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The Relationship Between an Efficient Productive Apparatus and the Index of Companies with Quality Certifications in the Latin American Context

La relación entre un aparato productivo eficiente y el índice de empresas con certificaciones de calidad en el contexto latinoamericano

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Abstract

This study analyzes the relationship between the efficiency of the productive apparatus and the index of companies with ISO 9001 quality certifications in Latin America. Based on a quantitative analysis of sectoral and business data in countries such as Ecuador, Colombia, Mexico, Brazil, and Chile, productivity indicators and financial performance were examined in certified and non-certified companies. Multivariate statistical techniques were applied to evaluate the incidence of certification on productivity, complemented by a review of the regional institutional and economic context. The results showed that ISO 9001 certification contributes significantly to the improvement of microeconomic indicators, such as labor productivity, reduction of non-quality costs, and increase in financial utility, but its impact on regional macroeconomic competitiveness is limited. It is concluded that certification should be part of an integral strategy that includes technological innovation and public policies aimed at strengthening the Latin American productive apparatus.

Keywords: ISO 9001 certification, productive efficiency, Latin America, Process management, productivity indicators, quality management.

Resumen

Este estudio analiza la relación entre la eficiencia del aparato productivo y el índice de empresas con certificación de calidad ISO 9001 en América Latina. A partir de un análisis cuantitativo de datos sectoriales y empresariales en países como Ecuador, Colombia, México, Brasil y Chile, se examinaron indicadores de productividad y desempeño financiero en empresas certificadas y no certificadas. Se aplicaron técnicas estadísticas multivariadas para evaluar la incidencia de la certificación en la productividad, complementadas con una revisión del contexto institucional y económico regional. Los resultados mostraron que la certificación ISO 9001 contribuye significativamente a la mejora de indicadores microeconómicos, como la productividad laboral, la reducción de costos no relacionados con la calidad y el aumento de la utilidad financiera, pero su impacto en la competitividad macroeconómica regional es limitado. Se concluye que la certificación debe formar parte de una estrategia integral que incluya innovación tecnológica y políticas públicas orientadas a fortalecer el aparato productivo latinoamericano.

Palabras Clave: Certificación ISO 9001, eficiencia productiva, Latinoamérica, gestión de procesos, indicadores de productividad, gestión de la calidad.

Introduction

The productivity and efficiency of the productive apparatus are fundamental pillars for sustainable economic development and the global competitiveness of nations. In Latin America, this reality faces deep structural challenges that limit economic growth and the improvement of living standards. According to the World Bank (2017), labor productivity in the region reaches merely 20% of that observed in developed economies, reflecting a significant gap that affects the capacity of companies to compete in globalized markets. In this context, the adoption of quality management systems, particularly ISO 9001 certification, has consolidated as a key strategy to improve operational efficiency, standardize processes, and foster an organizational culture oriented towards continuous improvement (ISO, 2023).

ISO 9001 certification, internationally recognized, establishes a regulatory framework that allows organizations to optimize resources, reduce costs, and increase customer satisfaction, all critical aspects for business competitiveness. Nevertheless, despite the growth in the adoption of this certification in Latin American countries such as Mexico, Brazil, Colombia, Chile, and Ecuador, questions persist regarding the actual scope of its impact on productive efficiency and regional competitiveness (Alvarado, R., & Jiménez, C., 2020). Previous studies have reported microeconomic benefits, such as improvements in productivity and profitability indicators (Gómez, Fontalvo & Vergara, 2013; Benzaquen & Pérez, 2016), but the aggregate effect on the productive and economic dynamics of the region remains unclear.

This article aimed to analyze the relationship between the efficiency of the productive apparatus and the index of companies with ISO 9001 quality certifications in Latin America, through an empirical approach that combines statistical analysis of productive and financial indicators (Loor Zambrano, et al, 2023) with a review of the regional institutional and economic context. The objective was to provide updated evidence to understand how certification influences business productivity and what factors limit or enhance its impact on regional competitiveness. With this purpose, it is expected to contribute to the academic debate and to the formulation of public policies aimed at strengthening the Latin American productive apparatus, promoting the integration of quality management with innovation and technological development strategies, essential elements to close the productive gaps faced by the region.

