDCA to convert diagnostic findings into monitored actions
9	Tineo Camizan (2024), research paper	Apply the Deming cycle to improve the postharvest area	Acopagro Ltda. agricultural cooperative, Peru	The proposal structures improvement and standardization actions in the area studied	Provides an applied precedent for the PDCA cycle in an agricultural cooperative
10	Tirado Luna et al. (2025), LACCEI-LEIRD conference paper	Design an integrated management system based on ISO 9001, ISO 14001, and ISO 45001	Buenavista Agricultural Cooperative, blueberry producer, La Libertad, Peru	The diagnosis identified quality, environmental, and safety deficiencies; the proposal organizes the design through PDCA and process management	Shows the use of PDCA to structure an organizational strengthening proposal in a cooperative
11	Simões et al. (2021)	Develop a hybrid model to evaluate quality, production, and satisfaction	Agricultural production units in Cabo Verde	Integrates quality management, satisfaction, and production capabilities in the SQual4Agri model	Supports linking perceptual measurements with organizational indicators
12	Chau et al. (2024)	Analyze factors associated with member satisfaction regarding cooperative support activities	Horticultural cooperatives in Son La, Vietnam (n = 301 members)	Responsiveness was the main factor, followed by assurance and reliability, empathy, managerial competence, and tangibles	Confirms the importance of responsiveness and managerial practices in cooperative services
13	Octobre and Legorio (2025)	Determine the effect of service quality on member satisfaction	Multipurpose cooperatives in Davao, Philippines (n = 368 members)	All five SERVQUAL dimensions had significant effects; assurance and responsiveness were the main predictors	Provides recent evidence on the relationship between SERVQUAL dimensions and member satisfaction
14	Alvarado Contreras (2025), master's thesis	Design an improvement plan for service quality	Regional Agriculture Office in northern Peru	The diagnosis is used as the basis for formulating actions to improve institutional service quality	Provides a precedent for diagnosis and improvement planning in an organization linked to the agricultural sector
15	Bamdad et al. (2025)	Develop a strategic SERVQUAL-AHP-SWOT framework to improve service quality	Agricultural mechanization cooperatives in Guilan, Iran (n = 214 farmers)	The largest gaps were found in machinery performance (-1.82) and cost-service balance (-1.75); AHP supported strategy prioritization	Shows how SERVQUAL gaps can be linked with prioritization tools when resources are limited
16	Simba Cantuña and Salazar Tapia (2025)	Evaluate service quality and customer satisfaction using SERVQUAL and CSAT	Agricultural and livestock associations in La Maná, Ecuador (n = 82 customers)	Strengths were observed in personalized attention and process simplicity, along with opportunities to improve speed and overall quality	Provides Latin American evidence on customer service in agricultural associations
17	Palacios-Talavera et al. (2024)	Apply PDCA to improve the management and reuse of by-products in the packaging area	Agave distillery in the state of Morelos, Mexico	PDCA structured the classification, collection, monitoring, and adjustment of by-product management actions	Provides a Mexican precedent for implementing and monitoring actions through PDCA

No.	Author(s), year, and publication type	Study objective	Scope / Context	Main results	Relevance to the present study
18	Qi and Ma (2022)	Evaluate the quality of an agricultural service platform using SERVQUAL	Agricultural information platform in Shouguang, China	Gaps between expectations and perceptions ranged from -2.26 to -1.86, revealing opportunities for service optimization	Shows the application of SERVQUAL to an information service related to agricultural marketing
19	Mohedano Torres et al. (2023), systematic review	Analyze SERVQUAL applications among distribution logistics operators	Twelve studies identified in Web of Science, ScienceDirect, and Redalyc	The review identified applications of SERVQUAL combined with multicriteria prioritization methods in logistics services	Connects quality evaluation with distribution and delivery, which are components of the marketing service
20	Huizache-Santos et al. (2024)	Determine service quality using SERVQUAL to establish customer service strategies	Service company in Pachuca, Hidalgo (n = 30 customers)	The dimensions scored above the mean, although tangibles had the lowest values	Provides an organizational precedent from Hidalgo on SERVQUAL diagnosis and the formulation of service strategies

The proposed methodology is supported by the key findings summarized in the table. Tangibles, reliability, and responsiveness account for negative SERVQUAL gaps in most of the studies. In rural cooperative service management, these findings are reflected in infrastructure limitations, while the fulfillment of commitments and response times influence the satisfaction of both customers and member producers.

