

APPLYING THE THEORY OF CONSTRAINTS TO ENHANCE OPERATIONAL EFFICIENCY IN INDUSTRIAL MICRO AND SMALL ENTERPRISES: EVIDENCE FROM PIURA, PERU

VÍCTOR HUGO RAMÍREZ ORDINOLA¹,
JOSÉ ALFREDO HERRERA FARFÁN², JUAN IGNACIO QUISPE NEYRA³

¹DOCTOR EN INGENIERÍA INDUSTRIAL. UNIVERSIDAD NACIONAL DE PIURA, ORCID: 0000-0002-7749-9247

²DOCTOR EN CIENCIAS ADMINISTRATIVAS. UNIVERSIDAD NACIONAL DE PIURA. ORCID: 0000-0002-2419-2524

³DOCTOR EN CIENCIAS DE LOS ALIMENTOS
UNIVERSIDAD NACIONAL DE PIURA
ORCID: 0000-0002-2370-3265

vramirezo @ unp.edu.pe¹
jherreraf@ unp.edu.pe²
jquispen@unp.edu.pe³

Abstract

This study analyzes the impact of the Theory of Constraints (TOC) on operational efficiency among micro and small enterprises (MSEs) in the industrial sector of Piura, Peru. A quantitative methodology was applied through structured surveys administered to local enterprises to identify, evaluate, and improve the principal constraints affecting their processes, as well as to determine the benefits derived from TOC implementation. The findings indicate that most MSEs are emerging businesses characterized by reduced labor structures and empirical operational practices, where logistical bottlenecks—particularly in procurement, transportation, warehousing, and distribution—predominate alongside deficiencies in process standardization, technology, and quality management. The absence of standard operating times and the prevalence of informal procedures generate inefficiencies and diminish competitiveness. Corrective measures were designed following TOC's five focusing steps, including supplier negotiation, supply diversification, route planning, adoption of modern warehouse management systems, technological upgrading, and the implementation of certified quality management frameworks. The results demonstrate that TOC substantially reduces operating times, optimizes resource utilization, and enhances customer satisfaction, thereby strengthening the profitability, sustainability, and competitiveness of MSEs in dynamic environments. Moreover, these improvements extend beyond operational performance to foster financial stability, job creation, and sustainable local development.

Keywords: Operational efficiency; Constraint management; Process optimization; Industrial SMEs; Sustainable competitiveness.

Resumen

Este estudio analiza el impacto de la Teoría de Restricciones (TOC) en la eficiencia operativa de las micro y pequeñas empresas (MYPE) del sector industrial de Piura, Perú. Se aplicó una metodología cuantitativa mediante encuestas estructuradas dirigidas a empresas locales, con el propósito de identificar, evaluar y mejorar las principales restricciones que afectan sus procesos, así como determinar los beneficios derivados de la implementación de la TOC. Los hallazgos indican que la mayoría de las MYPE son negocios emergentes caracterizados por estructuras laborales reducidas y prácticas operativas empíricas, donde predominan los cuellos de botella logísticos—particularmente en la adquisición, el transporte, el almacenamiento y la distribución—junto con deficiencias en la estandarización de procesos, la tecnología y la gestión de calidad. La ausencia de tiempos operativos estándar y la prevalencia de procedimientos informales generan ineficiencias y reducen la competitividad. Se diseñaron medidas correctivas siguiendo los cinco pasos de enfoque de la TOC, que incluyen la negociación con proveedores, la diversificación de suministros, la planificación de rutas, la adopción de sistemas modernos de gestión de almacenes, la actualización tecnológica y la implementación de marcos de gestión de calidad certificados. Los resultados demuestran que la TOC reduce sustancialmente los tiempos operativos, optimiza el uso de recursos y

mejora la satisfacción del cliente, fortaleciendo así la rentabilidad, la sostenibilidad y la competitividad de las MYPE en entornos dinámicos. Además, estas mejoras trascienden el desempeño operativo al fomentar la estabilidad financiera, la creación de empleo y el desarrollo local sostenible.

Palabras clave: Eficiencia operativa; Gestión de restricciones; Optimización de procesos; Pymes industriales; Competitividad sostenible.

INTRODUCTION

At the global level, the World Bank (WB, 2023) estimates that there are approximately 420 million micro and small enterprises (MSEs), which account for 90% of all businesses worldwide. Each year, 35 million new MSEs are created; however, 29 million simultaneously cease operations due to managerial weaknesses (International Trade Centre, ITC, 2023). As, China, India, and the United States together concentrate more than 210 million of these productive units (United Nations Conference on Trade and Development, UNCTAD, 2023). Their main activities are concentrated in trade, services, and light manufacturing—sectors where limited access to finance, low levels of innovation, and insufficient integration into international markets significantly constrain their long-term sustainability (Organisation for Economic Co-operation and Development, OECD, 2023a; OECD, 2024).

In Latin America, the Development Bank of Latin America and the Caribbean (CAF, 2021) reports that 64 million micro and small enterprises (MSEs) operate in the region, generating 61% of total employment and sustaining a substantial share of local economies. Each year, 5.8 million of these organizations are created, in spite of 4.3 million close before reaching three years of operation (Inter-American Development Bank, IDB, 2023). Furthermore, Brazil, Mexico, and Colombia together account for 34 million MSEs, primarily engaged in retail trade and services (Economic Commission for Latin America and the Caribbean, ECLAC, 2022a; ECLAC, 2022b). Weak managerial practices, pervasive informality, and limited technological capacity remain persistent barriers that hinder productivity gains and jeopardize the long-term survival of these enterprises in both regional and global markets (International Labour Organization, ILO, 2022).

In the Peruvian case, the National Institute of Statistics and Informatics (INEI, 2024) reports the existence of 5.2 million micro and small enterprises (MSEs), which account for 99% of all business units in the country. Each year, 280,000 new MSEs are established, while 190,000 cease operations due to insufficient capital, low competitiveness, and pervasive informality (Ministry of Foreign Trade and Tourism of Peru, MINCETUR, 2024). As well, Lima, Arequipa, and La Libertad concentrate more than 2.4 million of these organizations, primarily engaged in commerce, artisanal manufacturing, and basic services (Ministry of Economy and Finance of Peru, MEF, 2023). Deficiencies in administrative management, limited access to credit, and low technological innovation undermine their sustainability, thereby generating heightened economic and labor vulnerability (Ministry of Production of Peru, PRODUCE, 2022; PRODUCE, 2023). PerúContable (2023) argues that micro and small enterprises (MSEs) play a pivotal role in the economy, not only because they constitute a major source of employment generation and drive innovation, but also because they influence multiple strategic domains. First, by being closely embedded within the communities where they operate, they contribute to strengthening local skills and competencies, which in turn consolidates the economic and social infrastructure of those territories. Moreover, MSEs function as genuine incubators of entrepreneurship, as a significant proportion of business owners begin their trajectory with small ventures before achieving broader expansion. This dynamic fosters an entrepreneurial culture that enriches the business fabric through dynamism and diversification. There, their presence in the market produces a positive effect on competition, which benefits consumers by promoting improvements in product quality, more competitive prices, and more efficient services. In this way, MSEs emerge as agents that not only diversify economic activity but also foster sustained growth in key sectors of national development.

According to Comex Perú (2022), the influence of micro and small enterprises (MSEs) is so extensive that, in Peru, they account for 99.5% of all enterprises, contribute 40% to the national GDP, and generate 80% of private sector employment. Indeed, in 2021 alone, MSEs employed millions of workers, representing 43%

of the Economically Active Population. Enterprises in general play a crucial role in Peru's economic development, both at the national and regional levels, as well as in the well-being of the broader business community. Nevertheless, these enterprises frequently encounter a series of constraints that hinder their success and long-term sustainability. It is therefore essential to understand and address such limitations effectively in order to foster a healthy and dynamic business environment in the region. The present study examines how enterprises in Piura—and micro and small enterprises (MSEs) in particular—can benefit from the application of the Theory of Constraints. Our focus lies in identifying the specific obstacles faced by these enterprises and analyzing how the Theory of Constraints can provide viable pathways to overcoming them. To this end, we employed a carefully designed survey aimed at capturing the distinctive constraints that affect businesses in Piura. The overarching objective is to offer a clear perspective on how the implementation of the Theory of Constraints can drive growth and enhance the sustainability of these enterprises within the regional context.

