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Closing the Diagnostic-to-Management Gap in Public Transport: An Integrated SERVQUAL–ISO 9001–PDCA Framework for Resource-Constrained Bus Terminals

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Abstract

Service-quality surveys in public transport routinely reveal passenger dissatisfaction, yet they rarely specify how that evidence becomes owned processes, verifiable indicators and organizational learning. This study conceptualizes this shortfall as a diagnostic-to-management gap, a failure to convert externally acquired passenger knowledge into realized organizational action, and proposes the Management Model for Quality in Land Transport Terminals (MGCT-T) as a translation mechanism that integrates SERVQUAL, ISO 9001:2015 and the Plan-Do-Check-Act (PDCA) cycle. A sequential explanatory mixed-methods design was applied at an interprovincial bus terminal in Riobamba, Ecuador, triangulating 384 matched SERVQUAL expectation–perception assessments, a census of 30 transport-operator managers, a structured infrastructure observation (Infrastructure and Services Condition Index, ICIS = 42.5%) and a semi-structured institutional interview. Expectations exceeded perceptions in every dimension ($p < .001$; $d = 0.65–0.73$), but the gaps were nearly flat (0.64–0.70 scale points, overlapping confidence intervals), so the survey alone could not indicate where to intervene. Operator and infrastructure evidence converged on congestion, insufficient platform capacity, reactive maintenance and security weaknesses. The MGCT-T converts these signals through three components and five explicit translation rules that assign each prioritized gap to an ISO 9001 process, an accountable owner, an intervention, an indicator and a PDCA verification step. A three-specialist panel supported design coherence (normalized index 0.91); financial results are ex ante scenarios only. The contribution is a transferable voice-to-process governance architecture, positioned at the intersection of service-quality measurement, quality-management systems and open-innovation knowledge absorption. Transfer to other settings requires local recalibration of weights, thresholds and responsibilities, and causal effectiveness remains untested.

Highlights

• Defines the diagnostic-to-management gap as a failure to absorb passenger evidence

• Five translation rules link SERVQUAL gaps to ISO 9001 processes, owners and KPIs

• Raw gaps were nearly flat (0.64–0.70), so the survey alone could not rank priorities

• The top-three priority set is identical under raw and weighted schemes

• Design-validated only: causal effects require longitudinal, multi-terminal testing

1 Introduction

Service quality is a central concern in public transport because passengers evaluate not only whether a trip is completed, but also whether the system is reliable, understandable, safe, accessible, responsive and physically adequate. These evaluations affect satisfaction, loyalty and the attractiveness of public transport relative to private alternatives (van Lierop & El-Geneidy, 2016; de Oña, 2022). Reviews of bus

systems in developing countries identify reliability, safety, accessibility and comfort as recurrent determinants of perceived quality (Sogbe et al., 2025), and recent studies examine satisfaction and loyalty in bus and metro services (Arancibia et al., 2025) and the link between the state of bus operations and passenger satisfaction (Weng et al., 2023).

Regional and intercity services merit particular attention. Hansson et al. (2019) show that research on regional public transport has historically been less developed than research on local urban services, even though reliability, frequency, comfort, travel time and network coordination are repeatedly important to regional travellers. For bus-based systems, the quality of terminals and transfer environments forms part of the passenger experience because information, waiting conditions, security, dispatch discipline and coordination are encountered at the node as well as on board the vehicle. Evidence from medium-sized European cities points in the same direction: Al Suleiman et al. (2023) identify comfort, information, service performance and integration as important factors, and Göransson and Andersson (2023) conclude that reliability and frequency remain fundamental to attractive public transport.

The measurement side of this field is mature. SERVQUAL, importance–performance analysis, factor analysis, structural models and, increasingly, digital or operational data sources are used to diagnose and prioritize service attributes (Tuan et al., 2022; Kalaoane et al., 2024; Urbano et al., 2025), and non-solicited user feedback is now being exploited to evaluate service quality (Beck et al., 2025). From an open-innovation perspective, these sources are inflows of external knowledge about the service (Chesbrough, 2003; Hilgers & Ihl, 2010). Research on absorptive capacity, however, stresses that acquiring external knowledge creates value only when the organization can also transform and exploit it (Cohen & Levinthal, 1990; Zahra & George, 2002). This is where public-transport quality research offers least guidance: identifying that reliability, responsiveness or security is weak is not the same as specifying which process owner is accountable, which operating procedure should change, which risk requires control, which resource should be assigned and which indicator should verify improvement.

We define this unresolved transition as a *diagnostic-to-management gap*: the condition in which an organization holds valid evidence of passenger dissatisfaction but lacks a repeatable mechanism for translating it into standardized processes, accountable actions and continuous learning. Conceptually, it is a failure of realized absorptive capacity: passenger knowledge is acquired and assimilated, but not transformed and exploited.

Three established traditions partly bridge measurement and management. The EN 13816 quality loop links expected, targeted, delivered and perceived quality and has been operationalized through gap analysis (European Committee for Standardization [CEN], 2002; Barabino et al., 2015). Quality function deployment (QFD) translates customer requirements into technical requirements and has been applied to urban public transport (Hauser & Clausing, 1988; Andriskova & Strenitzerova, 2014). ISO 9001:2015 requires organizations to monitor customer perceptions and to use the results in evaluation and improvement (International Organization for Standardization, 2015). Each addresses a portion of the problem. To the best of our knowledge, and within the literature reviewed for this study, none specifies

for a resource-constrained terminal a rule-based sequence that (i) separates raw perceived deficits from weighted managerial priorities, (ii) assigns each prioritized gap to an ISO 9001 process with an accountable owner and an indicator, and (iii) closes the loop through PDCA verification and renewed passenger evidence. Section 2.2 details these differences.