Studies using PDCA show its usefulness in translating diagnostic findings into standardized procedures and improvements that can be monitored. However, few studies connect a SERVQUAL diagnosis with a complete cycle of planning, implementation, verification, and adjustment for marketing service management.

Table 2. Limitations identified in the studies reviewed

Study / Author(s)	Main limitations
Stefano (2025), Xu et al. (2024), Shanmuga Priya et al. (2025), Chau et al. (2024), and Bamdad et al. (2025)	Specific contexts and samples; predominance of cross-sectional diagnoses; Stefano's preprint does not present peer-reviewed empirical evidence
Rwela (2023) and Msuya (2025)	Specific geographic context in Tanzania and no longitudinal monitoring of actions derived from the diagnosis

Study / Author(s)	Main limitations
Bandaru (2024), Manzano (2024), Octubre and Legorio (2025), Simba Cantuña and Salazar Tapia (2025), and Huizache-Santos et al. (2024)	Predominance of cross-sectional designs or specific organizational contexts; they do not develop a complete intervention and monitoring cycle
Dudin et al. (2017), Tineo Camizan (2024), Tirado Luna et al. (2025), and Palacios-Talavera et al. (2024)	PDCA is applied mainly to agro-industrial, postharvest, integrated management, or by-product processes, with less emphasis on marketing service management
Synthesis of the identified sources	The reviewed sources do not jointly document a SERVQUAL diagnosis, a complete PDCA cycle, monitoring indicators, and a pre-post comparison in a cooperative's marketing service

This study addresses an opportunity identified in the existing literature: the predominance of one-time diagnoses and the focus of the PDCA cycle on agricultural or postharvest processes. In contrast, limited research has examined marketing service management and indicator evaluation after implementation.

Table 3. Tools and methodologies most frequently used in the studies reviewed

Tool / Methodology	Presence in the identified sources	Examples of use	Advantages in the context of cooperatives and rural SMEs
SERVQUAL (or Fuzzy/SERVPERF adaptations)	Recurring	Shanmuga Priya et al. (2025), Rwela (2023), Chau et al. (2024), Bamdad et al. (2025), Simba Cantuña and Salazar Tapia (2025), Qi and Ma (2022), and Huizache-Santos et al. (2024)	Organizes the measurement of service gaps through comparable dimensions and Likert-scale surveys

Tool / Methodology	Presence in the identified sources	Examples of use	Advantages in the context of cooperatives and rural SMEs
IPA (Importance-Performance Analysis)	Occasional	Xu et al. (2024)	Supports priority ranking by relating importance and performance
CSI (Customer Satisfaction Index)	Occasional	Rwela (2023)	Summarizes overall satisfaction in a comparable indicator
PDCA + ISO 9001	Specific to improvement studies	Dudin et al. (2017), Tineo Camizan (2024), Tirado Luna et al. (2025), and Palacios-Talavera et al. (2024)	Organizes the planning, implementation, verification, and adjustment of actions
Statistical analysis (Cronbach's α , ANOVA/paired t-test, EFA, SEM/PLS)	Recurring	Internal consistency and association or comparison tests used according to each study design	Provides criteria for examining the instrument and comparing results according to the design
RACI, FMEA, SOPs / standardized procedures	Applied precedent	Ángeles González (2026)	Can support the assignment of responsibilities, prioritization of incidents, and documentation of procedures

SERVQUAL is the dominant tool because of its capacity to capture the intangible nature of the marketing service, including timely deliveries, confidence in quality and prices, and empathetic attention. Combining it with PDCA makes it possible to move from diagnosis to structured action and results verification, which is relevant for rural cooperatives seeking to strengthen their organizational management and, through it, their competitiveness.