The present research project addresses the problem of excessive operational times in the processes of micro and small enterprises (MSEs), which lead to low productivity. This inefficiency is primarily caused by the use of resources that generate time wastage and elevated costs, which in turn are reflected in product prices and consequently reduced profitability. Therefore, this study is of critical importance, as it seeks to reduce operational times in the processes of industrial-sector MSEs in Piura in order to enhance their productivity. Given that the study focuses on processes and time management, it is essential to analyze operations through the application of techniques such as flowcharts, work simplification, rationalization, and resource optimization, along with other methods that contribute to the intended objectives. The benefits expected from applying this approach include improving productivity, efficiency, and effectiveness in business processes through resource optimization, eliminating unnecessary tasks, and standardizing operations so that MSEs can meet their goals and become more competitive in the market. This aspect is particularly relevant as it contributes to stronger business positioning, ultimately benefiting customers, shareholders, and employees. Furthermore, the study is expected to serve as a significant foundation that can be complemented with additional research techniques and later applications, particularly in the domains of automation and Industry 4.0. The measurement and analysis of the application of the Theory of Constraints (TOC) and its impact on operational times in industrial-sector MSEs in Piura (2023) constitute the central focus of this investigation.

The overarching objective of this research is to measure and analyze the application of the Theory of Constraints (TOC) and its effect on operational times in micro and small enterprises (MSEs) belonging to the industrial sector of Piura. To achieve this aim, several specific objectives are established to guide the study. First, the research seeks to identify the constraints that limit system performance within these organizations. Subsequently, it aims to analyze such constraints in order to understand their nature, underlying causes, and degree of impact on productive processes. Building on this diagnostic stage, the study is oriented toward improving these constraints by proposing alternatives designed to optimize the operational capacity of MSEs. In closing, it seeks to determine the benefits derived from these actions in terms of reducing and enhancing the efficiency of operational times, therefore demonstrating the added value that the application of TOC can contribute to the development of the industrial sector in the region.

THEORETICAL FRAMEWORK

The Theory of Constraints (TOC), developed by Eliyahu M. Goldratt in the 1980s and presented in *The Goal*, focuses on identifying the limiting factors that hinder organizational objectives. It is based on the principle that every system contains at least one constraint that restricts overall performance. These constraints, or bottlenecks, represent the critical points limiting production, efficiency, and system outcomes (Flores, 2023). TOC emphasizes optimizing global performance rather than isolated components, fostering a process of continuous improvement grounded in logical cause-effect reasoning (Quiroa, 2021). In parallel, Lean Manufacturing reinforces the strategic management of bottlenecks, since improving their productivity directly enhances total output. The approach has demonstrated broad applicability across sectors such as project management, accounting, reengineering, and manufacturing, consistently improving

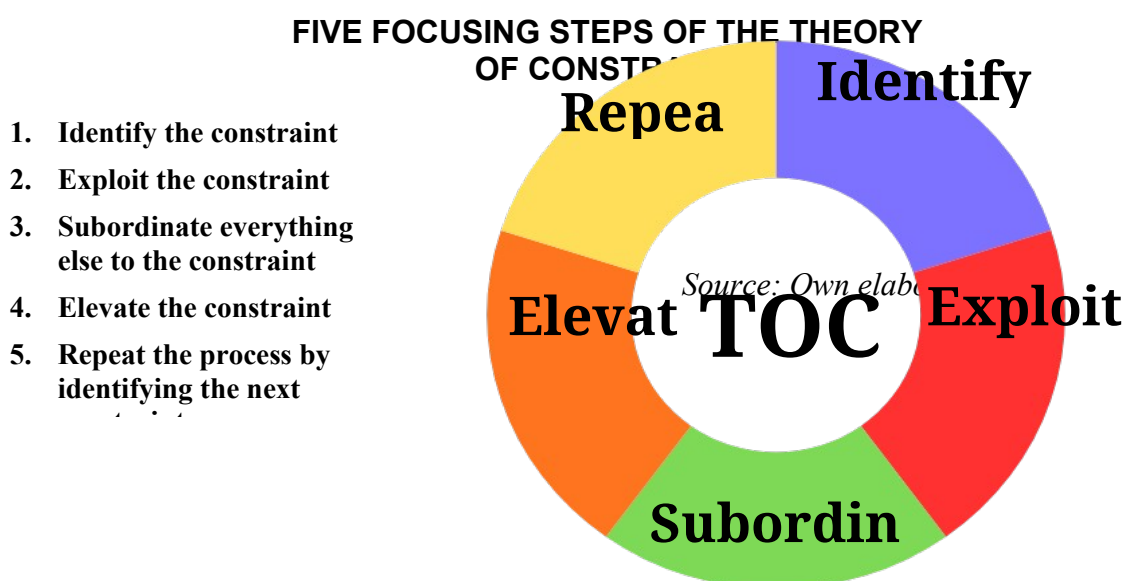
performance and reducing costs (Şimşit et al., 2014). Overall, TOC promotes ongoing improvement through the systematic removal of constraints, conflict resolution, and organizational learning (Kefe & Tanış, 2023).

Constraints may appear at any stage of a process—from planning to implementation—or even within the project team itself (Martins, 2022). They can be administrative, arising from restrictive business policies that reduce profitability (Gupta et al., 2024); capacity-related, when infrastructure fails to meet demand; or logistical, as in supply delays that disrupt operations (Tarte & Doke, 2021). Other forms include material shortages limiting production, behavioral resistance to technology (Gutiérrez et al., 2023), and policy rules restricting flexibility, such as hiring bans during peak demand (Sánchez-Zapata et al., 2023). Likewise, market constraints depend on client-base size (Zhao & Hou, 2021), supplier constraints stem from poor quality or delivery compliance (Rota & de Souza, 2021), and financial constraints arise from limited access to modernization capital.

The fundamental pillars of the Theory of Constraints (TOC), articulated by Goldratt in *The Choice*, comprise four core principles: (1) Inherent Simplicity, (2) Every Conflict Can Be Removed, (3) People Are Good, and (4) Never Say “I Know” (Flores, 2013). Inherent simplicity highlights the value of straightforward solutions that enable effective implementation, while the principle that every conflict can be removed rejects the notion of unavoidable tensions and encourages proactive problem-solving (Blais & Agbodoh-Falschau, 2023). The belief that people are good reflects trust in workers’ capacity to contribute to improvement when properly motivated and empowered, and the call to never say “I know” fosters continuous learning and prevents organizational stagnation.

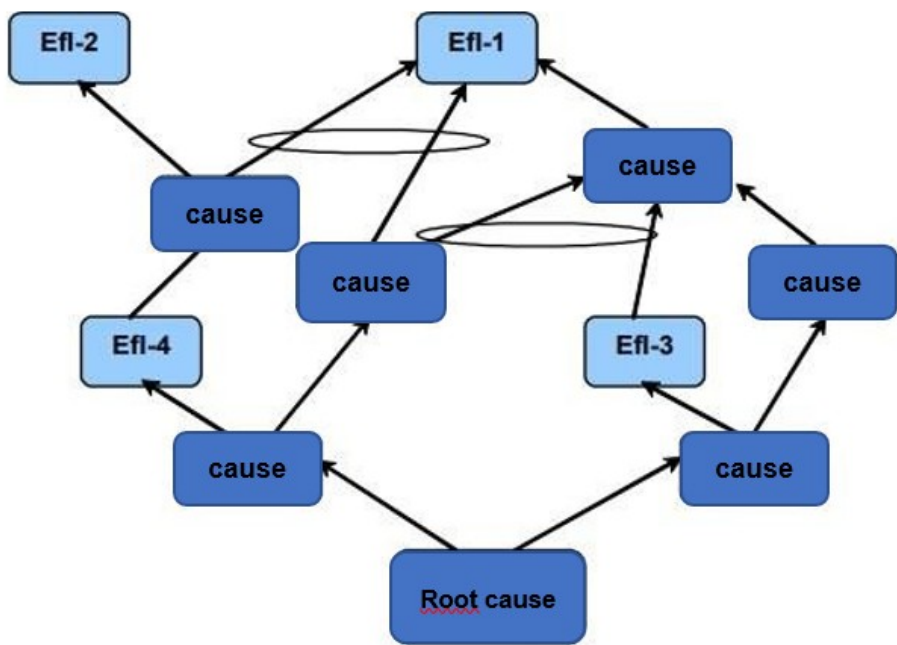
Building on these foundations, the TOC methodology unfolds through five sequential steps (Martins, 2022). The first is to identify the constraint, whether in operators, equipment, finances, or materials; this aligns with Lean Manufacturing principles aimed at reducing waste (Ramírez, 2022). The second step, exploit the constraint, seeks to maximize output without additional investment, often reinforced by Kaizen. Third, subordinate all other processes to the identified constraint to ensure systemic coherence. The fourth step, elevate the constraint, involves increasing capacity through targeted actions such as staff training, machinery acquisition, or improved maintenance, supported by tools like Poka Yoke, Total Productive Maintenance (TPM), and SMED (Muhammad & Isbiandono, 2021). Finally, the process must be repeated, as removing one limitation reveals new ones, generating a continuous improvement cycle that enhances overall organizational performance.