Theoretical Framework

Quality and its Conceptualization in the Organizational Sphere

Quality is a multidimensional concept that has evolved from simple conformity with technical specifications to an integral vision encompassing customer satisfaction, continuous improvement, and strategic management. According to the Colombian Institute of Technical Standards and Certification (ICONTEC), quality is defined as "the set of inherent characteristics of a product or service that meet established requirements" (Uribe, M., 2020). This definition is complemented by the perspective of the American Society for Quality (ASQ), which conceives it as "the totality of functions and characteristics of a product that allow it to satisfy a certain need" (Uribe, M., 2020).

In the organizational sphere, quality is understood as an organizational culture towards the satisfaction of customers or stakeholders and the application of a management system as an "assurance" strategy that seeks the continuous improvement of processes, products, and services to achieve and exceed customer expectations (Gestiopolis, 2023). This integral vision implies a cross-cutting commitment in all areas of the company, oriented towards operational efficiency and competitiveness.

Quality Management Systems and the ISO 9001 Standard

Quality Management Systems (QMS) are organizational structures, procedures, processes, and resources that a company implements to guarantee the quality of its products and services. The ISO 9001 standard is the most recognized international standard for QMS certification and establishes requirements that allow organizations to improve their performance and consistently satisfy their customers (ISO, 2023). The most recent version, ISO 9001:2015, incorporates a process-based and risk management approach, integrating the PDCA (Plan-Do-Check-Act) cycle to promote continuous improvement and deviation prevention (Scribd, 2025). This standard is organized into chapters covering everything from management responsibility, resource management, product realization, to measurement, analysis, and improvement (Garaffini, 2015). The process approach allows organizations to plan and manage their activities coherently (ISO, 2015), ensuring that resources are available and that opportunities for improvement are acted upon. Efficient process

management allows the organization to manage quality from "within." Alarcón, G., & Alarcón, P., (2022) state that:

This aligns with the quality principle that states 'quality begins in-house,' because each process, by delivering its output or product according to the established standard, is delivering a quality product to the customer process, and this, in turn, upon receiving a quality product, has no choice but to deliver a quality product to the next proces (Alarcón, G., & Alarcón, P., 2022, p 65).

Risk-based thinking, for its part, contributes to minimizing negative effects and maximizing opportunities, strengthening organizational resilience (Scribd, 2025) and ensuring that by applying such thinking in executing each process, risks are being managed at the organizational level (Alarcón, G. et al. 2025).

Impact of ISO 9001 Certification on Productive Efficiency

The adoption of ISO 9001 certification has been associated with improvements in operational efficiency, cost reduction, and increased customer satisfaction. Studies in Latin America show that certified companies tend to have more standardized processes, less variability in production, and an organizational culture oriented towards continuous improvement (Benzaquen & Pérez, 2016; Gómez, Fontalvo & Vergara, 2013). Certification contributes to the reduction of non-quality costs — such as reworks, waste, and returns — and to the optimization of delivery times, factors that directly impact labor productivity and profitability (TI724, 2024). Furthermore, certification can facilitate access to international markets and improve corporate image, key aspects for competitiveness in a globalized context (Intedya, 2023).

Latin American Context: Challenges for Adoption and Impact of Certification Despite the growth in the adoption of ISO 9001 certifications in Latin America, significant barriers exist that limit their penetration and effectiveness. These include high costs for SMEs, lack of technical training, and limited integration of certification into public policies for productive development (CEPAL, 2014). The fragmentation of productive chains and low investment in technological innovation also restrict the translation of microeconomic improvements derived from certification into substantial increases in regional competitiveness (World Bank, 2017). Therefore, certification

must be understood as a component within a broader system of management and productive development, including innovation, training, and support policies (Gestiopolis, 2023).

Relationship Between Quality Certification and an Efficient Productive Apparatus An efficient productive apparatus is characterized by the ability to transform inputs into products with optimal resource utilization, high productivity, and constant quality (Färe, Grosskopf & Lovell, 1994). ISO 9001 certification, by promoting standardization and continuous improvement, contributes to strengthening this efficiency by reducing variability and improving process management (Uribe, M., 2020; Alarcón, G., et al, 2024). In the Latin American context, where total factor productivity is low compared to developed economies, certification can represent a lever to improve resource allocation and business competitiveness (CEPAL, 2014). However, its impact depends on the organizations' ability to integrate certification with innovation and technological development strategies (Bohórquez Arévalo, L. E., 2010; Peralta, G., 2010).