IPA and CSI complement prioritization and overall measurement. Tools such as RACI, FMEA, and standard operating procedures provide practical support for implementation in organizations with limited personnel without replacing the central role of SERVQUAL and PDCA within the proposal.

Proposed methodological model

The proposed methodological model responds to the organizational need to manage marketing service quality through a diagnosis that can be converted into monitored actions. Within this implementation model, SERVQUAL and PDCA perform complementary functions: SERVQUAL serves as the diagnostic stage by identifying and prioritizing gaps by dimension, and these results subsequently inform the Plan phase of the PDCA cycle.

The management framework follows the phases of the PDCA cycle: diagnosis and prioritization of gaps through SERVQUAL in the Plan phase, implementation of improvement actions in the Do phase, measurement of results and evaluation of indicators in the Check phase, and adjustment or standardization of viable practices in the Act phase. In this way, both methodologies operate as tools within a continuous improvement process focused on service management and the organizational strengthening of the cooperative.

Operationalization

To operationalize the methodological framework, the SERVQUAL questionnaire adapted to the tomato marketing service contains 20 paired items distributed across the five dimensions and evaluated on a 1-to-5 Likert scale. Each item is presented in two sections: expectations, referring to how the service should be, and perceptions, referring to how it currently is. Segmentation questions and three open-ended qualitative questions are also included.

The gaps will be calculated as the difference between perception and expectation for each item and dimension. Negative values will represent aspects in which perceptions fall below expectations and will support the prioritization of actions in the Plan phase.

As part of the management framework, operational indicators will be designed for the percentage of orders fulfilled on time, complaint response time, the rate of quality- or price-related incidents, and the margin obtained compared with the market. The data source, measurement frequency, baseline, and corresponding target will be defined for each indicator.

The internal consistency of the SERVQUAL instrument will be evaluated using Cronbach's alpha. Pre-post comparisons of gaps and indicators will be conducted using a statistical test consistent with the paired sample and the fulfillment of parametric assumptions (Tavakol and Dennick, 2011).

Application in the cooperative

The population of interest will comprise external customers, such as buyers or wholesalers, member producers, and personnel involved in service management. Customers and producers will provide the measurements of expectations and perceptions, while personnel will participate in the process diagnosis and implementation of the model through the pilot.

Plan phase:

Diagnosis of the current marketing process using SIPOC or a similar flowchart: receipt of orders from customers or wholesalers, collection, selection and quality control, logistics and delivery, invoicing, and after-sales service.

Administration of the SERVQUAL questionnaire, calculation and prioritization of gaps, design of operational indicators, and preparation of a RACI matrix for incident management. FMEA will be used to prioritize issues such as delays, quality variability, price complaints, and lack of information.

Do phase: Pilot implementation

Training for cooperative personnel, with emphasis on empathy, response times, and the use of basic traceability and order management tools.

Implementation of standardized procedures for managing complaints related to delays, damage, or tomato quality, as well as product release and customer communication.

Implementation of the pilot during a harvest and sales season, with systematic records of orders, incidents, and supporting evidence.

Check phase:

Readministration of the SERVQUAL questionnaire after the pilot, calculation of dimensional and overall gaps, internal consistency analysis, and comparison of operational indicators before and after the intervention.

Evaluation of the operational and economic feasibility of the implemented actions based on incident records and responses to the open-ended questions.

Act phase:

Adjustment of procedures based on the pilot results and standardization of viable practices through updated manuals and forms.

Definition of the next continuous improvement cycle and knowledge transfer to strengthen the cooperative's operational autonomy.

Validation and continuity of improvement

The continuous improvement procedure will be verified by comparing SERVQUAL gaps and operational indicators before and after the pilot. Quantitative evidence will be complemented by responses to the open-ended questions and incident records to evaluate both perceived change and the application of the procedures.

The results of this stage will determine which actions should be maintained, adjusted, or incorporated into the next PDCA cycle. In this way, the procedure connects service quality diagnosis with indicator implementation, continuity in the improvement of marketing service management, and the organizational strengthening of the cooperative.