Figure 1
The Five Steps of the Theory of Constraints



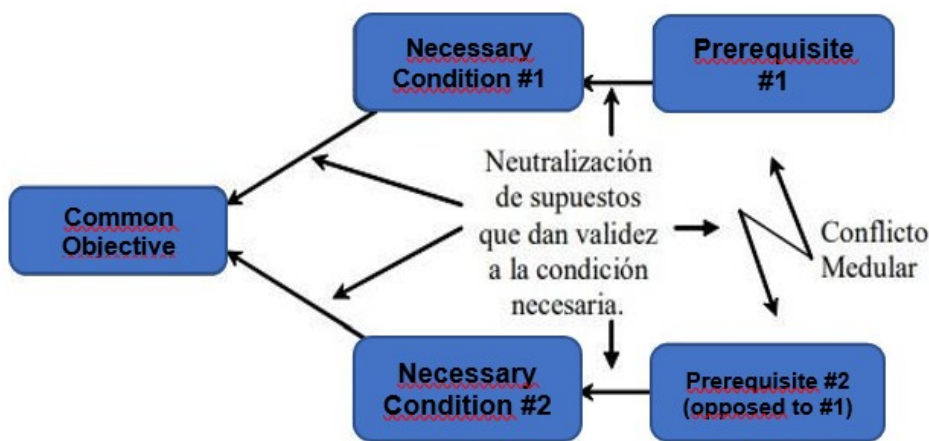
The TOC Thinking Processes emerge when the structure of the system obstructs performance, requiring the identification, exploitation, subordination, or elevation of constraints through logical tools. According to Ramírez (2022), this process is guided by three fundamental questions: what to change, what to change to, and how to effect the change. It entails recognizing flawed assumptions, constructing simple solutions, and designing action plans with minimal resistance. Among its key tools is the Current Reality Tree (CRT). As Flores (2023) emphasizes, this technique assesses cause–effect relationships to identify root problems responsible for undesirable effects that undermine organizational effectiveness.

Figure 2: Current Reality Tree (CRT) Diagram



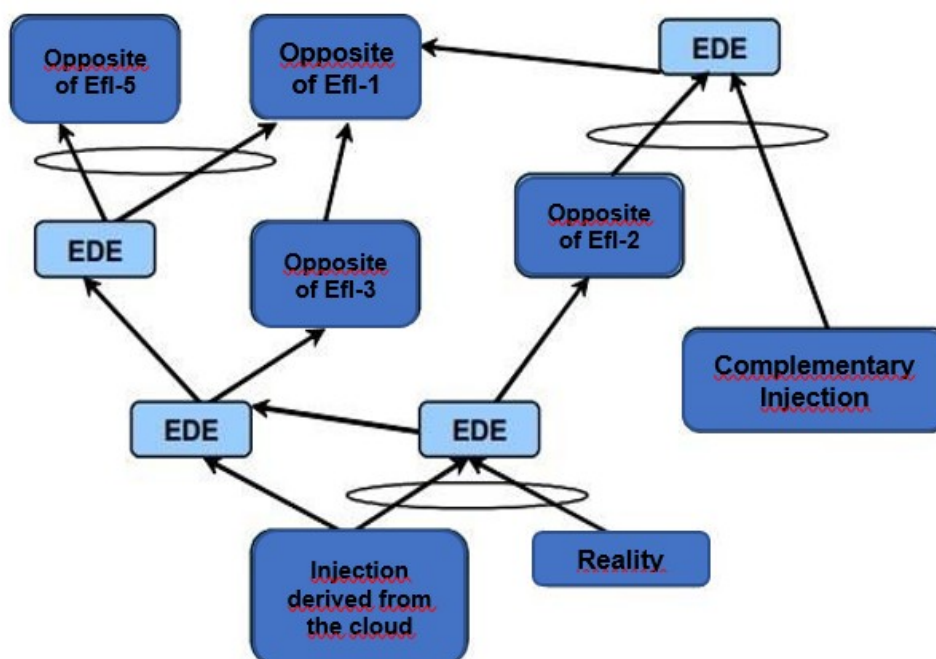
The Conflict Resolution Diagram (CRD) addresses conflicts by revealing problems as clashes between necessary conditions, thus seeking to overcome the root causes of undesirable situations (Flores, 2023).

Figure 3: Conflict Resolution Diagram (CRD)



The Future Reality Tree (FRT) projects prospective states following the implementation of injections, anticipating potential negative branches in order to eliminate undesirable effects prior to the introduction of changes (Flores, 2023).

Figure 4: Future Reality Tree (FRT) Diagram



The complementary tools of the Theory of Constraints (TOC) expand its applicability across diverse contexts. The Process Flow Diagram (PFD) visualizes activity sequences and clarifies how operations interact with the core constraint (Ovedje, 2024). Likewise, production scheduling aligns activities around the bottleneck to maximize performance, while Constraint Engineering (CE) targets the long-term removal of structural barriers through systemic redesign. In all cases, the ultimate goal is to enhance overall efficiency by strategically managing resources to overcome limiting factors and achieve superior business performance (Mutambo et al., 2023).

Accurate constraint identification is pivotal to successful TOC implementation. The Business & Marketing School (2023) emphasizes that detecting bottlenecks precisely determines the method's effectiveness in any organization. Workflow analysis systematically examines internal processes to reveal task accumulations that expose limitations (Mahadevan & Chejarla, 2023). For instance, in electronics manufacturing, the final assembly stage often becomes a critical bottleneck due to sequential dependencies, producing backlogs and reducing throughput (Lyakurwa, 2023). Similarly, inventory analysis helps identify process constraints by observing product or material build-ups at specific points, such as congestion in warehouse receiving areas that signal inefficiencies in order preparation (Lyakurwa, 2023). Complementary techniques such as performance metrics also provide objective indicators—cycle times, hourly output, and resource utilization rates—that reveal hidden capacity constraints. For example, in call centers, prolonged handling times indicate service bottlenecks that delay operations and reduce customer satisfaction (Nguyen et al., 2023). Cost analysis offers a valuable perspective for detecting hidden constraints by identifying disproportionate expenditures associated with operational bottlenecks. In furniture manufacturing, for instance, high storage and handling costs often reveal assembly inefficiencies and poor resource utilization (Nguyen et al., 2023).

Likewise, employee feedback provides crucial insight, as frontline workers frequently detect recurring issues—such as repeated machinery failures—that disrupt production continuity. This participatory approach enriches the diagnosis of obstacles and promotes the design of pragmatic, context-specific solutions. The Theory of Constraints (TOC) also exhibits wide-ranging practical applications. Martins (2022) highlights its effectiveness in improving production processes, project management, and supply-chain optimization. In operations management, identifying assembly-line constraints reduces lead times and enhances efficiency; in project settings, recognizing limited critical resources enables proactive planning (Mahadevan & Chejarla, 2023). Similarly, automating accounting procedures eliminates bottlenecks in financial closing. Collectively, these cases confirm the versatility of TOC for addressing sector-specific limitations in industrial, service, and financial contexts, thereby strengthening organizational performance and adaptability.