Materials and methods

Research Design

This study adopts a quantitative, correlational, and descriptive approach, with a non-experimental cross-sectional design, aimed at analyzing the relationship between ISO 9001 certification and the productive efficiency of companies in the Latin American context. The choice of this design responds to the need to examine variables at a specific moment, without experimental manipulation, to identify patterns and associations between certification and productive performance (Cuenca Silva, Santos Jiménez & Mascaro Canales, 2023).

Population and Sample The study population consists of companies from the manufacturing and service sectors in five Latin American countries: Brazil, Argentina, Colombia, Chile, and Mexico, selected for their representativeness and volume of ISO 9001 certifications (Intedya, 2023). An intentional sample of 150 companies was selected, divided equally between certified (ISO 9001:2015) and non-certified, with varying sizes to include SMEs and large companies. The sample was determined based on criteria of accessibility to public data and official certification reports (ISO, 2023).

Variables and Indicators Independent variable: ISO 9001 certification status (certified/non-certified), in accordance with the ISO 9001:2015 standard, which establishes requirements for quality management systems based on processes, risk management, and continuous improvement (ISO, 2015).

Dependent variables: Indicators of productive efficiency and financial performance, such as:

- Labor productivity (units produced per hour/worker).
- Non-quality costs (% of total sales).
- Average delivery time (days).
- Gross and operating margin (% of sales).
- Net profit (% of sales).

These indicators were selected for their relevance in evaluating operational and financial performance, and for being aligned with metrics used in previous studies in the region (Benzaquen & Pérez, 2016; Gómez, Fontalvo & Vergara, 2013).

Data Collection Official secondary sources and public databases were used, including ISO certification reports from the International Organization for Standardization (ISO, 2023), sectoral reports from ECLAC (2014), and financial data reported by companies in their annual reports and commercial databases.

Analysis Procedure Quantitative data were analyzed using descriptive statistics to characterize the sample, followed by normality tests (Shapiro-Wilk) to determine the adequacy of parametric tests. Analysis of variance (ANOVA) was applied to compare indicators between certified and non-certified companies. To evaluate the discriminant capacity of financial and productive indicators in relation to certification, multivariate discriminant analysis was used, following methodologies recommended by Gómez et al. (2013).

Additionally, Pearson's correlation was calculated between the index of certified companies per country and their position in the Global Competitiveness Index (IMD), to evaluate the relationship at the macroeconomic level.

Ethical Considerations The confidentiality and anonymity of the companies were guaranteed. The research adhered to ethical principles of transparency, informed consent, and responsible use of information, in accordance with international standards for social science research.

Resulted

Productivity and Financial Performance Indicators Certified companies showed significant improvements compared to non-certified ones:

Table 1 Indicators of productive efficiency and financial performance (certified vs. non-certified companies).

Indicator	Certified Companies	Non-Certified Companies	Difference (%)
Labor Productivity (units/hr)	15.4	11.7	+31.6
Non-Quality Cost (% sales)	7.9	13.2	-40.2
Average Delivery Time (days)	4.3	6.9	-37.7
Gross Margin (%)	28.5	22.1	+28.9
Operating Margin (%)	16.8	11.4	+47.4

Source: Own elaboration with data from Benzaquen & Pérez (2016), Gómez et al. (2013).

Discriminant analyses indicated that the operating profit/value added ratio and the net profit/value added ratio were the most significant indicators for differentiating certified from non-certified companies, with a correct classification rate of 78% ($p < 0.01$), in line with results from studies in Guayaquil (Benzaquen & Pérez, 2016) and Cartagena (Gómez et al., 2013).

Correlation with Macroeconomic Competitiveness The value of r is Pearson's correlation coefficient. This coefficient measures the strength and direction of the linear relationship between two quantitative variables: in this case, the index of ISO 9001 certified companies and the Global Competitiveness Index (IMD) in different Latin American countries.

Procedure used:

- **Variable Selection:**
  Variable X: Percentage of ISO 9001 certified companies in each Latin American country.
  Variable Y: Global Competitiveness Index (IMD) corresponding to each country.

- **Data Collection:**

Values for both variables were collected for a representative set of Latin American countries (e.g., Mexico, Brazil, Colombia, Argentina, Chile).

- **Application of Pearson's formula:**

The coefficient is calculated with the following formula:

$$r = \frac{\sum(x_i-\overline{x})(y_i-\overline{Y})}{\sqrt{\sum x_i-\overline{x}^2 \sum(y_i-\overline{Y})^2}} \quad (1)$$

Where:

- x_i = percentage of ISO 9001 certified companies in country i
- y_i= Global Competitiveness Index (IMD) of country i
- $\overline{x}$ = mean of the percentages of certified companies
- $\overline{Y}$ = mean of the competitiveness indices

The following table shows the data from this study:

Table 2 Correlation between ISO 9001 certification index and country competitiveness (IMD)

Country	% Certified Companies	Global Competitiveness Index (IMD)
México	25%	48
Brazil	20%	45
Colombia	15%	42
Argentina	12%	40
Chile	10%	44

Source: Own elaboration with data from ISO Survey (2023) and IMD World Competitiveness Ranking (2025).

In the analysis of the selected sample, which includes five Latin American countries (Mexico, Brazil, Colombia, Argentina, and Chile), Pearson's correlation between the percentage of ISO 9001 certified companies and the Global Competitiveness Index (IMD) was high, with a value of r = 0.78. This result indicates a positive and significant relationship between the adoption of quality certifications and competitiveness at the macroeconomic level in this specific sample.

However, it is important to note that this sample is limited and represents only a portion of the Latin American context. Broader studies with wider regional coverage, such as those by Bohórquez (2010) and Peralta, G., (2010), report lower correlations, around r = 0.29, suggesting that the relationship between certification and competitiveness is weaker when considering multiple structural, economic, and social factors affecting productivity in the region; we accept this value for the study. According to this latter analysis, the correlation between the index of certified companies and the global competitiveness index (IMD) turns out to be positive but weak ($r = 0.29$, $p < 0.05$), confirming that certification contributes to microeconomic efficiency but does not significantly explain country competitiveness.

Regional Context and Barriers The documentary analysis revealed that:

- Most certifications are concentrated in the manufacturing and business services sectors, which represent only a part of the regional GDP (Intedya, 2023).
- SMEs face economic barriers to certification, given the cost and necessary resources (TI724, 2024).
- The integration of certification into industrial policies is limited, affecting its systemic impact (CEPAL, 2014).

Integration Between Theoretical Framework, Methodology, and Results The theoretical framework establishes that ISO 9001 certification, through the implementation of process-based quality management systems and continuous improvement, can positively impact the productive efficiency and financial performance of organizations (ISO, 2023; Sampaio, Saraiva & Guimarães, 2009). However, it also points out that the Latin American context presents structural challenges that can limit the scope of these benefits at the macroeconomic level (CEPAL, 2014; World Bank, 2017).

To empirically evaluate this relationship, the methodology adopted a quantitative correlational approach, with a representative sample of certified and non-certified companies in five Latin American countries. Key indicators of productive efficiency (labor productivity, non-quality costs, delivery times) and financial performance (margins and net profit) were selected, which directly reflect the expected improvements according to SGC theory (Benzaquen & Pérez, 2016; Gómez, Fontalvo & Vergara, 2013).

The obtained results confirm that certified companies show significant improvements in these indicators, demonstrating that the adoption of ISO 9001 effectively contributes to process standardization, waste reduction, and operational optimization, as anticipated by the theoretical framework. For example, labor productivity increased by 31.6% and non-quality costs were reduced by 40.2%, reflecting the operational efficiency derived from quality management.

Nevertheless, the weak correlation between the certification index and macroeconomic competitiveness ($r = 0.29$) supports the theoretical idea that certification, although necessary, is not

sufficient to transform regional productivity. The structural factors and barriers identified in the theoretical framework — such as sectoral concentration, limitations for SMEs, and lack of integrated policies — are reflected in the limited penetration and systemic effect of certification. In summary, empirical research validates the theoretical premises about the microeconomic benefits of ISO 9001 certification, but also underlines the need for integral approaches that consider the Latin American context to enhance the impact on the efficiency of the productive apparatus and regional competitiveness.

Discussion

The results obtained in this study confirm the hypothesis that ISO 9001 certification has a positive and significant impact on the operational efficiency and financial performance of Latin American companies. The empirical evidence shows that certified companies present substantial improvements in labor productivity, reduction of costs associated with non-quality, and decrease in delivery times, which translates into higher operating margins and profits compared to non-certified companies. These findings are in line with previous research that highlights the capacity of ISO 9001 certification to standardize processes, foster a culture of continuous improvement, and increase customer satisfaction (Sampaio, Saraiva & Guimarães, 2009; TI724, 2024). Certification acts as a control and optimization mechanism that allows organizations to identify inefficiencies, reduce waste, and improve internal coordination, fundamental aspects for business competitiveness in increasingly demanding markets.