RESULTS OR FINDING

Consistent with the methodological model described above, this section presents the results of its diagnostic phase for managing the quality of the marketing service provided by the Jitomates cooperative in La Estancia, Chilcuautila, Hidalgo. The data were obtained by administering the adapted SERVQUAL questionnaire to a sample of $N = 30$ participants comprising member producers, buyers, and other stakeholders. Because the instrument recorded current service perceptions at this stage using a 1-to-5 Likert scale, the analysis covers questionnaire reliability, means by dimension and item, sample composition, and the themes identified in the open-ended responses. The findings establish the baseline for guiding the Plan phase of the continuous improvement procedure, defining management indicators, and preparing the subsequent action pilot through the PDCA cycle.

Sociodemographic characteristics of the sample

Thirty valid responses were analyzed. Of all participants, 53.3% ($n=16$) identified as female and 46.7% ($n=14$) as male. The largest proportion was concentrated in the group aged 56 years or older, at 36.7% ($n=11$), followed by participants aged 36 to 45 years, at 26.7% ($n=8$). Regarding educational attainment, secondary school was the most common level, at 43.3% ($n=13$). High school and bachelor's or engineering degrees ranked second, both at 26.7% ($n=8$).

Regarding the participants' relationship with the cooperative, 73.3% ($n=22$) were member producers who used the collective collection and marketing service. Chilcuautila, Hidalgo, was the main area of operation for 53.3% ($n=16$) of the sample, followed by Pachuca de Soto and other municipalities in the central region of the state. Table 4 summarizes the participants' sociodemographic characteristics and relationship with the organization.

Table 4. Sociodemographic characteristics and relationship with the cooperative ($N = 30$)

Variable	Category	n (%)
Gender	Female	16 (53.3)
	Male	14 (46.7)
Age range	18-25 years	1 (3.3)
	26-35 years	5 (16.7)
	36-45 years	8 (26.7)
	46-55 years	5 (16.7)
	56 years or older	11 (36.7)
Highest level of education	Secondary school	13 (43.3)
	High school	8 (26.7)
	Bachelor's or engineering degree	8 (26.7)
	Graduate degree (master's or doctorate)	1 (3.3)
Primary relationship with the cooperative	Member producer	22 (73.3)
	Wholesale buyer / marketer	3 (10.0)
	Faculty member / Support institution	3 (10.0)
Main municipality or region	Consumer	2 (6.7)
	Chilcuautila, Hidalgo	16 (53.3)
	Pachuca de Soto, Hidalgo	5 (16.7)
	Other municipalities in Hidalgo	9 (30.0)

Reliability analysis of the instrument

The internal consistency of the adapted SERVQUAL questionnaire, comprising 20 perception items, was examined using Cronbach's alpha coefficient. The overall scale reached $\alpha = 0.933$, classified as excellent according to the criteria of George and Mallery (2003) and Nunnally (1978). In the analysis by dimension, coefficients ranged from 0.797 for Reliability to 0.900 for Assurance. Each value exceeded the recommended minimum threshold of 0.70 (Hair et al., 2019), supporting the instrument's consistency in evaluating the perceived quality of the tomato marketing service in the case analyzed (Table 5). Therefore, the results support its use as a diagnostic tool within the proposed service management model.

Table 5. Reliability coefficients (Cronbach's alpha) of the adapted SERVQUAL instrument

Dimension	No. of items	Cronbach's alpha (α)	Interpretation
Reliability	4	0.797	Good
Responsiveness	4	0.851	Good to excellent
Assurance	4	0.900	Excellent
Empathy	4	0.876	Excellent
Tangibles	4	0.857	Good to excellent
Overall perception scale	20	0.933	Excellent

Service quality perceptions by dimension and item

On a scale from 1 to 5, the overall perception of service quality recorded a mean of 4.23 (SD = 0.48), representing a high overall rating among participants. Assurance received the highest score (M = 4.30, SD = 0.65), followed by Reliability (M = 4.29, SD = 0.51) and Empathy (M = 4.27, SD = 0.58). From a service management perspective, these ratings reflect strengths associated with trust, the fulfillment of commitments, and the attention provided to producers and customers. In contrast, Tangibles had the lowest mean (M = 4.08, SD = 0.69), making it the main opportunity to strengthen service operations through improvements in infrastructure, documentation, and communication (Table 6).

