

Mapping ISO 9001:2015 Compliance in Ecuadorian SMEs: An HJ-Biplot and Cluster Analysis

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ABSTRACT

Purpose: This study aims to quantify clause-level compliance and profile the types of organisations that drive this disparity.

Methodology/Approach: A structured questionnaire validated by certified auditors (Cronbach's $\alpha = 0.83$) was administered to 291 commercial, industrial, and service SMEs in Ecuador. The instrument covers all twelve ISO 9001 clause families. An HJ-Biplot analysis retained 70.1% of the total variance, and a k-means clustering approach, optimised using the Calinski–Harabasz index, segmented firms based on quality-management maturity level.

Findings: Three organisational strata emerged. High adherence was observed in Document Control, Product/Service Requirements, and Continuous Improvement, while Resource Procurement showed high uncertainty. Sector, legal structure, and foreign ownership were significant predictors of cluster membership.

Research Limitation/Implication: This study employed a cross-sectional design, which may not capture temporal improvements.

Originality/Value of paper: Beyond certification status, the findings highlight the importance of internalising leadership and planning clauses to achieve substantive quality gains. This study identifies key policy levers—training subsidies, soft credit lines, and best-practice diffusion—that can strengthen SME competitiveness in emerging markets.

Category: Research papers

Keywords: ISO 9001:2015; Ecuador; HJ-Biplot; quality-management compliance; supply-chain readiness

Research Areas: Quality Management; Strategic Quality Management

1 INTRODUCTION

ISO 9001:2015 has become the de facto passport to high-value supply chains and export markets, and its adoption is increasingly framed as strategic for small and medium-sized enterprises (SMEs) seeking to compete beyond local markets (Ben Arab, 2020; Corbett, 2006; Hidalgo Proaño et al., 2018). Nevertheless, certification rates remain uneven: recent surveys locate compliance frequencies between 19 % and 78 % among otherwise comparable SMEs, underscoring pronounced heterogeneity (Chiarini, 2019; Heras-Saizarbitoria and Boiral, 2015; Lazibat et al., 2022; Sfakianaki and Kakouris, 2020).

Despite robust evidence that the standard improves process capabilities, customer confidence, and overall competitiveness, SMEs face persistent structural obstacles. Financial and human resource constraints, perceived administrative burden, and limited access to specialised training frequently delay or derail implementation (Briscoe et al., 2005; Cagnazzo et al., 2010; Lo and Humphreys, 2000; Napitupulu, 2018; Zeng et al., 2007). Comparative studies further highlight top-management commitment, systematic staff development, and deliberate resource allocation as decisive enablers, whereas weaknesses in risk-based thinking and documentation persist (Chiarini, 2017; Chowdhury et al., 2007; Gołaś, 2014; Ledewara and Utami, 2019).

Most empirical work relies on univariate indicators or simple cross-tabulations, which conceal the joint dynamics between ISO clauses and organisational attributes. To date, no published study has employed HJ-Biplot or analogous multivariate mapping to visualise simultaneous relationships between enterprises and the full constellation of ISO 9001 requirements (Frutos-Bernal et al., 2024). The HJ-Biplot, originally formulated by Villardón (1986), preserves joint information on cases and variables in a low-dimensional space, enabling the detection of latent adoption profiles and outlier behaviour.

This study closes the methodological gap by applying the HJ-Biplot to a census of 291 Ecuadorian SMEs across the commercial, industrial, and service sectors. Coupled with k-means clustering, the analysis extracts distinct compliance archetypes and relates them to the sector, ownership, and firm origin. The resulting visual taxonomy provides actionable guidance for policymakers and managers seeking to channel technical assistance and prioritise corrective actions in clauses that are most critical to competitive performance. By mapping clause-level compliance and segmenting organisational profiles through multivariate methods, this study contributes to the evolving agenda of quality innovation and strategic quality management in SMEs, with clear implications for enhancing competitiveness, resource efficiency, and human-centred quality systems in emerging economies.