In the financial sphere, TOC relies on three indicators—throughput, investment, and operating expenses. Throughput measures the rate at which the system generates sales revenue after deducting variable costs (Ángel Baguer Alcalá, 2012). Achieving optimal performance requires simultaneously increasing throughput, reducing inventories, and minimizing expenses. As Goldratt (2005) noted, when throughput grows without raising inventories or costs, both profit and cash flow expand. This logic reinforces strategic decision-making by showing that TOC-aligned financial management enhances profitability and return on investment. Globally, TOC has delivered notable outcomes. Goldratt Consulting's work with Grupo Mabe in home-appliance manufacturing shortened delivery times and improved supply-chain efficiency. At Intel, constraint management optimized semiconductor production, boosting performance (Ng et al., 2023). Likewise, Delta Airlines applied TOC to refine flight scheduling and resource allocation, achieving greater operational efficiency. These experiences demonstrate TOC's adaptability across technological, manufacturing, and service sectors, generating sustainable competitive advantages. Despite its wide applicability, the Theory of Constraints (TOC) has also faced criticism and limitations. Quiroa (2021) notes that several scholars consider it overly simplistic, with a scope mainly confined to small-scale and production-oriented systems. Key critiques emphasize its strong manufacturing focus, cultural resistance to change, and dependence on subjective human judgment in identifying constraints (Ng et al., 2023). Moreover, its implementation often demands financial and technological resources that may be scarce, alongside a culture of continuous improvement that is difficult to sustain. Hence, although TOC remains a powerful management approach, it should be integrated within broader frameworks to ensure lasting effectiveness.

In the context of micro, small, and medium-sized enterprises (MSMEs), TOC acquires particular relevance. These organizations, defined by their scale, flexibility, and contribution to employment and innovation, constitute the backbone of national economies (Perú Contable, 2023; Library, 2020). While they benefit from adaptability and fiscal incentives, they face persistent challenges related to limited resources, market inequality, and regulatory complexity (Mahadevan & Chejarla, 2023). Within this scenario, TOC emerges as a strategic tool to strengthen sustainability and competitiveness in dynamic environments. Recent research supports this view. Chikwanda and Jardim (2024) demonstrated in South African coal mining that TOC reduced inventories, enhanced capacity, and streamlined processes without additional investment. Similarly, Njagi and Musau (2025) found that combining TOC with Lean, JIT, and EOQ improved profitability and liquidity in Nairobi's manufacturing SMEs. Chamrada and Kollmann (2023) further highlighted that applying TOC in SMEs facilitates resource prioritization, bottleneck elimination, and productivity gains, especially when integrated with continuous improvement frameworks.

Other studies reinforce TOC's versatility. Nurdin et al. (2024) optimized labor in an Indonesian SME through dynamic programming, achieving cost reductions and greater responsiveness to demand. Likewise, Muhammad (2025) showed that applying TOC's five-step process in a sustainable fashion SME improved profit margins, supplier coordination, and resilience in volatile markets. Finally, Bui et al. (2021), surveying over 1,500 Vietnamese enterprises, confirmed that although SMEs face greater legal and financial constraints than larger firms, TOC remains crucial for resource prioritization, productivity, and job creation.

Pascucci et al. (2022) analyzed how family ownership and financial constraints influence the performance of Italian exporting SMEs, finding that financial flexibility enhances export outcomes, whereas financial limitations weaken them. They further concluded that applying the Theory of Constraints (TOC) promotes efficient resource use, thereby strengthening international competitiveness and fostering sustainable growth. Similarly, Taneo et al. (2021) examined food SMEs in Indonesia during the pandemic, identifying shortages in inputs, licensing barriers, and marketing limitations that undermined competitiveness. Nonetheless, TOC facilitated the detection of bottlenecks, the design of alternative financing mechanisms, and the optimization of resource allocation, ensuring business continuity and consolidation. In the same line, Widnyana et al. (2021), analyzing 4.36 million Indonesian SMEs, demonstrated that TOC effectively overcomes financial constraints, improves capital allocation, and enhances performance, with strategic partnerships and institutional support amplifying its positive effects.

From a complementary perspective, Manzoor et al. (2021) evaluated SMEs' role in rural development in Pakistan, showing that access to finance mediates growth and that applying TOC to critical resources fosters employment, income, and community sustainability. Likewise, Phan (2022), analyzing over 2,500 Vietnamese SMEs, found that financial constraints reduce labor benefits, whereas TOC enhances resource prioritization, labor sustainability, and international competitiveness. Savitri (2025), through a mixed-method study in the Indonesian automotive firm PT XYZ, confirmed that identifying bottlenecks in used-vehicle management increased both efficiency and profitability—further validating TOC's contribution to SME performance. In innovation and sustainability contexts, Mason-Jones et al. (2022) examined the UK renewable-energy supply chain, identifying logistical and investment constraints that TOC helped to map and mitigate, thereby improving SME participation in manufacturing. Similarly, Dossou et al. (2022) developed a sustainable Industry 4.0 framework for French SMEs by integrating TOC with Lean and digital tools, demonstrating that overcoming technological and organizational limitations increases flexibility, reduces waste, and accelerates the sustainable digital transition of enterprises.

METHODOLOGY

The study adopted a quantitative approach with a descriptive and correlational scope, aimed at identifying and analyzing the constraints affecting the processes of industrial SMEs in Piura.

The population consisted of formally registered micro and small enterprises in the region, from which a sample of 14 SMEs was selected through non-probabilistic convenience sampling, based on accessibility and the willingness of entrepreneurs to participate in the study. The inclusion criteria were as follows: (i) belonging to the industrial sector of Piura, (ii) having a minimum of one year of operation, and (iii) employing managerial or administrative staff available to respond to the survey. Conversely, the exclusion criteria considered enterprises that were informal or lacked current productive activity.

Table 1

Characteristics of the enterprises evaluated in the research

Enterprise	Main Activity
E1	Gastronomy (<i>picantería</i> , traditional restaurant)
E2	Retail trade (grocery store)
E3	Bookstore
E4	Copying and printing services
E5	Cleaning, engineering, and maintenance services
E6	Gas pipeline installations
E7	Raw material transportation (Pacasmayo Plant)
E8	Industrial electronic and mechanical systems projects
E9	Poultry farming and egg distribution

E10	Processing and commercialization of hydrobiological products
E11	Engineering, construction, maintenance, and electrical automation
E12	Trade (shopping center)
E13	Retail trade (market)
E14	Trade
E15	Frozen/hydrobiological products industry
E16	Commercial distribution

The instrument applied was a structured questionnaire consisting of 25 items, developed on the basis of the literature on the Theory of Constraints (TOC) and validated by three experts in business management. The questions combined five-point Likert scales (1 = very low to 5 = very high) to measure perceptions of logistical, technological, and managerial constraints, together with items addressing socio-business characteristics. The reliability of the questionnaire was assessed using Cronbach's α coefficient ($\alpha = 0.87$), which indicates a high level of internal consistency.

Data analysis was performed using IBM SPSS Statistics version 26, which enabled the organization, tabulation, and interpretation of the collected data. Descriptive statistics—such as frequencies and percentages—were employed to summarize the main characteristics of the sample, while exploratory comparative techniques were applied to identify patterns and differences among enterprises. In addition, qualitative tools such as the 5 Whys technique and process flowcharts were used to deepen the identification of critical constraints within the operational systems of SMEs.

Inferential analysis:

In addition to descriptive statistics, a non-parametric inferential analysis was conducted using Spearman's rank correlation coefficient to examine the association between the main variables—logistical, technological, and managerial constraints—and operational performance indicators. Furthermore, an analysis of variance (ANOVA) was applied to identify significant differences in constraint intensity across business sectors (manufacturing, services, and commerce). These inferential procedures allowed for a more robust validation of the relationships observed in the descriptive phase and provided additional evidence on the systemic nature of constraints affecting industrial microenterprises.