The item-level analysis placed the highest scores on transparency and honesty in price and volume negotiations (P11, M = 4.40), the accuracy of information on product availability and delivery times (P3, M = 4.37), and fair and empathetic attention accompanied by appropriate follow-up on complaints or problems (P15, M = 4.37). The lowest rating concerned the clarity, completeness, and ease of understanding of documents such as invoices, quality reports, and shipping documents (P18, M = 3.93). This was followed by product packaging and presentation (P20, M = 4.10) and the channels used for communication and order tracking (P19, M = 4.13). At the organizational level, these results establish specific priorities for documentation, logistics, and communication processes from which actions and monitoring indicators can be formulated.

Table 6. Means and standard deviations of service quality perceptions by dimension and item (N = 30)

Dimension / Item	Mean	SD	Range
Reliability (P1-P4)	4.29	0.51	3.25-5.00
P1. Delivery on the promised dates and in the promised quantities and quality	4.33	0.61	3-5
P2. Prices and payment terms consistently honored	4.27	0.52	3-5
P3. Accurate and reliable information on availability and delivery times	4.37	0.77	2-5
P4. Fulfillment of quality and traceability commitments	4.20	0.66	3-5
Responsiveness (P5-P8)	4.23	0.63	2.50-5.00
P5. Prompt and timely response to inquiries, changes, or urgent requests	4.20	0.76	3-5
P6. Proactive information on delays, problems, or incidents	4.23	0.68	3-5
P7. Willingness to resolve problems or complaints promptly	4.27	0.74	2-5
P8. Attention to special or last-minute orders	4.20	0.85	2-5
Assurance (P9-P12)	4.30	0.65	3.00-5.00
P9. Technical knowledge of varieties, postharvest practices, and standards	4.23	0.77	3-5
P10. Confidence in product traceability, health, and safety	4.23	0.68	3-5
P11. Transparency and honesty in price and volume negotiations	4.40	0.77	3-5
P12. Assurance and professionalism in interactions	4.33	0.71	3-5
Empathy (P13-P16)	4.27	0.58	3.00-5.00
P13. Genuine interest in understanding specific needs	4.30	0.65	3-5
P14. Personalized and flexible attention according to buyer type	4.17	0.65	3-5
P15. Complaints handled fairly and empathetically, with follow-up	4.37	0.62	3-5
P16. Consideration of the customer's particular circumstances	4.23	0.77	2-5
Tangibles (P17-P20)	4.08	0.69	2.50-5.00
P17. Appropriate collection, selection, and presentation facilities	4.17	0.75	3-5

Dimension / Item	Mean	SD	Range
P18. Clear and complete documentation (invoices, reports, shipping documents)	3.93	0.91	2-5
P19. Modern and reliable communication channels (WhatsApp, telephone)	4.13	0.82	2-5
P20. Product packaging and presentation convey quality	4.10	0.80	2-5
OVERALL PERCEPTION (20 items)	4.23	0.48	-

Note. A Likert scale from 1 (strongly disagree / very low perception) to 5 (strongly agree / very high perception) was used. SD = standard deviation. To obtain the mean for each dimension, the corresponding four items were first averaged for each participant, and the mean of the 30 individual results was then calculated.

Hypothetical distances from the ideal level (value = 5)

Participants' expectations were not collected separately during the diagnostic stage. Nevertheless, distances from an ideal value of 5 were estimated for exploratory purposes to facilitate the identification of priority areas. These values do not represent empirical SERVQUAL gaps because they were not calculated from the difference between observed expectations and perceptions. The overall distance was -0.77, while Tangibles showed the largest negative result (-0.92), followed by Responsiveness (-0.78). In the item-level analysis, P18, related to documentation, reached the largest distance (-1.07). The results support prioritizing tangibles and the processes associated with documentation, packaging, and communication when planning the intervention and establishing indicators for the PDCA cycle.

Qualitative findings from the open-ended questions

Content analysis of the three open-ended questions, which addressed areas for improvement, proposed concrete actions, and additional comments, identified perceived opportunities and strengths. To connect these responses with service operations, recurring themes were grouped according to organizational processes and are summarized in the following paragraphs and in Table 7.

Priority organizational processes: The responses highlighted documentation and traceability, particularly the need to improve quality documents, update certifications, and strengthen related reporting. They also emphasized logistics operations associated with routes, fleet capacity, and collection and distribution times and schedules; infrastructure, particularly cold-storage facilities, collection facilities, packaging, and waste reduction; talent development through continuous staff training; and communication through organized channels for receiving orders, handling incidents, and providing follow-up.

Suggested concrete actions: The proposals included providing digital traceability reports and keeping documentation up to date; defining collection schedules and expanding distribution routes and fleet capacity; allocating resources to cold-chain infrastructure and packaging; training personnel in customer service; organizing

WhatsApp groups by route; and maintaining fair prices. These suggestions translate the identified needs into lines of action that can be linked to responsible personnel, targets, and indicators within the implementation model.

Organizational strengths and expectations for improvement:

Favorable responses focused on the quality of the region's product ("The tomatoes from this area are of good quality"), the attention provided by personnel, compliance with agreements, and support for producers. These strengths were accompanied by direct expectations of change ("We hope to see improvements soon"). Therefore, the existing trust provides a favorable basis for developing service operations and monitoring the proposed actions.

Table 7. Synthesis of themes emerging from the open-ended questions

Theme / Category	Examples of mentions	Relative frequency
Infrastructure management	Improve cold-storage facilities, greenhouse plastic coverings, packaging, and product presentation	High
Documentation and traceability management	Update expired certifications, improve quality documentation, and provide digital traceability reports	High
Logistics management	Expand distribution routes and fleet capacity, establish fixed collection schedules, and reduce product waste	High
Talent management	Provide continuous staff training and customer service training	Medium to high
Communication and digitalization management	Faster channels, WhatsApp groups organized by route, and updated order channels	Medium
Service management strengths	Quality of locally grown tomatoes, compliance with agreements, good staff treatment, transparency, and fair prices	High
Expectation of continuous improvement	"We hope to see improvements soon," "Keep up the good work," and "Thank you for supporting the producers"	High
Expectation of continuous improvement	"We hope to see improvements soon," "Keep up the good work," and "Thank you for supporting the producers"	High

Summary of results and implications for the PDCA cycle

Overall, the diagnostic stage identified a high perception of service quality in the Jitomates cooperative, with a global mean of 4.23 out of 5, and confirmed the high internal consistency of the measurement instrument ($\alpha = 0.933$). The main strengths were found

in Assurance, Reliability, and Empathy, particularly in the transparency of negotiations, fulfillment of delivery and quality commitments, appropriate treatment, and response to complaints. Opportunities for strengthening were concentrated in documentation, logistics, infrastructure, talent development, and communication. Within these processes, documents, packaging, collection facilities, tracking channels, cold-chain infrastructure, and the systematization of activities were especially prominent.

The findings are incorporated directly into the Plan phase of the PDCA cycle as part of the proposed model. Based on these results, priority is given to low- or medium-cost interventions aimed at (1) standardizing and digitizing documentation, including quality and traceability reports; (2) strengthening packaging and cold-storage conditions to reduce waste; (3) improving collection and distribution schedules and routes; and (4) training personnel in customer service and the use of basic tools for service operations. Monitoring these actions requires indicators such as the percentage of orders with complete documentation, the time required to issue reports, the rate of waste and quality-related incidents, the percentage of on-time deliveries, complaint response time, and recurrence of incidents. The baseline, target, data source, measurement frequency, and responsible person must be defined for each indicator. After the pilot, readministration of the instrument will make it possible to compare service perceptions and the indicators established during the Check phase. In the Act phase, procedures with favorable results may be adjusted or standardized through operating procedures and RACI matrices. In this way, the diagnosis is linked to continuous improvement and the strengthening of the cooperative to create organizational conditions that contribute to its competitiveness.