This study makes two original contributions to the literature on SME quality management. First, it applies HJ-Biplot mapping to clause-level ISO 9001:2015 compliance data—a technique not previously used in this context—to reveal multivariate patterns and latent firm profiles. Second, it introduces a segmentation

framework that links compliance maturity to firm-level characteristics such as sector, legal form, and ownership. These insights expand the current understanding of how structural and contextual factors influence the adoption of quality systems, providing a novel empirical lens for targeted managerial and policy interventions in emerging economies.

2 METHODOLOGY

2.1 Study design

A quantitative, descriptive-correlational study assessed the degree to which Ecuadorian small and medium-sized enterprises (SMEs) comply with ISO 9001:2015 and examined how compliance varies across different economic sectors, legal structures, and firm origins. The investigation was non-experimental and cross-sectional; all data were gathered once, between March 4 and June 30, 2024, with no manipulation of the independent variables (Levin, 2006).

2.2 Population, sampling frame, and rationale for non-probability sampling

The target population consisted of 4,176 SMEs, as recorded by the Superintendencia de Compañías, Valores y Seguros, which had legally pursued ISO certification as of January 1, 2024. A fully probabilistic design was unattainable because Ecuador lacks a national register that combines sector, province, and up-to-date contact information for quality-system staff. Without a complete sampling frame, true random selection would have produced high non-contact rates and sectoral imbalances (Raina, 2014; Taherdoost, 2016; Wolf et al., 2005). To approximate coverage across the main economic regions, membership rosters from the Chambers of Commerce and Industry of Pichincha, Guayas, and Azuay were merged with client lists supplied by two ISO-accredited registrars, yielding 417 reachable firms. All met three eligibility criteria: 10–199 employees, at least three years in operation, and annual sales below USD 5 million. Invitations were extended to every firm on the merged list; 291 completed the questionnaire, a 69.8 % response rate. The final sample contained 124 commercial, 86 industrial, and 81 service firms; 57.0 % were limited-liability companies, 29.2 % corporations, and 13.8 % other legal forms.

2.3 Respondent identification and recruitment

Within each firm, the intended informant was formally responsible for the quality management system. During frame construction, the research team recorded the name, job title, corporate e-mail, and mobile number for one of three roles in order of preference: quality or continuous-improvement manager, operations or production manager, or owner-manager. Initial contact on March 4, 2024, was made by personalised e-mail that explained study goals, confidentiality safeguards, and provided a unique Qualtrics link. Messages that bounced ($n = 83$) triggered WhatsApp text containing the same information and a short URL. Non-respondents received an automated e-mail reminder seven days later and, after a further week, up to three telephone calls at staggered times. When contact was

achieved, the link was resent by SMS. The survey was closed exactly 30 days after the first contact to preserve a cross-sectional design. Among completed questionnaires, 62.2 % arrived via e-mail links, 29.6 % via WhatsApp, and 8.2 % via telephone-assisted Web entry. Token-protected links and IP logging prevent duplicate submission. The median completion time was 18 min.

2.4 Instrument development and validation

A structured questionnaire with multiple-choice items was constructed directly from the 12 clause groups specified in ISO 9001:2015 (International Organisation for Standardisation, 2015). Three certified ISO 9001 lead auditors reviewed the draft, and every item achieved a Content Validity Index of at least 0.83. A pilot test with 30 SMEs that were not in the final sample produced a Cronbach's alpha of 0.83, indicating a high internal consistency (Cronbach, 1951). Minor wording refinements followed this pilot.

2.5 Variables

The primary outcome was clause-level compliance, coded 1 when the firm reported full implementation and zero otherwise. The predictor variables were economic sector (commercial, industrial, or service), legal structure (corporation, limited liability, or other), and firm origin (domestic market or export-oriented).