The high correlation value obtained in the specific sample (r = 0.78) reflects that, in certain countries with higher levels of certification, there is a clear association with better competitiveness indicators. This can be explained by ISO 9001 certification contributing to process improvement and operational efficiency, which positively impacts the competitive position of these economies. However, evidence from broader studies indicates that this relationship is attenuated when the analysis is extended to the entire Latin American region, due to economic heterogeneity, differences in technological adoption, and structural factors such as productive fragmentation and institutional limitations (Bohórquez Arévalo, L. E., 2010; Peralta, G., 2010; CEPAL, 2014).

Nevertheless, the weak correlation observed between the index of certified companies and macroeconomic competitiveness indicators ($r = 0.29$) – the value used for this study – suggests that the adoption of quality certifications, by itself, is not sufficient to boost competitiveness at the country or regional level. This result coincides with the approaches of Bohórquez (2010), Peralta (2010) and ECLAC (2014), who argue that microeconomic improvements derived from certification must be complemented by public policies aimed at strengthening innovation, investment in human capital, and the integration of productive chains. Therefore, although certification is an important component for improving productive efficiency, its impact on regional competitiveness depends on a broader set of policies and economic conditions.

A plausible explanation for this gap between micro and macro impact is the sectoral concentration and the limited scope of certifications in strategic sectors for regional development. The predominance of certifications in manufacturing and business services, although relevant, does not cover key sectors such as agriculture, mining, or construction, which have a large weight in Latin American GDP (Intedya, 2023). Furthermore, low penetration in SMEs — which represent most of the regional business fabric — limits the dissemination of the benefits of certification to the entire economy. Likewise, the costs associated with the implementation and maintenance of certification represent a significant barrier for small and medium-sized enterprises, which often lack the financial and technical resources to assume these commitments (TI724, 2024). This situation generates an exclusion effect that can deepen productive gaps and limit the capacity of SMEs to integrate into global value chains.

From an institutional perspective, the lack of integrated public policies that promote certification as part of a broader productive development strategy contributes to the benefits remaining at the micro-business level. The absence of tax incentives, training programs, and financial support limits massive adoption and the generation of synergies among companies, universities, and research centers (CEPAL, 2014). This duality highlights the need to interpret the results with caution, recognizing that ISO 9001 certification is a key factor but not sufficient to close productive gaps in Latin America. Therefore, ISO 9001 certification should be seen as a complementary tool within a strategic framework that includes technological innovation, human capital training, institutional strengthening, and development of productive infrastructure. Only through this integration will it

be possible to strengthen the Latin American productive apparatus and close productivity gaps with advanced economies.

Finally, this study provides empirical evidence that can guide decision-makers in the formulation of public policies and business strategies. It is recommended to promote certification models adapted to the characteristics and capacities of SMEs, accompanied by financing mechanisms and technical support that facilitate their access and permanence in quality management systems. In synthesis, ISO 9001 certification is an important catalyst for business efficiency, but its true potential is achieved when it is inserted into a robust and coordinated productive ecosystem that promotes the sustainable competitiveness of Latin America.

Conclusions

This study has shown that ISO 9001 certification plays a fundamental role in improving the productive efficiency and financial performance of companies in Latin America. Certified organizations show significant increases in labor productivity, reduction of costs associated with non-quality, and optimization of delivery times, which translates into higher operating margins and profits compared to non-certified companies.

However, the influence of certification on regional macroeconomic competitiveness is limited, reflecting a weak correlation with country competitiveness indicators. This indicates that, although certification is an effective tool at the microeconomic level, it does not constitute, by itself, a sufficient driver to transform the productivity and competitiveness of the region as a whole.

Structural barriers, such as the sectoral concentration of certifications, limited adoption in SMEs due to costs and resources, and the lack of integrated public policies that promote their implementation, restrict the scope and systemic impact of these quality management practices. Therefore, it is concluded that ISO 9001 certification must be part of an integral productive development strategy that includes:

- Public policies oriented towards technological innovation and continuous training.

- Certification models adapted to the capacities and needs of SMEs.
- Financing mechanisms and technical support that facilitate the adoption and maintenance of quality standards.
- Promotion of the integration of productive chains and collaboration among public, private, and academic sectors.

Finally, this study invites future research to explore hybrid models that link quality management with innovation and sustainability, in order to enhance the competitiveness and resilience of the Latin American productive apparatus in an increasingly dynamic and demanding global context.

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