The study addresses three research questions. **RQ1**: How large and how discriminating are passenger-perceived service-quality gaps at a regional bus terminal, and do operator and infrastructure evidence converge with them? **RQ2**: How can the gaps be translated systematically into prioritized, owned, measurable and verifiable management processes under resource constraints? **RQ3**: What can legitimately be claimed about the validity and transferability of the resulting design?

The study makes four contributions. First, it conceptualizes the diagnostic-to-management gap as a failure of realized absorptive capacity and shows, in one case, why survey evidence alone is insufficient: the five SERVQUAL gaps were nearly identical in magnitude and indistinguishable on the reported confidence intervals. Second, it proposes the MGCT-T, a voice-to-process architecture whose components perform functionally distinct roles and whose translation rules (R1–R5) make the passage from gap to owned process, indicator and verification explicit. Third, it introduces a methodological separation between raw gaps and weighted priorities, together with a rank-stability check that identifies a priority set robust to the weighting scheme. Fourth, it delimits what has been design-validated from what requires longitudinal testing, a distinction that is often blurred in model-building studies.

The empirical case is the Interprovincial Bus Terminal of Riobamba, Ecuador, a regional transport node serving a medium-sized city and surrounding intercity flows. The case is non-European and the study does not claim statistical generalizability to other systems. Instead, it uses the case as an institutional stress test for a governance mechanism intended to be transferable at the architectural level: local weights, thresholds, regulations and organizational roles must be recalibrated when the framework is applied elsewhere, whereas the underlying sequence from passenger evidence to process control can be examined across contexts.

The remainder of the article is organized as follows. Section 2 positions the study conceptually. Section 3 describes the methods, Section 4 the diagnostic results, Section 5 the MGCT-T architecture and Section 6 its design validation. Sections 7 to 10 discuss, draw implications, state limitations and conclude.

2 Theoretical background and positioning

2.1 Service quality in regional and intercity public transport

SERVQUAL conceptualizes perceived service quality through differences between customer expectations and perceptions across tangibles, reliability, responsiveness, assurance and empathy (Parasuraman et al., 1988). In the Spanish-language instrument used here, assurance is rendered as *seguridad* and is labelled “Security” in the tables; we therefore refer to Security (Assurance). In transport

applications, the dimensions are expressed through concrete operating phenomena: infrastructure and cleanliness under tangibles; timetable and service fulfilment under reliability; information and problem resolution under responsiveness; safety and confidence under assurance; and individualized attention under empathy. The gap-score logic has been debated relative to performance-only measurement (Cronin & Taylor, 1992); we return to this in Section 9.

The diagnostic value of these dimensions is clear, but their managerial interpretation requires context. In a terminal, passenger perceptions may reflect several organizational actors simultaneously: terminal administration, bus operators, security personnel, maintenance units and information services. A low score can therefore be a symptom of a cross-process failure rather than a single front-line problem. Prioritization is also essential because resource-constrained organizations cannot address every deficit at once. Tuan et al. (2022) demonstrate the usefulness of combining importance and performance information to set intervention priorities. The present study follows the same managerial logic but distinguishes between the magnitude of a direct expectation–perception gap and the priority produced after applying study-specific importance weights. The two metrics answer different questions: where is the most immediate perceived shortfall, and where does the chosen weighting scheme direct managerial attention?

2.2 From measurement to management: existing bridges and their limits

Table 1 positions the MGCT-T against the approaches that already connect perception to management. It shows that the novelty claimed here does not lie in any single component, nor in the idea that perception should inform management, which the EN 13816 loop and QFD already embody. It lies in the functional specification of the passage from a perceived gap to a governed process, and in the explicit verification that returns the result to the passenger-information system.

Table 1
Positioning of the MGCT-T against existing bridges between measurement and management

Approach	Primary function	Typical output	Limit for terminal-level management (as read from the literature reviewed)	Role in the MGCT-T
SERVQUAL, IPA and related survey methods (Parasuraman et al., 1988; Tuan et al., 2022)	Diagnose and prioritize service attributes	Gap scores; priority quadrants	Do not specify process owners, controls, indicators or verification	Input to the CDE; prioritization under R1
EN 13816 quality loop and EN 15140 measurement (CEN, 2002, 2006; Barabino et al., 2015)	Define, target and measure quality across four quality areas	Gaps between expected, targeted, delivered and perceived quality	Framed around quality criteria and commitments between authorities and operators; internal process governance is left to the organization	Conceptual precedent for the closed loop; MGCT-T adds the internal process architecture
QFD / House of Quality (Hauser & Clausing, 1988; Andriskova & Strenitzerova, 2014)	Translate customer requirements into technical requirements	Requirement–specification matrices	Typically a design-stage matrix; ownership, management review and recurrent verification lie outside the method	Precedent for translation; the OTC extends it to owner, indicator and verification
ISO 9001:2015 implementation (ISO, 2015; Susanto et al., 2025)	Institutionalize process-based quality management	Documented processes, controls, audits	Requires customer-perception monitoring but does not prescribe how a specific perceived gap becomes a specific process change	Structural reference of the QMSS
PDCA (Deming, 1986)	Recurrent improvement logic	Plan–do–check–act cycles	Generic: needs an input signal and a governance structure	Temporal logic of the loop
MGCT-T (this study)	Translate passenger-perceived gaps	Rule-based chain from gap to owner, intervention,	Design-validated only; not tested longitudinally	—

Note. Characterizations of EN 13816 and EN 15140 rely on published descriptions of the standards and their applications, not on the full text of the standards. The positioning is narrative and selective, not a systematic review.

Approach	Primary function	Typical output	Limit for terminal-level management (as read from the literature reviewed)	Role in the MGCT-T
	into governed processes	indicator and verification		

Note. Characterizations of EN 13816 and EN 15140 rely on published descriptions of the standards and their applications, not on the full text of the standards. The positioning is narrative and selective, not a systematic review.