2.6 Statistical analysis

Analyses were conducted using R 4.3.2. Descriptive statistics summarise clause compliance as percentages disaggregated by sector, legal structure, and origin. Multivariate exploration employed the HJ-Biplot algorithm (Villardón, 1986) through the *MultBiplotR* package; the first two latent dimensions captured 70.1% of the total variance, with 62.1% on axis 1 and 8.0% on axis 2, providing an interpretable two-dimensional map of firms and clause groups. Cluster patterns in that reduced space were detected with the k-means algorithm using squared Euclidean distance, and the Calinski–Harabasz index confirmed that a three-cluster solution maximised between-cluster separation (Macqueen, 1967).

2.7 Ethical considerations

Participation was voluntary and anonymous. Before starting the questionnaire, respondents reviewed an informed consent statement that detailed the study aims, data use restrictions, and confidentiality measures. No personal identification information was stored. The Research Office of Universidad Estatal de Milagro approved the study protocol.

3 RESULTS

3.1 Overall clause-level compliance

Table 1 – Compliance with ISO 9001:2015 across 291 Ecuadorian SMEs

Clause family	No %	Yes %	Maybe %
Organisational Context	1.37	62.89	35.74
Leadership	1.37	44.67	53.95
Planning	0.00	54.64	45.36
Resource Procurement	24.05	0.00	75.95
Resource Management	0.69	32.30	67.01
Document Control	0.69	72.16	27.15
Operational Planning	2.75	60.82	36.08
Product / Service Requirements	1.37	72.85	25.77
Control of External Providers	2.75	56.01	40.89
Production / Service Provision	1.72	58.08	40.21
Performance Evaluation	1.72	49.14	49.14
Improvement	3.09	72.16	24.74

Three compliance strata were visible across the complete sample. The highest stratum comprises document control, product/service requirements, and improvement, where affirmative responses exceed 72 % and indecision is limited to roughly one-quarter of firms, signifying that these processes are largely institutionalised. A middle band of five clauses—Planning, Operational Planning, Control of External Providers, Production / Service Provision and Performance Evaluation—shows mixed implementation, with “Yes” and “Maybe” proportions of 49 to 61 % and 36 to 49 %, respectively. Leadership and Resource Management sit at the margin of this intermediate group, with each drawing more uncertainty than confirmation. Resource Procurement marks the most critical gap: no enterprise claims full conformity, about one company in four openly rejects adequacy, and fully three-quarters remain unsure, underscoring systemic weaknesses in sourcing and capital allocation procedures.

3.2 Compliance by economic sector

Table 2. Compliance with ISO 9001:2015 by sector (Commercial = 124; Industrial = 86; Service = 81)

Clause family	Commercial No / Yes / Maybe	Industrial No / Yes / Maybe	Service No / Yes / Maybe
Organisational Context	2.48 / 55.37 / 42.15	1.01 / 73.74 / 25.25	0.00 / 60.56 / 39.44
Leadership	2.48 / 32.23 / 65.29	1.01 / 61.62 / 37.37	0.00 / 42.25 / 57.75
Planning	0.00 / 42.98 / 57.02	0.00 / 66.67 / 33.33	0.00 / 57.75 / 42.25
Resource Procurement	29.75 / 0.00 / 70.25	17.17 / 0.00 / 82.83	23.94 / 0.00 / 76.06

Clause family	Commercial No / Yes / Maybe	Industrial No / Yes / Maybe	Service No / Yes / Maybe
Resource Management	1.65 / 24.79 / 73.55	0.00 / 42.42 / 57.58	0.00 / 30.99 / 69.01
Document Control	0.83 / 68.60 / 30.58	0.00 / 77.78 / 22.22	1.41 / 70.42 / 28.17
Operational Planning	4.17 / 55.83 / 40.00	3.03 / 65.66 / 31.31	0.00 / 63.38 / 36.62
Product / Service Requirements	2.48 / 64.46 / 33.06	1.01 / 77.78 / 21.21	0.00 / 80.28 / 19.72
Control of External Providers	5.00 / 52.50 / 42.50	2.02 / 65.11 / 33.39	0.00 / 56.34 / 43.66
Production / Service Provision	2.48 / 50.41 / 47.11	1.01 / 69.70 / 29.29	1.41 / 54.93 / 43.66
Performance Evaluation	3.31 / 47.11 / 49.59	1.01 / 54.55 / 44.44	0.00 / 45.07 / 54.93
Improvement	5.79 / 66.94 / 27.27	2.02 / 76.77 / 21.21	0.00 / 74.65 / 25.35