Ethical considerations:

The study was conducted in accordance with ethical research standards, ensuring the confidentiality and anonymity of all participants. Prior informed consent was obtained from each respondent, and the research protocol received institutional approval before data collection.

RESULTS

The results of this research are presented according to its objectives:

Objective 1: To identify system constraints in industrial SMEs in Piura

In order to identify system constraints within SMEs operating in the industrial sector of Piura, a survey was administered to a range of local enterprises, which enabled the development of a diagnostic assessment of their organizational and process conditions. Regarding the economic sector, the results reveal considerable heterogeneity: 35.7% correspond to services, while both manufacturing and commerce account for 28.6% each, and 7.1% belong to the bookstore sector. This finding indicates a business structure predominantly shaped by service-oriented activities, which in turn conditions the type of constraints encountered when compared with those faced by manufacturing or commercial enterprises.

With respect to staffing, the data show that 42.9% of SMEs operate with between 1 and 5 employees, 28.6% with 6 to 20 employees, and another 28.6% with more than 21 employees. These figures reflect the predominance of small organizational structures, which may constrain functional specialization and generate overload in critical processes. In terms of business longevity, it was found that 50% of enterprises have between 1 and 5 years of operation, while 21.4% have between 11 and 20 years, and 14.3% between 6

and 10 years; only 7.1% have been in operation for more than two decades. This scenario suggests that the majority of enterprises remain in early consolidation phases, a stage often associated with constraints linked to process maturation, the adoption of standards, and the accumulation of organizational capabilities. A critical aspect concerns the type of operating infrastructure. Although no enterprise reported inadequate facilities, only two enterprises possess their own premises with limitations, ten operate in adequate facilities, and two rent their installations. This reliance on limited or non-owned infrastructure represents a restrictive factor for long-term projection and reinvestment capacity. At the level of document management, 35.7% of enterprises lack manuals or written procedures, while 14.3% possess outdated documentation; only 50% report having updated manuals. This deficiency constitutes a significant constraint, as the absence of standardized procedures hinders operational efficiency and reduces the replicability of processes. The analysis of internal processes reveals that distribution is the area requiring the greatest amount of time and concentrating the most significant challenges. Indeed, 71.4% of enterprises reported failures in the logistics system—purchasing, warehousing, inventory, distribution, and transportation—as their principal problem. This convergence confirms that logistics constitutes a systemic constraint limiting overall performance. Conversely, regarding resource efficiency, most enterprises rated their resources, processes, and products as adequate, even though one enterprise acknowledged deficiencies in its machinery and equipment. Despite this relatively positive assessment, it was observed that the majority lack standardized timeframes for their activities, which prevents them from measuring, controlling, and optimizing productivity. Such absence of standardization represents a latent constraint in operational management. With respect to demand satisfaction, 92.9% of enterprises reported adequately meeting customer requirements, while 7.1% acknowledged failing to fully respond. However, when evaluating product or service quality, only 42.9% achieved the “very good” category, 50% were rated as “good,” and 7.1% as “fair.” Nevertheless, most enterprises aim to ensure customer satisfaction, the dispersion in perceived quality indicates that consistency in standards remains a persistent challenge. In summary, the findings reveal that the main systemic constraints of SMEs in Piura are concentrated in logistical weaknesses, the absence of manuals and standardized times, reliance on limited infrastructure, and insufficient organizational consolidation. These structural and process-related limitations explain the bottlenecks in operational efficiency and constitute critical areas for intervention under the framework of the Theory of Constraints (TOC).

Table 2
Results of the survey applied to the identified SMEs

Category	Indicator	Main Results
Economic sector	Sectoral distribution	Services: 35.7% · Manufacturing: 28.6% · Commerce: 28.6% · Bookstore: 7.1%
Staffing	Number of employees	1–5: 42.9% · 6–20: 28.6% · 21 or more: 28.6%
Enterprise Age	Years in operation	1–5 years: 50% · 6–10 years: 14.3% · 11–20 years: 21.4% · More than 20: 7.1%
Infrastructure	Type of premises	Owned with limitations: 2 enterprises · Adequate: 10 enterprises · Rented: 2 enterprises
Document management	Manuals and procedures	Updated: 50% · Nonexistent: 35.7% · Outdated: 14.3%
Internal processes	Critical constraints	Logistics (purchasing, warehousing, stocks, distribution, transport): 71.4%

		report failures
Resources & processes	Perceived efficiency	Majority rated as “good” · One enterprise reported machinery deficiencies · General absence of standardized times
Demand satisfaction	Customer compliance	Fulfilled: 92.9% · Not fulfilled: 7.1%
Perceived quality	Product/service level	Very good: 42.9% · Good: 50% · Fair: 7.1%

Objective 2: To analyze the system constraints of SMEs in the industrial sector of Piura

The analysis of system constraints affecting SMEs in Piura’s industrial sector made it possible to identify limitations both at the organizational level and within operational processes.

Business organization: The findings reveal that most of the surveyed enterprises belong to the service sector and operate with small-scale structures, predominantly employing between one and five workers, while having been in operation for only one to five years. This scenario reflects a business ecosystem largely composed of emerging organizations still in a stage of consolidation, which constrains their capacity for strategic planning and operational stability. Although it is encouraging that more than 60% of SMEs report having procedural manuals, many of them updated, this strength is counterbalanced by the limited availability of specialized human capital and the absence of accumulated experience in process management. Taken together, these factors configure a scenario of vulnerability in the face of competitive environments.

Processes and operational constraints: Within the process dimension, the analysis identified the most significant constraints in critical activities such as administration, procurement, distribution, accounting, transportation, and quality control. The evidence indicates that procurement is the most affected area, while 71.4% of enterprises reported logistical failures related to input supply, storage, and distribution. These problems directly impact operating times, generating inefficiencies that translate into delays, cost overruns, and difficulties in responding promptly to demand. A particularly relevant finding is the predominance of empiricism over the application of systematic techniques based on standardized times. The absence of objective metrics prevents the establishment of efficiency benchmarks, the reduction of idle time, and the assurance of process continuity. Likewise, the lack of a robust quality management system results in deficiencies in the standardization of procedures and in ensuring customer satisfaction—an especially critical issue in a market where perceived quality directly influences loyalty and competitiveness.

Prioritization of constraints: Based on the results, the following were identified as priority constraints: (i) long waiting times in the acquisition of raw materials, (ii) inefficient transportation and distribution, (iii) inadequate warehouse management, (iv) the absence of a formalized quality system, (v) technological obsolescence, and (vi) low demand resulting from limited innovation in products and services. The convergence of these restrictions positions the supply chain as the principal bottleneck of the business system in Piura, with repercussions such as misaligned inventories, increased storage and transportation costs, and a reduced capacity to effectively meet market demand.

Root cause analysis: Through the application of the 5 Whys technique, it was verified that the constraints are rooted in structural factors. The lack of clear agreements with suppliers and limited communication explain delays in supply; the absence of route planning and demand data analysis generates inefficiencies in distribution; and the lack of modern inventory management methodologies undermines warehouse performance. Added to this are the insufficient allocation of resources for the implementation of quality systems, the lack of budget for technological modernization, and the limited investment in market research, all of which restrict innovation and the value added to the products and services offered.

Analytical synthesis: Taken together, these results lead to the conclusion that the system constraints of Piuran companies are concentrated in logistical and operational management, the limited professionalization of administrative processes, and the absence of innovation mechanisms to secure

sustained demand. Such restrictions represent bottlenecks that directly impair efficiency, increase operating costs, and compromise business sustainability. The analysis therefore confirms that the principal challenge faced by these organizations does not lie in the availability of basic resources, but rather in their ability to manage them efficiently, systematically, and innovatively within a holistic framework.

Objective 3: To improve system constraints in SMEs of Piura's industrial sector

With the purpose of addressing the identified constraints in the system of Piuran companies, proposals were designed based on the application of the Theory of Constraints (TOC). This approach emphasizes prioritizing the most critical bottleneck—in this case, the long lead times in the acquisition of raw materials—and, once resolved, progressively advancing toward subsequent constraints, thereby ensuring a process of continuous improvement. First, regarding the prolonged procurement times for inputs, it is proposed to establish formal contracts with suppliers that guarantee shorter and more reliable delivery schedules, as well as to diversify sourcing in order to mitigate risks associated with dependence on a single provider. These measures strengthen supply chain flow and ensure greater production stability.