2.3 Open innovation and absorptive capacity: reframing the gap

Open-innovation research holds that organizations benefit from purposive inflows of external knowledge (Chesbrough, 2003) and that these principles can be transferred to the public sector through user and citizen involvement (Hilgers & Ihl, 2010). Passenger evaluations are such an inflow. Absorptive capacity, the ability to recognize the value of external information, assimilate it and apply it (Cohen & Levinthal, 1990), determines whether the inflow produces organizational change. Zahra and George (2002) distinguish potential capacity (acquisition and assimilation) from realized capacity (transformation and exploitation).

Applied to a terminal, SERVQUAL surveys, complaint records and pulse surveys constitute acquisition; interpretation through priority and causal analysis constitutes assimilation; the conversion of an interpreted gap into a process design is transformation; and implementation, verification and institutional learning constitute exploitation. The diagnostic-to-management gap is the wedge between potential and realized capacity. The framing also connects to the complexity of the setting. A terminal is a multi-actor system in which cooperatives, administration, security and maintenance units share responsibility for what the passenger experiences, so that explicit ownership and interface rules are preconditions for exploitation rather than administrative refinements.

SERVQUAL itself originates in a provider-gap model in which the customer gap (Gap 5) results from four internal gaps: knowledge, standards, delivery and communication (Parasuraman et al., 1985; Zeithaml et al., 1988). This offers a second anchor: a management model should specify which organizational mechanism closes each internal gap. The mapping is developed in Section 5.4.

The framework yields three design propositions, which we state as testable expectations and not as findings of this study. **DP1**: terminals that translate perceived gaps into owned processes with indicators will shorten the interval between detection and corrective action relative to terminals that rely on survey reports alone. **DP2**: priority sets that remain stable under alternative weighting schemes are more robust guides to resource allocation than a single weighted ranking. **DP3**: closed-loop verification (Check and Act) increases the persistence of improvements relative to one-off interventions.

2.4 Conceptual framework

Figure 1 summarizes the framework. The proposed chain is: passenger evidence → service gap → managerial priority → responsible process → operational intervention → key performance indicator → evaluation → corrective action → renewed passenger evidence. The integration is functional: SERVQUAL detects the passenger-defined deficit; priority analysis focuses scarce managerial attention; ISO 9001 institutionalizes the response through roles, documentation, resources and controls; and PDCA requires the organization to verify effects and correct the intervention. This shifts the unit of analysis from the survey score to the organizational pathway through which a survey signal is acted upon. Contemporary reviews of ISO 9001 implementation emphasize that the standard must be contextualized rather than applied mechanically where organizations face resource constraints or implementation barriers (Susanto et al., 2025), which is why the standard is used here as an architecture and not as a certification endpoint.

3 Methods

3.1 Research design and setting

A non-experimental, cross-sectional, sequential explanatory mixed-methods design (QUAN→qual) was used (Creswell & Plano Clark, 2018). Fieldwork was conducted at the Interprovincial Bus Terminal of Riobamba during 2024–2025. The underlying operational population was approximately 7,618 users per day. Evidence was collected from passengers, transport-operator representatives, structured infrastructure observation and a key institutional informant. The mixed design was selected because passenger scores alone could identify dissatisfaction but could not explain the organizational mechanisms behind it: quantitative evidence established the pattern and magnitude of the gaps, and operator, observational and qualitative evidence were used to interpret likely process-level causes and implementation constraints.

The study has two analytical layers: an empirical diagnostic layer (Sections 3.2–3.5 and 4) and a design layer in which the MGCT-T is constructed and evaluated (Sections <link rid="Sec13">3.6</link>, 5 and 6). The design layer is reported in line with design-science principles of problem relevance, artefact construction and evaluation (Hevner et al., 2004), with the limitation that evaluation is restricted to expert judgment and ex ante scenarios. The literature positioning in Section 2 is narrative and selective, not a systematic review.

3.2 Passenger SERVQUAL component

The principal quantitative instrument was a 22-item SERVQUAL questionnaire adapted to the terminal context and applied to 384 users. Expectations and perceptions were measured on a five-point scale with the verbal anchors *Malo*, *Regular*, *Bueno*, *Muy bueno* and *Excelente*; in the project, *Bueno* was the minimum acceptable level and 80% the operational control reference. The sample size was calculated using a conventional 95% confidence level and 5% error, but field recruitment was non-probabilistic and based on convenience. The sample-size calculation therefore must not be interpreted as design-based representativeness of the passenger population.

Internal consistency was Cronbach's α = .81 for expectations and α = .94 for perceptions. Content adaptation was reviewed before field application. The project dataset did not include confirmatory factor analysis, composite reliability or McDonald's omega, and none of these statistics is claimed here. Expectations and perceptions were treated as matched observations.

3.3 Operator and infrastructure evidence

A structured questionnaire was administered orally to the full accessible population of 30 managers or representatives of interprovincial transport cooperatives operating at the terminal. It generated binary and ordinal responses summarized through frequencies and percentages. Non-participant structured observation, a qualitative instrument, rated eight physical and functional criteria: building condition, platforms, pavement, signage, seating, toilets, waste management and accessibility ramps. The Infrastructure and Services Condition Index (ICIS) expresses the observed score as a percentage of the maximum possible score. It is a study-specific summary of a qualitative observation and not a standardized external benchmark.

3.4 Qualitative and expert-validation components

The explanatory qualitative phase consisted of a semi-structured interview with a former terminal administrator selected for accumulated operational, historical and institutional knowledge. The interview explored the causes of low reliability, institutional response capacity, perceived security, financial constraints and the feasibility of a quality-management system, and was processed through thematic content analysis. The proposed model was subsequently assessed by three specialists using five-point ratings of theoretical and operational components. The normalized mean validation index was 0.91. Given the small panel, this is interpreted as expert-supported design and content coherence, not as universal consensus and not as evidence that the model has improved service outcomes.

3.5 Statistical and priority analysis

Paired-sample t tests compared expectation and perception scores by SERVQUAL dimension. Mean differences, 95% confidence intervals and Cohen's d were reported. The original hypothesis was directional (expectations greater than perceptions); the test statistics are large enough that the corresponding two-sided p values also remain below .001.

A second managerial layer used study-specific importance weights of 20% for tangibles, 30% for reliability, 20% for responsiveness, 20% for security and 10% for empathy. These weights were not generated by a separately validated weighting model and are treated as exploratory decision weights, not population parameters. Minor rounding inconsistencies exist between the direct gap table and the weighted table of the source study (for example, the weighted deficit for responsiveness, 14.4 at a 20% weight, implies a gap of 0.72, whereas the direct gap is 0.70). Inferential gaps and weighted priority scores are therefore reported as analytically distinct outputs, and percentage contributions are recalculated from the reported weighted deficits.

To examine how far the priority ordering depends on the weighting scheme, we compared the ordering of raw gaps (equivalent to equal weights) with the ordering under the study weights, and computed the weight ratio at which the two largest raw gaps exchange rank. These are arithmetic re-expressions of reported values; no new data were generated. Because dimension-level intervals are reported but item-level data are not part of this manuscript, differences between dimensions were assessed descriptively by inspecting interval overlap.

3.6 Construction and evaluation of the MGCT-T

The MGCT-T was constructed from the diagnostic evidence, the clause structure of ISO 9001:2015 and the PDCA logic. Its evaluation combined theoretical–empirical coherence mapping, expert judgment, actor consultation and prospective financial scenarios (Section 6). The translation matrix (Table 5) is an author-developed artefact: its entries illustrate how rules R1–R5 apply to the evidence of this case and have not been tested in operation.

4 Results

4.1 Expectations exceeded perceptions in every dimension, but the gaps were nearly flat

The expectation–perception differences are summarized in Table 2. All five comparisons were statistically significant, with standardized effects between 0.65 and 0.73, indicating a multidimensional service-quality deficit rather than an isolated weakness. Responsiveness showed the largest direct difference (0.70; d = 0.73), followed by reliability (0.68; d = 0.70).

Table 2
Expectation–perception differences by SERVQUAL dimension (n = 384)

Dimension	Expectation	Perception	Mean diff. (E – P)	95% CI	Cohen's d	p
Tangibles	3.56	2.91	0.65	0.55–0.75	0.67	< .001
Reliability	3.66	2.98	0.68	0.58–0.78	0.70	< .001
Responsiveness	3.60	2.89	0.70	0.61–0.80	0.73	< .001
Security (Assurance)	3.59	2.92	0.67	0.57–0.77	0.67	< .001
Empathy	3.51	2.87	0.64	0.54–0.74	0.65	< .001

Note. Mean differences are expectation minus perception. The source analysis used a directional hypothesis; all observed t statistics also imply two-sided p < .001.

Two features of Table 2 matter for management. First, the dimension-level gaps ranged only from 0.64 to 0.70 scale points (a spread of 0.06), and all five 95% confidence intervals overlap. On the reported intervals the dimensions cannot be separated statistically, so the raw ordering (responsiveness, reliability, security, tangibles, empathy) should be read as indicative and not as a ranking. Second, if the verbal anchors are read as a 1–5 scale (*Malo* = 1 … *Excelente* = 5), *Bueno* corresponds to 3, and all five perception means (2.87–2.98) lie marginally below the minimum acceptable level while expectations (3.51–3.66) lie above it. In short, the survey establishes that every dimension is deficient, but by almost the same amount; it cannot by itself say where a resource-constrained organization should start.

4.2 Weighted managerial priority and its stability

Table 3 combines the raw gaps with the study-specific weighted deficits. Under these weights, reliability becomes the largest priority because it receives a 30% weight, and the three leading weighted deficits (reliability, responsiveness and security) sum to 48.2 of 67.6 weighted-deficit points, or approximately 71.3% of the total. Under equal weights, the same three dimensions lead, but they account for approximately 61% of the total (2.05 of 3.34 scale points of summed raw gaps). The concentration of priority therefore depends partly on the weighting judgment.

Table 3
Raw gaps, weighted deficits and rank stability

Dimension	Raw gap	Raw rank	Weight	Reported weighted deficit	Weighted rank	Share of weighted total
Reliability	0.68	2	30%	−20.4	1	30.18%
Responsiveness	0.70	1	20%	−14.4	2	21.30%
Security (Assurance)	0.67	3	20%	−13.4	3	19.82%
Tangibles	0.65	4	20%	−13.0	4	19.23%
Empathy	0.64	5	10%	−6.4	5	9.47%
Total	—	—	100%	−67.6	—	100%

Note. Weighted deficits are reproduced as reported. Shares are recalculated from their summed magnitude (67.6 points), which resolves a minor rounding inconsistency in the source Pareto table. Raw rank is equivalent to rank under equal weights.

The distinction between the two rankings is explicit: responsiveness is the largest unweighted shortfall, whereas reliability is the largest weighted priority under the assigned weights. The two exchange rank whenever the reliability weight exceeds the responsiveness weight by more than about 3% (0.70/0.68 ≈ 1.03 using Table 2 values), a margin small enough that the order between them is fragile. What is stable is the set: reliability, responsiveness and security are the top three under both schemes, while tangibles and empathy rank fourth and fifth. The defensible conclusion is therefore not that reliability is universally

the most critical dimension, but that reliability and responsiveness form the leading intervention pair, with security also belonging to the principal priority cluster.

4.3 Operator and infrastructure evidence

The census of 30 transport-operator representatives reinforced the passenger diagnosis (Table 4). Structured observation produced an ICIS of 42.5% (17 of 40 possible points), with weaknesses in building condition, platforms, pavement, seating, sanitation, waste management and accessibility. The convergence of passenger, operator and observational evidence supports interpreting the problem as systemic: perceived quality deficits correspond to identifiable weaknesses in processes, operating conditions and physical services

Table 4
Operator census and structured observation: convergence with the passenger diagnosis

Indicator	Result	Dimension(s) to which it is attributed by the authors
Operators identifying insufficient platform capacity	73.3%	Tangibles; Reliability
Operators reporting inadequate driver rest areas	80.0%	Tangibles
Operators indicating recurrent congestion or operational delays	70.0%	Reliability; Responsiveness
Operators reporting compliance with established operating frequencies	40.0%	Reliability
Operators reporting feeling secure within the terminal	33.3%	Security (Assurance)
Operators considering existing security measures sufficient	23.3%	Security (Assurance)
Customer service rated “regular”	53.3%	Responsiveness; Empathy
Maintenance performed only “sometimes”	63.3%	Tangibles
ICIS (structured observation, 8 criteria)	42.5% (17/40)	Tangibles

Note. n = 30 operator representatives (census of the accessible population). The attribution of indicators to SERVQUAL dimensions is an interpretive judgment of the authors.

4.4 Causal interpretation

An Ishikawa analysis organized potential root causes into personnel, technology, methods, materials, measurement and operating environment. Persistent mechanisms included insufficient process standardization, uneven staff training, limited information technology, weak performance tracking, reactive maintenance and congestion. In management terms, reliability failure can be interpreted as a

process-control problem expressed through passenger perception. Responsiveness similarly reflects not only front-line behaviour but also the availability of information, escalation procedures, staffing and complaint handling, and security reflects both physical controls and interinstitutional coordination. These results constitute the input to the translation mechanism described next.

5 The MGCT-T voice-to-process architecture

5.1 Design logic

The MGCT-T is designed to prevent SERVQUAL from ending at diagnosis. Its central sequence is Detect → Prioritize → Translate → Act → Measure → Correct → Learn. Passenger information enters the management system as evidence, is assigned to a responsible process, is converted into an intervention and is re-evaluated through performance indicators and renewed passenger feedback. Three interacting components carry out this sequence (Fig. 1). For readability in English we use the acronyms CDE, OTC and QMSS; the original Spanish acronyms are listed among the abbreviations.

5.2 Continuous Diagnostic Engine (CDE)

The CDE captures recurrent evidence through SERVQUAL, pulse surveys, complaint records, operational indicators, direct observation and infrastructure monitoring. Its purpose is not to generate another satisfaction score but to produce actionable managerial intelligence: it identifies deteriorating patterns, distinguishes chronic from emerging problems and supplies the information required for prioritization. In absorptive-capacity terms, it performs acquisition and assimilation.

5.3 Operational Transformation Core (OTC) and translation rules

The OTC converts a prioritized gap into a process-level intervention. Its logic is expressed in five rules that make the translation step explicit and reproducible.

- **R1 (Priority).** Gaps are ranked by both raw magnitude and weighted deficit. Dimensions in the top set under both schemes enter the first cycle; dimensions whose rank changes with the weights are flagged for local verification of the weights.
- **R2 (Causal decomposition).** Each prioritized gap is decomposed into process-level causes (for example with an Ishikawa analysis), separating those correctable through standardization and accountability from capital-intensive ones that require phased investment.
- **R3 (Anchoring and ownership).** Each process-level cause is anchored to an ISO 9001:2015 clause and assigned to an accountable owner identified by role, not by person (clause 5.3).
- **R4 (Specification).** Each intervention has at least one indicator with a locally set target and an identified data source (complaint log, operational records, observation or pulse survey).
- **R5 (Verification).** Each intervention has a Check step (indicator against target) and an Act step (standardize or revise), and its result feeds renewed passenger evidence back to the CDE.

Table 5 illustrates the application of the rules to the evidence of this case. For instance, a reÑliability deficit is translated into timetable and dispatch controls, assigned process ownership, punctuality indicators and contingency procedures; a responsiveness deficit into passenger-information standards, complaint-resolution protocols, responsible staff and response-time targets; and a security deficit into risk registers, surveillance, incident procedures, coordination with public-security actors and response indicators. The key innovation is the translation step itself: the passenger-defined gap becomes an input to operational design. Numerical targets are deliberately left to local setting; where perception indicators are used, the project's own thresholds (*Bueno* as the minimum acceptable level and 80% as the operational control reference) provide a starting reference.

Table 5

Illustrative translation matrix: from SERVQUAL gap to governed process

Dimension and case evidence	ISO 9001:2015 anchor and accountable owner (role)	Operational intervention	Indicators	Verification (Check / Act)
Reliability (gap 0.68; weighted −20.4). 40.0% of operators report compliance with frequencies; 70.0% report recurrent congestion or delays; 73.3% report insufficient platform capacity.	6.2 objectives; 8.1 and 8.5.1 operational control of service provision; 5.3 roles. Owner: terminal operations and dispatch coordination, with cooperative representatives.	Timetable and dispatch controls; platform-assignment rules; contingency procedure for congestion; incident recording.	Departure-compliance (punctuality) rate; congestion-incident frequency; dispatch-rule compliance.	Compare indicators with local targets at each review cycle; revise dispatch rules if targets are missed; repeat reliability items in the pulse survey.
Responsiveness (gap 0.70; weighted − 14.4). 53.3% rate customer service “regular”; Ishikawa: limited information technology and weak performance tracking.	7.4 communication; 9.1.2 customer satisfaction; 10.2 complaints as nonconformities. Owner: customer-service and information unit of the terminal administration.	Passenger-information standard; complaint-resolution protocol with escalation; peak-time staffing rules.	Complaint response time; share of complaints resolved within the target; information-availability audit result.	Audit complaint records and pulse-survey responsiveness items; correct protocol and staffing rules.
Security (Assurance) (gap 0.67; weighted −13.4). 33.3% of operators feel secure; 23.3% consider security measures sufficient.	6.1 risks and opportunities; 8.5.1 operational control; 7.4 communication. Owner: security coordination between terminal administration and public-security actors.	Risk register; surveillance coverage; incident procedures; interinstitutional coordination protocol.	Incidents recorded and time to response; share of identified risks with a treatment; perceived-security pulse result.	Review register and incident data; update controls; compare perception with the minimum acceptable level.

Note. Author-developed illustration based on the case evidence in Sections 4.1–4.4. *Clause numbers refer to ISO 9001:2015. Owners are role types. The matrix was assessed only through the expert and actor consultation described in* Section 6; *it has not been implemented.*

Dimension and case evidence	ISO 9001:2015 anchor and accountable owner (role)	Operational intervention	Indicators	Verification (Check / Act)
Tangibles (gap 0.65; weighted −13.0). ICIS 42.5% (17/40); 63.3% report maintenance only “sometimes”; 80.0% report inadequate driver rest areas.	7.1.3 infrastructure; 7.1.4 environment for the operation of processes; 6.2 objectives. Owner: maintenance and infrastructure management unit.	Shift from reactive to planned maintenance; phased capital works for platforms, seating, sanitation and accessibility (separated from process fixes under R2).	Re-scored ICIS and its eight criteria; maintenance-plan compliance.	Repeat structured observation; adjust the maintenance plan and investment phasing.
Empathy (gap 0.64; weighted −6.4). Ishikawa: uneven staff training.	7.2 competence; 7.3 awareness. Owner: training function of the terminal administration.	Staff training and service protocol for attention to specific passenger needs, including accessibility.	Staff trained against plan; empathy-item perception results.	Compare training coverage and pulse-survey empathy items; revise content.

Note. Author-developed illustration based on the case evidence in Sections 4.1–4.4. *Clause numbers refer to ISO 9001:2015. Owners are role types. The matrix was assessed only through the expert and actor consultation described in* Section 6; *it has not been implemented.*

5.4 Quality-Management System Structure (QMSS) and functional integration

The QMSS institutionalizes interventions through documented processes, responsibilities, resources, risk controls, indicators, management review and corrective actions. ISO 9001:2015 clauses 4–10 provide the structural reference, while PDCA supplies the temporal logic for recurrent learning. The result is a feedback architecture and not a one-time improvement project. Table 6 summarizes the functional relationship among SERVQUAL, ISO 9001:2015 and PDCA and aligns each management function with an absorptive-capacity stage and with the internal gap of the provider-gap model that it addresses. The alignment is conceptual and author-developed.

Table 6
Functional integration of SERVQUAL, ISO 9001:2015 and PDCA within the MGCT-T

Management function	SERVQUAL / evidence role	ISO 9001:2015 anchors	PDCA	Absorptive-capacity stage	Provider gap addressed
Identify deficit	Expectation–perception evidence	4.1; 9.1.2	Plan	Acquisition	Gap 1 (knowledge)
Set priority	Gap and priority analysis (R1)	6.1; 6.2	Plan	Assimilation	Gap 1 (knowledge)
Assign response	User-defined need as process requirement (R2–R4)	5.3; 7.1–7.4; 8.1	Plan / Do	Transformation	Gap 2 (standards)
Implement	—	8.5.1; 7.4	Do	Exploitation	Gaps 3–4 (delivery, communication)
Measure	Repeated user assessment (R5)	9.1.1–9.1.3; 9.3	Check	Exploitation	Customer gap monitored
Correct	Updated evidence	10.2; 10.3	Act	Exploitation and learning	Loop closed

Note. The frameworks perform differentiated functions; the model does not treat them as interchangeable quality tools.

6 Design validation and ex ante feasibility

6.1 What the evidence supports

The model was evaluated through theoretical–empirical coherence mapping, expert judgment, actor consultation and prospective financial scenarios. Expert judgment across nine model foundations and components produced a mean of 4.56 out of 5 and a normalized index of 0.91. This supports design coherence and contextual pertinence. It does not demonstrate causal effectiveness, because the model has not been implemented or evaluated longitudinally. Table 7 makes the evidentiary boundary explicit.

Table 7
Evidence ladder: what has and has not been established

Level	Claim	Evidence	Status
1 Diagnostic	Expectations exceed perceptions in all five dimensions; operator and infrastructure evidence converge	384 SERVQUAL assessments; 30 operator managers; ICIS; one interview	Supported in one case with a non-probabilistic passenger sample
2 Design coherence	Components and rules form a coherent, contextually pertinent architecture	Coherence mapping; three-specialist panel (index 0.91); actor consultation	Expert-supported; not consensus
3 Ex ante feasibility	A staged implementation appears economically plausible under stated assumptions	Scenario projections (Section 6.2)	Scenario output, not realized return
4 Effectiveness	Implementation improves punctuality, response time, security, conditions and perceptions	None	Untested; requires longitudinal design

6.2 Ex ante financial scenarios

Implementation was proposed in three phases totalling USD 48,000: USD 18,000 for initial quality-system foundations, USD 15,000 for technology and efficiency improvements, and USD 15,000 for sustainability and institutionalization. The base scenario projected a net present value of approximately USD 54,567, an internal rate of return of 60%, a return on investment of 175.97% and a payback period of 1.52 years. A 20% adverse scenario still produced a positive projected net present value and an internal rate of return above the assumed 12% discount rate. These values are ex ante scenario outputs that depend on the financial assumptions of the study, not realized returns, and they are not used as evidence of the model's validity. Their legitimate interpretation is narrower: under those assumptions, the staged design appears economically plausible. Actual performance must be established after implementation through observed costs, operational savings and service outcomes.

7 Discussion

7.1 What is and is not new

The contribution should be located precisely. SERVQUAL, ISO 9001 and PDCA are not new individually, and neither is the idea that perceptions should inform management: the EN 13816 quality loop and QFD already embody it. The MGCT-T adds four things. The first is a reframing: the diagnostic-to-management gap is specified as the transition between potential and realized absorptive capacity, which turns an implicit managerial complaint ("surveys are not acted on") into a construct with identifiable stages, loci and failure points. The second is a specification: rules R1–R5 make the passage from a perceived gap to

an owned, measured and verified process reproducible, and they attach that passage to the clause structure of a widely used management-system standard. The third is a methodological discipline: raw gaps, weighted priorities and rank stability are reported separately so that managers can see which conclusions depend on the weighting judgment. The fourth is the setting: evidence from a resource-constrained regional node, where the capital intensity of many deficits makes the separation between process failures and investment problems (R2) managerially decisive. These claims are conceptual and design-level. The study does not assert superiority over QFD-based or EN 13816-based approaches, which it did not test.

7.2 Why diagnosis alone under-determines management

The Riobamba results illustrate the gap empirically. The survey established, with large standardized effects, that every dimension was deficient, but the five gaps differed by at most 0.06 scale points and their intervals overlapped. Any ranking derived from the survey alone is therefore weakly identified. The information that differentiates priorities came from the weighting judgment and from non-survey evidence such as the low compliance with operating frequencies, the low perceived security and the ICIS. A management model must therefore specify how these sources are combined and who is accountable for acting on them. This is the function of R1 and R2. At the same time, the stability of the top-three set under both weighting schemes suggests a practical heuristic consistent with DP2: begin with the set that survives alternative weights and verify the weights locally before allocating scarce budget within it.

7.3 Implications for open-innovation and complexity research

For open-innovation research, the case suggests that inbound knowledge flows in public-service organizations may be constrained less by acquisition than by absorption. Survey data, complaint records and, increasingly, non-solicited feedback and operational data (Beck et al., 2025; Urbano et al., 2025) expand the potential side of absorptive capacity; unless a transformation and exploitation mechanism exists, the additional information does not become improvement. The multi-actor structure of a terminal, with cooperatives, administration, security and maintenance units, also means that responsibility for any perceived failure is diffuse. Rule R3 addresses this by requiring explicit ownership at the interface. The CDE is designed to admit these richer data sources, but the present study used only surveys, observation, a census and an interview, so its compatibility with unsolicited or automatic data remains a design intention to be tested.

7.4 Transferability and international relevance

The empirical case is Ecuadorian, but the research problem is not geographically unique. Regional and intercity systems in different institutional settings must coordinate schedules, passenger information, terminal operations, accessibility, safety, maintenance and multiple operating actors. Hansson et al. (2019) emphasize that regional public transport has specific quality requirements and has received less research attention than local urban services. The present study contributes to that agenda by shifting

attention from individual vehicle service to the governance of the terminal node through which regional trips are organized.

Comparison with research on medium-sized European cities (Al Suleiman et al., 2023; Göransson & Andersson, 2023) should be made at the level of mechanism and not of parameter values: once information, service performance, integration, reliability and frequency are identified as weak, the framework specifies how they can be assigned to processes, risks, responsibilities and indicators. Transfer would require recalibration rather than replication. Local authorities or terminal operators would need to re-estimate passenger priorities, define context-specific indicators, map responsibilities to the relevant institutional structure and align the quality-management system with applicable regulatory requirements. The Riobamba weights should not be imported into another terminal. What is potentially transferable is the governance sequence that links passenger evidence to process control and continuous improvement.

7.5 Governance, implementation and organizational learning

ISO 9001 is used here as an institutional architecture and not as a certification endpoint. This matters because public-transport quality problems often cross departmental and organizational boundaries: a complaint about a delayed departure may involve dispatch rules, operator compliance, information systems, staffing and escalation procedures, and process mapping with explicit ownership makes these interdependencies visible. PDCA adds a learning requirement that static service-quality measurement lacks: an intervention is not complete when launched, but must be checked against operational and passenger outcomes and revised if the target is not reached.

8 Theoretical and practical implications

8.1 Theoretical implications

The framework advances a voice-to-process proposition: perceived service quality is conceptualized simultaneously as an outcome of organizational performance and as an input to future organizational governance, which closes a loop between passenger-perception research and process-management theory. It also extends the absorptive-capacity lens to a public-service setting by showing how the potential–realized distinction can be operationalized through management-system constructs. The contribution is not that SERVQUAL, ISO 9001 and PDCA are new; it is that each framework is assigned a distinct role in a causal-management sequence (detection, prioritization, institutionalization, verification and correction), shifting attention from instrument integration to functional integration.

8.2 Practical implications

For terminal and transport managers, the model suggests that quality improvement need not begin exclusively with large infrastructure expenditure. Reliability can first be addressed through timetable

control, dispatch protocols, incident recording and punctuality indicators; responsiveness through information standards, complaint pathways and response-time targets; and security through risk identification, preventive controls, surveillance, coordination and incident-response indicators. Physical deficits remain important, particularly where the ICIS or equivalent structured observations identify poor conditions. The managerial principle is sequencing: distinguish process failures that can be corrected through standardization and accountability from capital-intensive problems that require phased investment, which is especially relevant for public organizations operating under constrained budgets.

Implementation also depends on organizational culture. The qualitative evidence identified leadership, communication, training and resistance to change as central conditions. A technically coherent model can fail if process owners are not empowered, indicators are not reviewed or staff perceive the system as additional bureaucracy and not as a mechanism for service improvement.

9 Limitations and future research

The study is based on one interprovincial terminal, so external validity depends on replication across terminals with different governance, demand and infrastructure conditions. Passenger recruitment was non-probabilistic; the sample-size calculation should not be interpreted as probability-sampling representativeness, and future studies should use probability-based or carefully stratified designs where feasible. The design is cross-sectional and cannot demonstrate longitudinal improvement or causal effects of the MGCT-T.

The qualitative component relied on one key institutional informant, and the expert panel contained three specialists; the 0.91 index supports design coherence but should not be interpreted as broad Delphi consensus. The importance weights are study-specific and require independent empirical validation; future applications should derive weights from transparent passenger-importance measures, multicriteria methods, derived-importance approaches or other validated procedures. The ICIS is a context-specific index summarizing a qualitative observation and requires further construct, reliability and inter-rater validation before it can be treated as a standardized transferable measure. Financial indicators are scenario projections and not realized outcomes.

The adapted SERVQUAL structure was assessed through internal-consistency estimates, but confirmatory factor analysis and additional construct-validity tests were not reported, and the gap-score approach remains debated relative to performance-only measurement (Cronin & Taylor, 1992). Because item-level data are not part of this manuscript, differences between dimension-level gaps were assessed only descriptively. The literature positioning is narrative, so statements about what existing approaches do not specify are bounded by the literature reviewed and should be tested through a documented systematic search. Finally, the translation matrix and the alignment of Tables 5 and 6 are author-developed and were not tested in operation.

The next scientific stage should be a longitudinal implementation study. Controlled before–after evaluation, interrupted time-series analysis or multi-terminal quasi-experimental designs could test

whether implementation changes punctuality, waiting time, response time, complaint resolution, maintenance compliance, security indicators, infrastructure conditions and repeated passenger perceptions, and could test DP1–DP3 directly. Comparative studies could also contrast the MGCT-T with QFD-based and EN 13816-based approaches and could extend the CDE to unsolicited feedback and automatic operational data.

10 Conclusion

This study addresses a persistent managerial problem in public transport: service-quality diagnosis can identify dissatisfaction without specifying how organizations should convert that evidence into controlled action. We defined this problem as a diagnostic-to-management gap, a failure of realized absorptive capacity, and showed in the Riobamba case why the survey alone cannot close it: expectations exceeded perceptions in all five SERVQUAL dimensions, but by nearly identical amounts. Responsiveness showed the largest direct shortfall, reliability became the leading priority after study-specific weighting, and the set formed by reliability, responsiveness and security was stable under both schemes. Operator and infrastructure evidence indicated that these perceptions were accompanied by concrete operational and physical weaknesses.

On this foundation, the MGCT-T was developed as a closed-loop architecture linking passenger voice, priority setting, process governance and continuous improvement. SERVQUAL detects; priority analysis focuses; five translation rules assign each gap to an ISO 9001 process, an owner and an indicator; ISO 9001 institutionalizes; PDCA checks and corrects; and renewed passenger evidence restarts the cycle. The model has evidence of design coherence and prospective feasibility, but it has not yet demonstrated causal service improvement, and that boundary is central to the scientific claim. The framework should be understood as a design-validated governance model whose next test is longitudinal implementation and cross-terminal replication. For other international contexts the architecture may be transferable, but local weights, performance thresholds, institutional roles and regulatory alignments must be re-established rather than assumed.

Abbreviations

CDE
Continuous Diagnostic Engine (original Spanish acronym MDC,*Motor de Diagnóstico Continuo*)
ICIS
Infrastructure and Services Condition Index
ISO
International Organization for Standardization
MGCT-T
Management Model for Quality in Land Transport Terminals
OTC
Operational Transformation Core (NTO,*Núcleo de Transformación Operativa*)

PDCA
Plan-Do-Check-Act
QMSS
Quality-Management System Structure (SCSGC,*Sistema Circulatorio del Sistema de Gestión de Calidad*)
QFD
quality function deployment
SERVQUAL
service-quality expectation–perception measurement framework.

Declarations

Author Contribution

M.S.S. Sconceived and designed the study, developed the methodological framework and the integrated SERVQUAL–ISO 9001–PDCA management model, conducted the data analysis and interpretation, and drafted the original manuscript. M.F.H.C. contributed to the methodological review, interpretation of the results, and critical revision of the manuscript. E.F.S.CH contributed to the analysis and discussion of the results, preparation and review of the manuscript, and academic validation of its content. M.A.F. contributed to the literature review, interpretation of the findings, and critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript.

Data Availability

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

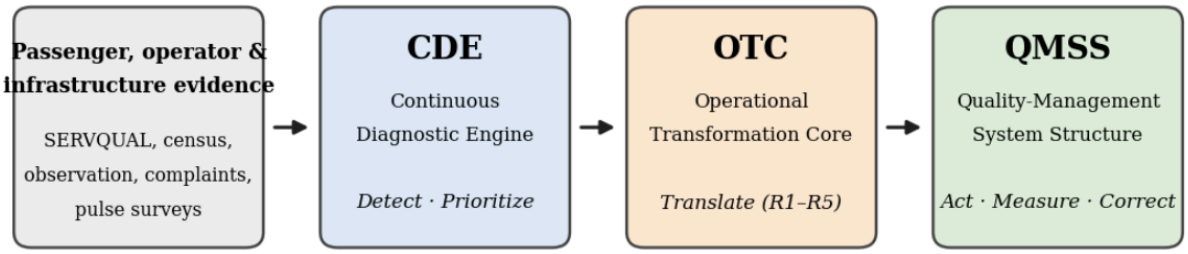
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Figures



Absorptive capacity	External knowledge inflow	Acquisition and assimilation (potential)	Transformation	Exploitation (realized)
ISO 9001:2015 clauses	—	4.1, 9.1.2, 9.1.3	5.3, 6.1, 6.2, 7.x	8.1, 8.5.1, 9.1, 9.3, 10.2, 10.3
PDCA phase	—	Plan	Plan / Do	Do / Check / Act
Provider gap (PZB, 1985)	Gap 5 (customer gap)	Gap 1 (knowledge)	Gap 2 (standards)	Gaps 3–4 (delivery, communication)

Learn: renewed passenger evidence restarts the cycle (closed loop)

Figure 1

The MGCT-T as a voice-to-process translation mechanism

Note. CDE = Continuous Diagnostic Engine; OTC = Operational Transformation Core; QMSS = Quality-Management System Structure; PZB = Parasuraman, Zeithaml and Berry. The mapping to absorptive-capacity stages, ISO 9001:2015 clauses and provider gaps is an author-developed conceptual alignment.