Industrial firms register with the most advanced quality systems. Their average affirmative rate across all clauses is 61 %, well above that of service firms at 53 % and commercial firms at 47 %. Industrial enterprises lead or share the lead in ten clauses; their highest scores, 78 % for both product/service requirements and document control, reflect systematic control from design to delivery. Service firms equal or exceed industrial performance on external, customer-oriented clauses, most notably an 80 % “Yes” on Product / Service Requirements, but display weaker internal monitoring, with Performance Evaluation showing 55 % indecision. Commercial firms exhibit the highest overall uncertainty: Leadership and Resource Procurement both attract about two-thirds “Maybe,” and affirmative responses on Organisational Context trail those of industrial peers by nearly 20 percentage points. Notably, zero companies in any sector affirmed full compliance with Resource Procurement, highlighting a pervasive supply-side shortfall.

3.3 Compliance by legal structure

Table 3 – Compliance with ISO 9001:2015 by organisation type (Family = 92; Corporation = 99; Limited = 90)

Clause family	Family No / Yes / Maybe	Corporation No / Yes / Maybe	Limited No / Yes / Maybe
Organisational Context	0.00 / 65.22 / 34.78	2.01 / 60.30 / 37.69	0.00 / 73.33 / 26.67
Leadership	0.00 / 36.96 / 63.04	2.01 / 46.23 / 51.76	0.00 / 44.44 / 55.56
Planning	0.00 / 56.52 / 43.48	0.00 / 51.76 / 48.24	0.00 / 64.44 / 35.56
Resource Procurement	26.09 / 0.00 / 73.91	23.62 / 0.00 / 76.38	24.44 / 0.00 / 75.56
Resource Management	0.00 / 30.43 / 69.57	1.01 / 33.67 / 65.33	0.00 / 28.89 / 71.11
Document Control	0.00 / 76.09 / 23.91	1.01 / 69.85 / 29.15	0.00 / 80.00 / 20.00
Operational Planning	2.17 / 52.17 / 45.65	3.54 / 63.64 / 32.83	0.00 / 60.00 / 40.00
Product / Service Requirements	0.00 / 73.91 / 26.09	2.01 / 70.35 / 27.64	0.00 / 84.44 / 15.56
Control of External Providers	0.00 / 71.74 / 28.26	4.04 / 37.33 / 58.63	0.00 / 60.00 / 40.00
Production / Service Provision	0.00 / 39.13 / 60.87	2.01 / 60.30 / 37.69	2.22 / 68.89 / 28.89

Clause family	Family	Corporation	Limited
	No / Yes / Maybe	No / Yes / Maybe	No / Yes / Maybe
Performance Evaluation	0.00 / 36.96 / 63.04	2.51 / 51.76 / 45.73	0.00 / 51.11 / 48.89
Improvement	2.17 / 78.26 / 19.57	4.02 / 69.35 / 26.63	0.00 / 80.00 / 20.00

The legal structure also differentiates adoption intensity. Limited-liability companies average 58 % “Yes” across clauses, surpassing family enterprises and corporations, both of which average nearly 51 %. Limited firms cross the 80 % threshold on product/service requirements, document control, and improvement, and record the lowest average uncertainty of 40 %. Family businesses exhibit a comparable profile on customer-facing and documentation clauses but remain markedly indecisive about Resource Procurement and Performance Evaluation, where “Maybe” responses exceed 63 %. Corporations show the widest spread between clauses: they are confident in Operational Planning, with 64 % affirmatives, but particularly unsure about Control of External Providers, where nearly 59 % of respondents select “Maybe.” In every ownership group, Resource Procurement continues to be unresolved, reinforcing its status as the least consolidated component of ISO 9001 implementation among the surveyed SMEs.