With respect to deficiencies in transportation and distribution, it is recommended that enterprises establish closer collaboration with logistics partners to optimize route planning and demand data management. Likewise, consolidating orders into larger batches represents an effective strategy to minimize costs and maximize load capacity without compromising product quality. Regarding inefficient warehouse management, the application of workflow analyses would allow the identification of bottlenecks and the redesign of the physical layout of inputs. Furthermore, staff training in modern management methodologies, the standardization of processes, and the implementation of periodic reviews would contribute to reducing idle time and ensuring the availability of resources.

With regard to the absence of a robust quality management system, the implementation of international standards such as ISO 9001, complemented by process control methodologies like Six Sigma, is recommended. These tools would enable the reduction of errors, ensure uniformity of results, and foster a culture of continuous improvement. Furthermore, the periodic execution of internal audits would facilitate the early detection of deviations and the timely adoption of corrective actions. Concerning obsolete equipment and technologies, it becomes essential to prioritize technological upgrading plans through return-on-investment (ROI) analysis and benchmarking against sector peers. These actions should be accompanied by flexible financing schemes, staff training programs in the use of new tools, and preventive maintenance routines aimed at extending the useful life of acquired equipment.

Finally, in response to low consumer demand, it is proposed to conduct market studies aimed at understanding emerging customer needs. Based on this information, SMEs can design more targeted marketing strategies, innovate in their services to add differential value, diversify their offerings, and explore underserved niches. This process would allow them to expand their client base and ensure greater stability in demand. Transversally, emphasis is placed on the importance of implementing time and motion studies as tools for process standardization, waste reduction, and the enhancement of operational efficiency. Such practices not only optimize internal resources but also consolidate the foundations for sustainable long-term management.

In synthesis, the proposed measures demonstrate that the systematic application of TOC, complemented by quality, logistics, and strategic management methodologies, provides a viable pathway for overcoming the current constraints faced by SMEs in Piura. In so doing, it contributes not only to enhancing operational efficiency and service quality but also to strengthening their competitiveness and adaptive capacity in dynamic and demanding environments.

Table 3
Constraints before applying TOC and improvements after applying TOC

Dimension	Constraints before applying TOC	Improvements after applying TOC
Procurement and supply	Long waiting times due to lack of agreements with suppliers and dependence on a single source.	Formal contracts with suppliers, diversification of sourcing, and reduced delivery lead times.
Transportation and distribution	Improvised routes, high costs, and frequent delays.	Route planning, use of demand data, and order consolidation that reduce both time and costs.
Warehouse management	Empirical processes without standardization or inventory control.	Workflow redesign, staff training, and the adoption of modern management methodologies.
Quality	Absence of formal systems, outdated manuals, and lack of audits.	Implementation of ISO 9001, internal audits, and Six Sigma, which strengthen consistency and reduce errors.
Technology	Obsolete equipment and low investment in innovation.	Technological upgrading based on ROI analysis, preventive maintenance, and staff training.
Demand and market	Limited product innovation and low customer loyalty capacity.	Market studies, diversification of offerings, and targeted marketing strategies.

Objective 4: To determine the benefits in operating times of SMEs in Piura's industrial sector

The assessment of the benefits derived from the application of the Theory of Constraints (TOC) in SMEs within Piura's industrial sector demonstrates a direct impact on the optimization of operating times, with positive effects on both internal efficiency and external competitiveness. First, the reduction of long waiting periods in the acquisition of raw materials enables better production planning and ensures a smoother flow of inputs. This improvement translates into fewer delivery delays and, correspondingly, an increase in customer satisfaction—an aspect that is crucial for the survival and positioning of micro and small enterprises in highly competitive markets.

Similarly, the optimization of warehouse management translates into a significant reduction in costs associated with excessive or insufficient inventories. Streamlining storage, retrieval, and dispatch processes not only enhances responsiveness to demand but also minimizes idle times, as a result fostering a more efficient utilization of available resources.

Conversely, strengthening consumer demand through innovation and marketing strategies directly impacts revenue growth and improves return on investment. This process not only broadens the customer base but also reinforces trust and loyalty, creating a virtuous cycle that sustains the growth of SMEs in the medium and long term. The implementation of a robust quality management system represents another strategic benefit, as it ensures consistency and excellence in the products or services offered. This reduces costs associated with reprocessing and defective outputs, while simultaneously reinforcing customer confidence in the brand. Moreover, the standardization of documentation and procedures provides clarity, coherence, and ease of monitoring for operational processes, thereby enhancing staff training and organizational continuity. Transversally, the TOC approach—by focusing on the identification and elimination of bottlenecks—enables enterprises to manage their resources more efficiently, which is reflected in reduced

operating costs, increased profitability, and greater organizational resilience. These benefits not only enhance local competitiveness but also consolidate SMEs as key actors in the sustainable economic development of the region.

Theoretical contribution:

Beyond its empirical findings, this study provides a theoretical contribution by extending the applicability of the Theory of Constraints (TOC) to the context of micro and small enterprises (MSEs) in developing economies. The results confirm that the systemic logic of TOC—originally conceived for large-scale manufacturing environments—can effectively diagnose and improve performance in smaller, resource-constrained organizations. In doing so, this research enriches the global discussion on operational efficiency and continuous improvement by demonstrating that the TOC framework is not only universal in principle but also adaptable to diverse socio-economic realities such as those of Latin America.

DISCUSSION

According to Objective 1, to identify the system constraints of Piuran companies, the survey results reveal a landscape dominated by micro and small enterprises characterized by emerging traits and structural limitations. In terms of sectoral distribution, 35.7% correspond to services, followed by manufacturing and commerce, each with 28.6%, while 7.1% belong to the bookstore sector. This composition illustrates the diversification of activities in the region, although with a marked predominance of the tertiary sector. Regarding personnel, 42.9% of enterprises operate with between one and five employees, confirming the prevalence of very small-scale productive units with limited human resources. Likewise, 50% of the enterprises have been in operation for between one and five years, reflecting business fragility given the high mortality rate of enterprises during their early years. In relation to infrastructure, the results show that ten enterprises operate in adequate facilities, two in their own but limited premises, and another two in rented facilities—conditions that are relatively acceptable but still pose sustainability risks. Concerning document management, 35.7% of enterprises lack procedural manuals, 14.3% maintain outdated documents, and only half report having updated processes. This deficiency restricts standardization, the transmission of organizational knowledge, and quality control.

Within the process dimension, the most critical constraint identified is logistical: 71.4% of enterprises reported failures in procurement, warehousing, inventory, distribution, and transportation, thereby confirming the existence of a systemic bottleneck that limits overall efficiency. Compounding this issue, most firms lack standardized operational times, which keeps them dependent on empirical practices with limited control over productivity. Despite these structural weaknesses, 92.9% of enterprises stated that they meet customer demand, with 50% rating their product or service quality as “good” and 42.9% as “very good”—evidence of an underlying commitment to customer value even under adverse conditions.

These findings resonate with the results of Bui et al. (2021), who, in a study of more than 1,500 Vietnamese SMEs, observed that small enterprises face disproportionately severe financial and logistical limitations compared to larger firms. In that context, the authors demonstrated that the implementation of the Theory of Constraints (TOC) enables organizations to concentrate resources, reduce operational inefficiencies, and generate employment—outcomes that mirror the needs of Piura’s industrial SMEs.

Similarly, Taneo et al. (2021) identified that 52% of Indonesian food SMEs experienced logistical and input-related constraints during the COVID-19 pandemic, which substantially weakened their competitiveness. Nevertheless, through TOC, these firms succeeded in mapping bottlenecks, optimizing material flows, and designing financial strategies that ensured operational continuity. This international evidence, when contrasted with Piura’s case—where logistical failures affect more than 70% of enterprises—suggests a greater structural intensity of constraints in the Peruvian context, largely attributable to limited process standardization and weak administrative systems. Consequently, addressing these deficiencies through TOC-driven interventions becomes crucial to preventing operational stagnation and fostering sustainable growth.