CONCLUSION

The study developed the diagnostic stage of the proposed model for managing the quality of the tomato marketing service provided by the Jitomates cooperative in La Estancia, Chilcuautila, Hidalgo. An adapted SERVQUAL questionnaire was administered to 30 stakeholders, most of whom were member producers. The following conclusions were drawn from the results:

1. **Diagnostic capacity of the model.** The questionnaire, comprising 20 perception items, achieved high internal consistency, with an overall Cronbach's alpha of 0.933. The coefficients for the five dimensions exceeded 0.70 and ranged from 0.797 to 0.900. These values support the use of the instrument to diagnose perceived quality as part of the proposed model for managing the service in the case analyzed.
2. **Strengths in service management.** Service quality received a high overall rating ($M = 4.23$ out of 5). Assurance ($M = 4.30$), Reliability ($M = 4.29$), and Empathy ($M = 4.27$) were the highest-rated dimensions. Their results are associated with confidence in price transparency, the fulfillment of delivery and quality commitments, personnel professionalism, and personalized attention. Together, these conditions provide a favorable organizational basis for operating the service and consolidating relationships with producers and customers.
3. **Opportunities for organizational strengthening.** Tangibles received the lowest mean score ($M = 4.08$), particularly because of the rating of documentation, including invoices, quality reports, and shipping documents ($M = 3.93$), as well as packaging, product presentation, collection facilities, and communication channels. The

qualitative component expanded these priorities and organized them into five processes: documentation and traceability, logistics operations, infrastructure, talent development, and communication. Rather than merely identifying operational shortcomings, these areas provide a basis for structuring actions, assigning responsibilities, and establishing indicators aimed at strengthening the cooperative.

4. **SERVQUAL-PDCA roadmap and management indicators.** Integrating both methodologies made it possible to organize a roadmap linking the diagnosis of perceived quality with action planning, indicator implementation, and subsequent verification. The results provide the baseline for the Plan phase and will support the design of the pilot corresponding to the Do phase. Priority actions include standardizing and digitizing documentation and traceability reports; improving packaging and cold-storage conditions; establishing collection schedules and optimizing routes; training personnel; and developing operating procedures and RACI matrices for incident management. During the Check phase, subsequent comparisons of service perceptions and indicators such as on-time deliveries, complaint response time, waste, and incidents will make it possible to assess the actions implemented. Finally, in the Act phase, viable practices may be adjusted or standardized in accordance with the continuous improvement approach established in ISO 9001:2015.
5. **Study contribution.** The main contribution of the study is the generation of diagnostic evidence from the local context that supports the methodological feasibility of integrating SERVQUAL and PDCA into a model for implementing continuous improvement indicators in the service quality management of rural cooperatives. In this proposal, the two tools perform complementary functions: SERVQUAL identifies priorities, while PDCA structures how they are addressed, evaluated, and adjusted. Consequently, the diagnosis goes beyond describing perceptions and becomes the starting point of a procedure aimed at organizational strengthening and at creating conditions that favor the cooperative's competitiveness.
6. **Limitations and future directions.** The sample of $N = 30$ belongs to a case study of a small cooperative, which limits the statistical generalizability of the results. Only perceptions were collected at this stage; therefore, the distances from the ideal value of 5 are exploratory and are not equivalent to SERVQUAL gaps calculated from paired expectations and perceptions. Furthermore, because the study remains at the pre-pilot stage, the effects of the actions and the behavior of the continuous improvement indicators cannot yet be evaluated. Subsequent cycles should include explicit measurement of expectations, post-intervention evaluation using a test compatible with the paired sample and statistical assumptions, and monitoring of operational indicators. The sample should also be expanded, and low-cost digital tools for traceability and order management should be examined.

In conclusion, the diagnosis identified a high perception of service quality and defined specific priorities for improvement. Integrating SERVQUAL and PDCA into the proposed model connects these priorities with actions and monitoring indicators, directing continuous improvement toward documentation, logistics, infrastructure, talent development, and communication processes.

Moving from diagnosis to the verification and standardization of actions provides a basis for strengthening the cooperative's internal organization and, through this progress, contributing to its competitiveness, transparency, and sustainability.

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