3.4 Multivariate map and cluster composition

Figure 5 plots the 291 firms and the twelve ISO-9001 indicators in a two-dimensional HJ-Biplot that preserves 70.1 % of the total inertia (Axis 1 = 62.15 %, Axis 2 = 7.95 %). Vectors radiating from the origin represent clause families; their tight bundle and small inter-vector angles indicate that improvements in one requirement tend to accompany progress in the others, consistent with the integrated design of the standard. The longest vectors correspond to Product / Service Requirements, Leadership and Organisational Context, confirming that these clauses contribute most strongly to the composite gradient on Axis 1, whereas Performance Evaluation and Control of External Providers exhibit additional leverage on Axis 2.

K-means segmentation of the factorial scores partitions the SMEs into three nonoverlapping clusters that occupy distinct regions of the plane. Cluster 2 (red, 23 firms, 7.9 % of the sample) stretches along the positive side of Axis 1; its position coincides with the heads of ten clause vectors, signaling the highest overall compliance in resource management, operational planning, support, Production / Service provision, organizational context, improvement, Product / Service requirements, leadership, planning, and document control. Cluster 1 (green, 112 firms, 38.5 %) lies mainly above the origin with positive Axis 2 scores and a moderate Axis 1 value. Members of this group align most closely with the vectors for Performance Evaluation and Control of External Providers, implying strength in monitoring and supplier oversight, but comparatively weaker scores for the remaining clauses situated nearer the origin. Cluster 3 (blue, 156 firms, 53.6 %) forms a dense cloud on the negative half of Axis 1 and near-zero Axis 2, placing

it opposite Cluster 2 and far from the vector endpoints; firms in this segment show the lowest mean scores on all 12 indicators.

The geometric separation of the three polygons confirms that the within-cluster variability is small relative to the between-cluster distances, thus validating the stability of the segmentation. Centroid coordinates follow the overall clause hierarchy observed in the univariate tables: Cluster 2 leads to every requirement except Performance Evaluation and Control, where Cluster 1 holds marginal advantages; Cluster 3 consistently lags behind both counterparts, especially on resource procurement, document control, and product/service requirements.

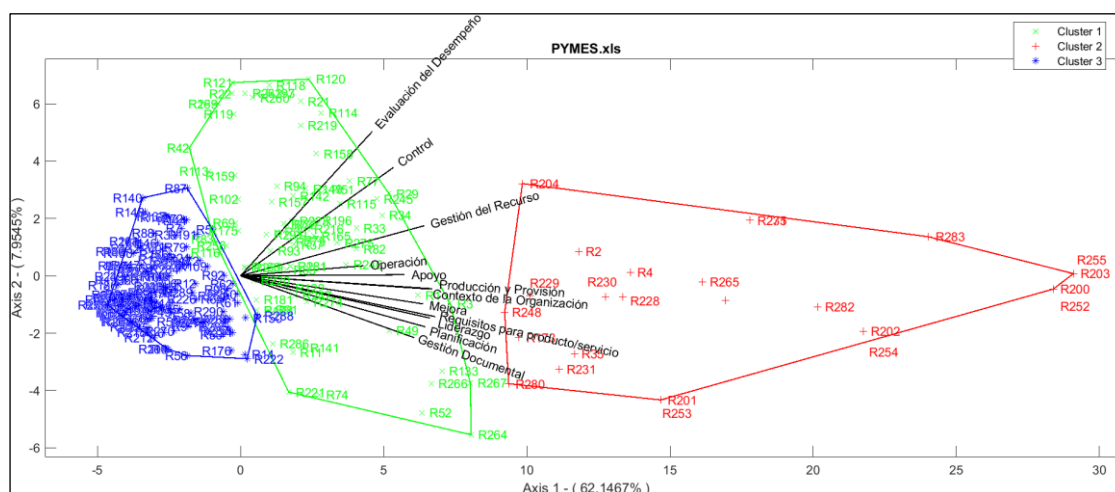


Figure 1 – HJ-Biplot representation of Ecuadorian SMEs

4 DISCUSSION

Ecuadorian SMEs exhibit a three-tier compliance pattern with ISO 9001:2015. At the top tier, clauses on document control, product-service requirements, and continuous improvement reach approximately 72 % adherence; the middle tier covers leadership and planning, where commitment is solid but not uniform; the bottom tier is resource acquisition, where no firm reports full compliance, and 76 % remains uncertain. The sector, governance, and origin sharpen these contrasts: industrial firms and limited-liability companies lead to nearly every clause, commercial firms and family businesses lag in resourcing, and foreign-owned enterprises outperform domestic ones in the organisational context and documentation. HJ-Biplot mapping further distinguishes a high-maturity cluster that already translates ISO routines into logistical efficiency from the two clusters hampered chiefly by leadership gaps and capital constraints (Zimon et al., 2018).

This study confirms that document control, product-service requirements, and continuous-improvement clauses are the most fully institutionalised elements, each exceeding 72 % compliance. Similar clause-level strengths have been reported in Polish and Slovak textile supply chains, where rigorous documentation has shortened order cycle times and reduced defect rates (Zimon et al., 2018). International meta-analyses likewise identify these domains as “early wins”

because they formalise routines already familiar to many managers (Psomas and Fotopoulos, 2009). In contrast, resource-acquisition procedures exhibited the weakest scores and highest uncertainty, echoing evidence that financial and human capital constraints remain the principal barriers for small firms in Latin America (Boiral and Amara, 2009) and Southeast Asia. This pattern suggests that while SMEs can codify existing processes with limited outlay, relocating capital toward preventive quality activities still poses a challenge.

Sectoral comparisons reinforce this interpretation. Industrial SMEs outperform commercial peers in every clause except leadership, mirroring Indonesian data in which market pressure and supply chain audits spur earlier adoption of international standards (Corbett et al., 2005). In Gauteng Province, South Africa, Magodi et al. (2022) also found that leadership commitment and earmarked budgets were decisive in sustaining certification benefits beyond the initial audit. Conversely, many commercial firms in the present sample reported ambivalence toward leadership and resource allocation clauses. Earlier work in Ecuador's Cotopaxi province attributes this hesitation to the perception that local INEN norms yield sufficient legitimacy for domestic markets, making ISO certification appear cost-inefficient (Mejía-Sulca et al., 2023).

Organisational form provides another explanatory lens. Limited-liability companies displayed the highest compliance with documentation (80 %) and product-service requirements (84 %), lending credence to the argument that formal governance structures accelerate the routinization of quality procedures and facilitate intergenerational knowledge transfer in family-owned businesses (Corbett et al., 2005). Nevertheless, these same firms expressed notable uncertainty about resource acquisition, an observation consistent with Jungwatt's caution that family SMEs often lack the liquidity and specialised staff needed to operationalise risk-based thinking.

Firm origin also matters. Foreign-owned SMEs achieved near-ceiling scores for organisational context (93.6%) and document control (90.3%), paralleling evidence from the Dominican construction sector, where multinational subsidiaries were several times more likely than domestic firms to adopt ISO 9001 (Ahmed et al., 2008). These firms typically view certification as a non-negotiable entry ticket to global supply chains, whereas local enterprises may underestimate their strategic value until the competitive pressure intensifies.

The HJ-Biplot segmentation enriched clause-by-clause analysis by revealing three distinct compliance archetypes. The best-performing cluster aligned closely with the "high-maturity" profile described by Zimon et al. (2018); firms in this group had already leveraged ISO routines to optimise inbound logistics and production scheduling, thereby lowering rework and stock-out rates. In contrast, the weakest cluster lagged on leadership and resource-related clauses, underscoring the need for targeted managerial training and financial incentives.

The findings offer clear theoretical contributions by reinforcing the idea that ISO 9001 implementation is not monolithic, but clause-dependent, with distinct

adoption pathways shaped by organisational form and sectoral positioning. By mapping clause-level maturity against firm characteristics, this study provides an empirical basis for refining quality management theory for SMEs in emerging contexts.

Practically, the results allow policymakers and quality managers to move beyond certification as a binary target and instead focus on the internalisation of key clauses, especially those related to leadership, planning, and resource acquisition. The identified firm clusters can serve as diagnostic profiles to guide tailored support strategies, including targeted training, sector-specific audits, and incentives for quality investments in lagging groups.

This study has several limitations. First, the non-probability sample, while extensive, restricts statistical generalisation beyond participating chambers and registrars. Second, compliance was self-reported rather than verified through third-party audits; therefore, social desirability bias may inflate adherence estimates. Third, the cross-sectional design precludes causal inferences regarding how compliance trajectories evolve over time. Finally, the study did not quantify the economic returns to certification, leaving open the question of cost–benefit ratios for resource-constrained firms.

Despite these caveats, this study has some actionable implications. Policymakers could subsidise training programmes that demystify resource planning and risk management clauses, particularly for commercial SMEs operating outside export-oriented supply chains. Industry associations might disseminate case studies from high-performing clusters to illustrate incremental pathways toward full compliance. Scholars should extend the present work through longitudinal designs that track postcertification performance and triangulate survey responses with audit records. Comparative analyses across Andean countries can also clarify the role of institutional environments in shaping adoption patterns.

In sum, the results consolidate the position of ISO 9001 as a foundational tool for professionalising quality practices in Ecuadorian SMEs, while highlighting clause-specific bottlenecks that constrain its transformative potential. Addressing these gaps through coordinated managerial and policy interventions could unlock the full spectrum of efficiency and market access benefits documented in international literature.

5 CONCLUSION

Through the combined use of HJ-Biplot and K-means clustering, this study identifies that Ecuadorian SMEs follow a pattern of compliance with ISO 9001:2015, segmented into three levels. At the top level, industrial companies, especially those with formal structures and foreign capital, form a highly mature cluster that has managed to institutionalise documentary controls, product-service requirements, and continuous improvement as operational practices.

One of the most notable achievements is the high degree of compliance in clauses related to the control of documented information. With an average adherence rate of over 90% in some segments, this aspect has been consolidated as a well-understood and standardised organisational practice. The implementation of systematic controls over documents, such as quality manuals, procedures, and records, has enabled many companies to establish more efficient traceability and ensure consistency in their operations. Significant progress has also been made in product and service requirements, where compliance has reached levels of over 70%. Companies have managed to align their processes with customer expectations and establish clear criteria for quality, inspection, and delivery. This progress translates into greater operational reliability and perceived improvement in customer experience, constituting a tangible competitive advantage. The second intermediate cluster presents considerable progress but shows gaps in leadership and strategic planning, which prevent systematic implementation. Finally, a lagging cluster dominated by commercial, family, and service companies shows significant difficulties in resource acquisition, talent development, and application of the risk-based approach, reflecting its human and financial capital constraints.

The results confirm that ISO 9001 certification alone does not guarantee competitiveness, but depends on the effective internalisation of quality management principles, which are conditioned by structural and organisational factors. Among the most representative problems identified are low compliance with the resource acquisition clause, persistent weaknesses in leadership, inequalities according to type of company, sector, and origin of capital, scarcity of technical training and public incentives, underestimation of the strategic value of certification in certain segments, and methodological limitations of the study that reflect broader institutional barriers.

These findings suggest that organisational policy instruments should go beyond the generic promotion of standards and focus on targeted and differentiated interventions.

Therefore, it is recommended that the design of specific grants for leadership and resource management training, the provision of sectoral technical assistance, the creation of credit lines with a focus on quality, and the dissemination of success stories from the high-maturity cluster be benchmarks for organisational transformation.

Despite the limitations of non-probabilistic sampling, the self-reported nature of the data, and the cross-sectional design, this research provides a useful empirical basis for longitudinal audits and cost-benefit studies, allowing for a more accurate assessment of the sustained impact of ISO 9001 on SMEs in emerging markets, such as Ecuador.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest. The funders had no role in the design of the study, the collection, analysis, or interpretation of data, the writing of the manuscript, or the decision to publish the results.



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