Furthermore, Chamrada and Kollmann (2023) highlight that the evolution of TOC applied in SMEs strengthens productivity by prioritizing resources and eliminating constraints. Their review emphasizes that integrating the methodology with continuous improvement frameworks drives business competitiveness. When contrasted with the case of Piura, the evidence points to the same necessity: focusing on logistics and document management, which constitute the critical constraints, in order to release productive capacity and sustain more efficient growth. Taken together, these antecedents reinforce the conclusion that the constraints faced by SMEs in Piura are not isolated phenomena, but rather local expressions of common problems affecting small enterprises in emerging contexts. The lack of standardization, the reliance on empirical processes, logistical weaknesses, and limited infrastructure not only impair efficiency but also condition business survival in the short term.

Beyond the figures, the identification of constraints represents a strategic step toward building a roadmap for continuous improvement. The efforts of SMEs to meet demand and maintain quality constitute a strength that can serve as a foundation for the systematic application of TOC. If these weaknesses are successfully transformed into opportunities for learning, enterprises could enhance their productivity, secure their permanence in the market, and consolidate a process of professionalization that is indispensable for competing in increasingly demanding environments.

According to Objective 2, to analyze the system constraints of SMEs in Piura's industrial sector, the survey results revealed that most enterprises operate in the service sector, with a predominance of microenterprises employing between one and five workers and with an age of one to five years, reflecting a young and consolidating business ecosystem. Notwithstanding the majority operate in facilities with adequate conditions and 60% report having updated procedures, limitations in the formalization of processes persist, which continue to undermine organizational efficiency.

Within the process dimension, significant time losses were identified in administration, accounting, procurement, distribution, quality control, and sales, with procurement being the most affected activity. The most critical areas with recurrent problems include accounting, warehousing, transportation, and quality control. Operational management is predominantly empirical due to the absence of standardized times, which constrains productivity. Overarchingly, recurring issues such as logistical failures, obsolete technology, and weak demand become key constraints that condition growth capacity. These findings are consistent with those of Chikwanda and Jardim (2024), who, in applying TOC to South African coal mining, demonstrated that identifying and addressing logistical constraints reduces inventories and improves production capacity without the need for large investments. Similarly, in Piura, the greatest bottlenecks lie in logistics and administrative processes, whose optimization would be decisive for enhancing SME efficiency. Complementarily, Njagi and Musau (2025) showed that in manufacturing SMEs in Nairobi, the integration of systems such as Just in Time and EOQ, alongside TOC, optimized material flows, reduced costs, and strengthened operational sustainability. The evidence aligns with the needs of Piuran enterprises to implement standardized methodologies that reduce idle time and losses in their supply chains. Likewise, Nurdin et al. (2024) evidenced in an Indonesian SME that applying TOC to labor management significantly reduced costs and increased responsiveness to demand. This illustrates that, as in Piura, the lack of standardization and technology generates inefficiencies that can be reversed through the identification and prioritization of constraints in critical resources. In synthesis, the results confirm that the main weakness of SMEs in Piura lies in supply chain management and the absence of control methodologies, which prolong idle times and undermine competitiveness. Overcoming these limitations through the application of TOC and the strengthening of administrative processes will enable them to sustain growth in an increasingly dynamic and demanding business environment.

According to Objective 3, to improve the system constraints of SMEs in Piura's industrial sector, proposals were designed focusing on the main bottlenecks identified. Priority was given to the long waiting times in raw material acquisition, for which clear contracts with suppliers, diversification of sourcing, and reduced dependency on a single provider were suggested. Correspondingly, efficiency in transportation and distribution was addressed through route planning, demand data analysis, and order consolidation. In terms

of warehouse management, the proposals included reorganizing storage spaces, training staff in modern methodologies, and establishing standardized processes to reduce confusion and time variability. For quality, the implementation of a certified system such as ISO 9001 was recommended, supported by periodic internal audits and the use of tools such as Six Sigma to ensure consistency and reliability in products and services. It was also suggested to update technology based on return-on-investment analyses and benchmarking, while investing in staff training and preventive maintenance. Finally, in response to low demand, proposals emphasized the importance of conducting market studies, innovating in products, and applying marketing strategies targeted at new segments. These approaches are consistent with the findings of Muhammad (2025), who demonstrated in a sustainable fashion SME in Indonesia that applying TOC's five-step process helped overcome financial and marketing constraints, optimize supplier coordination, and strengthen business resilience. This experience highlights the importance of prioritizing critical problems and addressing them through structured solutions. Similarly, Pascucci et al. (2022) found in Italian exporting SMEs that financial flexibility and efficient resource management under a TOC framework enhanced international competitiveness and sustainable growth. This precedent underscores that the improvement measures proposed for Piura could contribute not only to internal strengthening but also to expanding opportunities in more demanding markets. In the same line, Mason-Jones et al. (2022) showed that the application of TOC in the renewable energy supply chain in the United Kingdom enabled the identification of logistical barriers and the design of solutions that increased the responsiveness of manufacturing SMEs. This finding resonates with the logistical constraints observed in Piura, whose resolution would be fundamental to sustaining demand satisfaction. Taken together, the improvement proposals reflect a comprehensive approach aimed at transforming limitations into opportunities, driving productivity, quality, and innovation. The challenge for SMEs in Piura lies in translating these recommendations into sustainable actions that strengthen their competitiveness and secure their permanence in an ever-changing market environment.

According to Objective 4, *to determine the benefits in operating times of SMEs in Piura's industrial sector*, the results indicate that addressing the identified constraints can generate positive impacts on efficiency, quality, and competitiveness. Reducing long waiting times in procurement streamlines planning and production, by which means minimizing delivery delays and enhancing customer satisfaction—an essential factor for the survival of these organizations. Likewise, more efficient warehouse management reduces costs associated with excessive or insufficient inventories, while investment in strategies to stimulate demand strengthens revenues and consumer relationships. The implementation of a robust quality management system also emerges as a key benefit, as it ensures consistency in products or services, reduces errors and reprocessing costs, and reinforces customer trust in the brand. Furthermore, the documentation and standardization of processes provide clarity and internal coherence, which facilitates staff performance and enhances organizational coordination.

These results are consistent with Widnyana et al. (2021), who, after analyzing more than four million SME cases in Indonesia, concluded that overcoming financial constraints through TOC enhances capital allocation and strengthens performance, particularly when supported by strategic partnerships. This evidence underscores that the benefits of optimizing time and resources extend beyond operational efficiency, directly impacting financial robustness. In the same vein, Manzoor et al. (2021) demonstrated in rural Pakistani SMEs that access to financing, when articulated with TOC, fosters employment, income generation, and community sustainability. This precedent illustrates that the advantages of reducing times and optimizing operations also translate into positive social effects, reinforcing the local economic fabric—an aspect highly relevant to the Piura context. Finally, Phan (2022), in a study of more than 2,500 Vietnamese SMEs, showed that financial constraints limit labor benefits, whereas the application of TOC improved sustainability and competitiveness in international markets. This convergence of evidence confirms that the benefits expected in Piura are not confined to internal efficiency but also extend to labor conditions and the projection toward broader markets. In conclusion, the benefits identified for Piuran companies highlight the potential to transform current constraints into opportunities for development.

Reducing lead times, optimizing resources, and improving quality and customer satisfaction constitute a solid foundation for achieving greater profitability and securing sustainable growth.

Theoretical contribution

Beyond its empirical findings, this study makes a theoretical contribution by extending and validating the applicability of the Theory of Constraints (TOC) within Latin American micro and small enterprise contexts. The results demonstrate that the TOC framework—originally developed for large-scale industrial environments—retains explanatory power and operational relevance in smaller, resource-constrained organizations. This confirms that the systemic logic of identifying, exploiting, subordinating, and elevating constraints is universally applicable when adapted to local business realities. Moreover, by evidencing how logistical, managerial, and technological limitations interact in emerging economies, this research bridges a gap in the global literature and provides a conceptual foundation for future studies on productivity and competitiveness in developing regions.

Policy implications

The findings of this research carry significant implications for public policy in Peru, particularly regarding the institutional frameworks led by PRODUCE, CEPLAN, and MINCETUR. The evidence suggests that the structural and logistical constraints identified in Piura's industrial SMEs are not isolated management issues but systemic weaknesses that require coordinated governmental support. In this regard, public programs should prioritize the technological modernization of productive processes, the standardization of quality systems, and the development of managerial capacities among small entrepreneurs. Furthermore, integrating the Theory of Constraints (TOC) into regional competitiveness and innovation policies could help optimize resource allocation and improve the efficiency of local value chains. By aligning enterprise-level improvement tools with national productivity strategies, policymakers can foster a more resilient and sustainable SME sector that contributes to employment, formalization, and balanced territorial development.

Study Limitations

This study presents certain methodological limitations that must be acknowledged. First, the sample size was relatively small, which restricts the ability to fully generalize the findings to the entire population of Piuran companies. Second, the information was collected primarily through self-reported questionnaires, which may introduce biases derived from the perceptions of entrepreneurs and managers. Moreover, the study did not incorporate detailed financial indicators—such as cash flows, profit margins, or liquidity ratios—that would have enabled a more comprehensive assessment of the economic impact of TOC implementation. These limitations do not invalidate the results obtained but do call for cautious interpretation, emphasizing their exploratory character. Beyond the aforementioned constraints of sample size and potential self-report bias, additional limitations must be noted. First, the research relied exclusively on surveys without triangulation through interviews or the analysis of real financial indicators (e.g., cash flows, profitability margins, or liquidity ratios), which restricted the depth of the economic analysis. Second, external contextual factors such as public policies, inflation, or macroeconomic conditions were not considered, despite their potential influence on the constraints faced by SMEs. As a final point, given the exploratory nature of this study, the results should be interpreted with caution and validated in future research employing larger samples and mixed-method designs.

Future Research Projections

Building on the results achieved, several avenues for future research emerge. A promising direction lies in the application of process simulation methodologies to quantify more precisely the impact of TOC on the reduction of operating times. It is also relevant to explore the integration of TOC with complementary approaches such as Lean Manufacturing or Six Sigma, in order to further enhance efficiency and quality in SMEs. Future studies should additionally incorporate financial and sustainability metrics, thereby enabling a broader assessment of benefits that encompasses not only operational productivity but also the economic and social resilience of enterprises in regional contexts such as Piura. Therefore, the Theory of Constraints not only enhances operational performance but also acts as a catalyst for institutional learning and strategic

resilience among small enterprises operating under resource scarcity. These findings confirm Goldratt's original postulate that system performance depends on the identification and resolution of its most binding constraint, reaffirming the universal validity of TOC's systemic logic in emerging economies.

CONCLUSIONS

The findings of this research demonstrate that the application of the Theory of Constraints (TOC) has a significant and measurable impact on the operational efficiency of micro and small enterprises (MSEs) in the industrial sector of Piura, Peru. By identifying and addressing the primary bottlenecks—mainly logistical and technological in nature—firms were able to substantially reduce operating times, optimize resource utilization, and improve process coordination. The evidence revealed that inefficiencies were largely associated with non-standardized procedures, empirical management practices, and limited technological support. Implementing TOC's five focusing steps enabled enterprises to overcome these structural barriers, generating positive effects on production capacity, product quality, and customer satisfaction. Consequently, TOC emerges as a viable and adaptable management framework for small-scale industrial contexts characterized by constrained resources and high variability in demand.

From a theoretical perspective, this study reinforces the notion that TOC constitutes a comprehensive approach to organizational improvement grounded in systems thinking. It provides empirical validation that eliminating constraints at their root level leads to systemic optimization, aligning operational objectives with strategic goals. The integration of tools such as Poka Yoke, Total Productive Maintenance (TPM), and SMED further supports continuous improvement and strengthens interdepartmental collaboration. Moreover, the study expands the empirical scope of TOC by demonstrating its applicability beyond large manufacturing firms, extending its utility to emerging economies where productivity and competitiveness depend on efficient resource allocation and adaptive learning. These findings contribute to the ongoing academic debate on the relevance of constraint-based management in dynamic, resource-limited environments.

From a practical standpoint, the results emphasize that the systematic use of TOC can serve as a cornerstone for improving performance and sustainability in the industrial MSE sector. Enhancing supplier coordination, adopting digital tools for production planning, and implementing certified quality management systems are essential strategies for consolidating the gains derived from TOC implementation. Likewise, promoting a culture of continuous improvement and participatory problem-solving is crucial to ensure long-term results. Policymakers and regional development agencies are encouraged to support MSEs through training programs, technical assistance, and financial mechanisms that facilitate the adoption of constraint management principles. Such interventions would contribute not only to higher productivity and competitiveness but also to inclusive economic growth and regional industrial resilience.

Finally, this research lays the groundwork for future studies aimed at integrating TOC with complementary methodologies such as Lean Manufacturing, Six Sigma, and digital transformation frameworks. Exploring these synergies could yield more comprehensive models of operational excellence adapted to the realities of small and medium-sized enterprises in Latin America. In this sense, the Theory of Constraints should not be regarded as an isolated method but rather as an evolving philosophy of management that promotes efficiency, innovation, and sustainability across all levels of organizational functioning.

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INSTRUMENT FOR IDENTIFYING CONSTRAINTS AFFECTING SME PROCESSES

I. ORGANIZATION

1. Indicate the sector in which your company operates:
 - ☐ Manufacturing or Production
 - ☐ Services
 - ☐ Commerce
 - ☐ Other: _____
2. Specify the number of employees in your company:
 - ☐ 1–5 employees
 - ☐ 6–20 employees
 - ☐ 21 or more employees
3. How long has your company been in operation?
 - ☐ Less than 1 year
 - ☐ 1–5 years
 - ☐ 6–10 years
 - ☐ 11–20 years
 - ☐ More than 20 years
4. The premises where your company operates are:

Condition of the premises	Inadequate	Moderately adequate	Adequate
Owned	☐	☐	☐
Rented	☐	☐	☐
Lease-to-own	☐	☐	☐

II. PROCESSES

1. Indicate which areas your company has. Check those that apply and specify the intensity of the problems observed:

Area / Problem	Excessive time	Moderate time	Limited time	High problems	Moderate problems	Low problems
Administration	☐	☐	☐	☐	☐	☐
Accounting	☐	☐	☐	☐	☐	☐
Logistics	☐	☐	☐	☐	☐	☐
Warehousing	☐	☐	☐	☐	☐	☐
Procurement	☐	☐	☐	☐	☐	☐
Distribution	☐	☐	☐	☐	☐	☐
Transportation	☐	☐	☐	☐	☐	☐
Human Resources	☐	☐	☐	☐	☐	☐
Production	☐	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐	☐
Quality Control	☐	☐	☐	☐	☐	☐
Sales	☐	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐	☐

2. Indicate which of the following problems your company faces (you may check more than one):

☐ Failures in the logistics system (procurement, warehousing, inventory, distribution, transportation)

- ☐ Inadequate personnel
- ☐ Obsolete technology
- ☐ Internal norms and policies
- ☐ Low capacity to meet demand
- ☐ Limited demand
- ☐ Insufficient working capital
- ☐ Other: _____

3. According to your resources, processes, and products, rate the following:

Aspect	Poor	Fair	Good	Very Good
Workforce	☐	☐	☐	☐
Machinery and equipment	☐	☐	☐	☐
Materials	☐	☐	☐	☐
Infrastructure	☐	☐	☐	☐
Workspace	☐	☐	☐	☐
Process activities	☐	☐	☐	☐
Product or service	☐	☐	☐	☐

4. Do you have established times, standards, or averages for carrying out your activities or processes?

- ☐ No
- ☐ In some
- ☐ In most
- ☐ In all

If so, indicate how they are determined:

- ☐ Empirically
- ☐ By applying techniques

5. Do your products or services meet customer demand?

- ☐ Yes
- ☐ No

6. How would you rate the quality of your product or service for the customer?

- ☐ Poor
- ☐ Fair
- ☐ Good
- ☐ Very Good

III. COMMENTS

Please provide comments on this survey, indicating which additional aspects you consider important and what solutions you would propose to address your problems: