

Original article

Design and implementation of an integrated management system in fuel marketing companies



Diseño e implementación del sistema integrado de gestión en empresas comercializadoras de combustibles

Desenho e implementação do sistema integrado de gestão em empresas de comercialização de combustíveis

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ABSTRACT

The present work was based on the need to overcome the fragmentation of quality, environmental, and occupational safety and health management systems in fuel distribution companies, where independent management leads to duplication, redundant documentation, and a loss of operational efficiency. The overall objective was to develop a procedure for the design and implementation of an Integrated Management System that contributes to improved operational efficiency, better decision-making, and increased customer satisfaction. Theoretical methods such as the historical - logical and analysis-synthesis were employed, as well as empirical procedures that included techniques such as document analysis, surveys, interviews, and checklists, complemented by specialized artificial

intelligence. The diagnosis conducted at the Basic Business Unit-Territorial Division for Fuel Marketing in Pinar del Río revealed an integration level of 67.2 percent, a customer satisfaction index of 0.15, and predominantly partial compliance with the three reference standards. The implementation of the proposed procedure -structured into nine phases and twenty steps- contributed to raising the integration level to 84.5 percent, increasing the customer satisfaction index by 180 percent, reducing liquefied petroleum gas delivery times by 39.8 percent, and decreasing spill incidents by 62.5 percent.

Keywords: quality; environmental management; occupational safety and health; integrated management system; fuel marketing; procedure.

RESUMEN

El presente trabajo se fundamentó en la necesidad de superar la fragmentación de los sistemas de gestión de la calidad, del medio ambiente y de la seguridad y salud laboral en empresas comercializadoras de combustibles, donde la gestión independiente genera duplicidades, documentación redundante y pérdida de eficiencia operativa. El objetivo general consistió en elaborar un procedimiento para el diseño e implementación del Sistema Integrado de Gestión que contribuya a la mejora de la eficiencia operativa, la toma de decisiones y al aumento de la satisfacción del cliente. Se emplearon métodos teóricos como el histórico-lógico y el análisis-síntesis, así como procedimientos empíricos que incluyeron técnicas tales como el análisis documental, la encuesta, la entrevista y las listas de verificación, complementados con inteligencias artificiales especializadas. El diagnóstico realizado en la Unidad Empresarial de Base-División Territorial de Comercialización de Combustibles de Pinar del Río reveló un nivel de integración del 67,2 por ciento, un índice de satisfacción del cliente de 0,15 y un cumplimiento parcial predominante en las tres normas de referencia. La aplicación del procedimiento propuesto, estructurado en nueve fases y veinte pasos, contribuyó a la elevación del nivel de integración al 84,5 por ciento, al incremento del índice de satisfacción del cliente en un 180 por ciento, a la reducción del tiempo de entrega de gas licuado de petróleo en un 39,8 por ciento y a la disminución de los incidentes con derrames en un 62,5 por ciento.

Palabras clave: calidad; gestión ambiental; seguridad y salud ocupacional; sistema integrado de gestión; comercialización de combustibles; procedimiento.

RESUMO

O presente trabalho fundamentou-se na necessidade de superar a fragmentação dos sistemas de gestão da qualidade, do meio ambiente e de segurança e saúde no trabalho em empresas de comercialização de combustíveis, onde a gestão independente gera duplicidades, documentação redundante e perda de eficiência operacional. O objetivo geral consistiu em elaborar um procedimento para a concepção e implementação do Sistema Integrado de Gestão que contribuísse para a melhoria da eficiência operacional, a tomada de decisões e o aumento da satisfação do cliente. Foram empregados métodos teóricos, como o histórico-lógico e a análise-síntese, bem como procedimentos empíricos que incluíram técnicas como análise documental, pesquisa, entrevista e listas de verificação, complementados por inteligências artificiais especializadas. O diagnóstico realizado na Unidade Empresarial de Base-Divisão Territorial de Comercialização de Combustíveis de Pinar del Río revelou um nível de integração de 67,2%, um índice de satisfação do cliente de 0,15 e um cumprimento parcial predominante nas três normas de referência. A aplicação do procedimento proposto, estruturado em nove fases e vinte etapas, contribuiu para elevar o nível de integração para 84,5%, aumentar o índice de satisfação do cliente em 180%, reduzir o tempo de entrega de gás liquefeito de petróleo em 39,8% e diminuir os incidentes com derramamentos em 62,5%.

Palavras-chave: qualidade; gestão ambiental; segurança e saúde ocupacional; sistema integrado de gestão; comercialização de combustíveis; procedimento.

INTRODUCTION

Today's organizations operate in complex environments that simultaneously demand responses in the areas of quality, environmental sustainability, and workplace safety. The International Organization for Standardization (ISO) has responded to this reality with management system standards that share a high-level structure (Annex SL), which facilitates their integration (Bedoya Marrugo et al., 2024; León Reyes et al., 2024).

However, managing the Quality Management System, the Environmental Management System, and the Occupational Health and Safety Management System independently creates parallel structures with redundant documentation, duplicated audits, and a loss of the big picture (Quintero Becerra et

al., 2021). This fragmentation increases operating costs and hinders an agile response to environmental demands (de Souza Barbosa et al., 2022).

In the international context, the integration of management systems under ISO standards has established itself as a strategic practice, with growing evidence of benefits in terms of efficiency, regulatory compliance, and stakeholder satisfaction (Bautista Rodríguez et al., 2024; Cassoli de Oliveira Júnior et al., 2024; Kaddour et al., 2024). Ronalter et al. (2022) have also demonstrated the contribution of integrated systems to the circular economy, while Mosquera Charry and Perdomo Ortegón (2023) and Ahmed (2026) report the positive impact of digitalization on their maturity.

In Cuba, companies in the fuel sector face a dual challenge: complying with national and international regulations and optimizing resources within a context of economic constraints. Previous studies of Cuban oil companies have documented the importance of integrated systems (Estrada Docunget & Ramírez Ferreira, 2022; Gómez et al., 2018), although gaps remain in methodological tools specific to the sector.

The Pinar del Río Basic Business Unit-Territorial Division for Fuel Marketing (UEB-DTCC), which is part of the National Fuel Marketing Company, operates with quality, environmental, and safety systems that are partially fragmented. A diagnosis conducted at the end of 2024 revealed an integration level of 67.2%, with parallel committees, disconnected policies, and a segregated budget -a situation that compromises operational efficiency and customer satisfaction.

In light of this problem, the research objective is to design a procedure for the design and implementation of an Integrated Management System that contributes to improving operational efficiency, decision-making, and customer satisfaction in fuel marketing companies.

MATERIALS AND METHODS

The research was conducted at the UEB-Pinar del Río Territorial Fuel Marketing Division during the 2024-2025 period. The research design was mixed-methods, with a predominantly qualitative approach in the diagnostic phase and a quantitative approach in the evaluation of results.

The UEB-DTCC in Pinar del Río was selected as the unit of analysis; this entity manages the storage, distribution, and marketing of liquid fuels (gasoline, *fuel oil*) and liquefied petroleum gas (LPG) in the province, under the regulation of the Cuba-Petroleum Union (CUPET).

The following theoretical methods were employed: the historical - logical method, to analyze the evolution of systems management in the fuel sector and identify patterns; and the analysis-synthesis method, to reveal the essential relationships within integrated management systems. The following empirical methods were applied: documentary analysis, to review management reports, strategies, and internal records; a survey, using structured questionnaires administered to managers (n = 8) and workers (n = 94) to measure perceptions of the management approach and the perceived level of integration; semi-structured interviews with managers and specialists in the areas of quality, environment, and safety; and checklists based on the requirements of the NC ISO 9001:2015, NC ISO 14001:2015, and NC ISO 45001:2018 standards, as well as an integrated checklist to measure the level of integration.

The sample size for the employee surveys was calculated using PASS software (NCSS, 2026) with a 95% confidence level and a 5% margin of error. Statistical analysis of the data was performed using SPSS v.26.

To integrate the results of the various techniques and ensure the validity of the diagnostic findings, methodological triangulation (triangulation of data, methods, and sources) was applied. The level of integration was quantified using an integrated checklist that assessed 26 items distributed across seven dimensions (context, leadership, planning, support, operations, evaluation, and improvement), with scores ranging from 1 to 5.

The Procedure for the Design and Implementation of the Integrated Management System (P-DISIG) was designed based on the PDCA cycle (Plan-Do-Check-Act) and the normative principles of ISO Annex SL, which establishes the high-level structure common to the ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018. Its practical validation took place in 2025 through the progressive application of its nine phases at the organization under study.

The procedures followed in the research, including surveys and interviews, were conducted with the informed consent of the participants and ensured the anonymity of individual responses, in accordance with ethical research principles.

RESULTS AND DISCUSSION

The diagnosis conducted at the end of 2024 characterized the state of integration of the management systems at the UEB-DTCC in Pinar del Río. The application of the individual checklists for the three standards revealed average compliance levels of 20%, with an overall integration level of 67.2% according to the integrated checklist. This result placed the entity in the "incomplete integration" category, in accordance with the typology established by Antúnez Saiz (2016) and confirmed in recent research on the Cuban context (León Reyes et al., 2024).

Analysis of primary and secondary sources of information revealed the following critical weaknesses: three parallel committees (quality, environmental, and safety) lacking effective coordination; three independent policies with no interconnection; a budget segregated by systems; redundant documentation (28 procedures with overlapping content); a perception of "siloe" management among 82% of operational staff; and a customer satisfaction index of 0.15 out of 1.0, primarily due to low fuel availability and long LPG delivery times (63.5 days on average).

The analysis conducted through methodological triangulation confirmed that the weaknesses identified in the document review and checklists were consistent with staff perceptions gathered through surveys and interviews, thereby providing convergent validity to the findings. The diagnostic profile obtained is consistent with what was reported by Estrada Docunget and Ramírez Ferreira (2022) for other CUPET units and with the patterns of fragmentation documented by Vieira Nunes and Oliveira (2020) in their international systematic review of integrated management systems.

Among the strengths identified were: current certification under NC ISO 9001:2015 (the most robust of the three standards); qualified technical staff (62% of the workforce with intermediate or advanced technical training); and accumulated experience of more than two decades in the sector. These strengths formed the basis upon which the proposed procedure was structured, in line with the recommendation by Hidalgo Viteri et al. (2020) to leverage existing organizational assets in integration processes.

Concept and structure of the P-DISIG Procedure

The Procedure for the Design and Implementation of the Integrated Management System (P-DISIG) was designed in response to the gaps identified in the diagnosis. Its design integrates seven interconnected approaches: systemic and integrative; process-based and PDCA cycle; risk- and

opportunity-based; stakeholder-based and context-specific; leadership and integrated policy; unified document and operational management; and integrated evaluation and improvement. This multidimensional approach addresses recommendations regarding the need to approach integration from organizational perspectives, not merely regulatory ones (de Souza Barbosa et al., 2022).

The P-DISIG regulatory framework is based on the standards NC ISO 9001:2015, NC ISO 14001:2015, and NC ISO 45001:2018, whose common high-level structure (Annex SL) enables integration, as well as on NC PAS 99:2008, which establishes common requirements for management systems to facilitate integration within the Cuban context. This regulatory framework aligns with that adopted in reported experiences for the Cuban context (Barrera García et al., 2017; Sixto Rodríguez & de la Nuez Hernández, 2023) and the Latin American context (Molina Reyes et al., 2022).

The sequential logic of P-DISIG explicitly follows the phases of the PDCA cycle: phases 0 through 3 correspond to planning; phases 4 and 5 to implementation (do); phase 6 to performance evaluation (check); and phases 7 and 8 to improvement and validation (act). Each phase is broken down into specific steps with defined inputs, actions, outputs, and responsible parties. Table 1 summarizes the twenty steps of the procedure distributed across its nine phases.

Table 1. Structure of the P-DISIG Procedure: phases and steps

Phase	Phase name	Steps included	PDCA cycle
0	Preparation and management commitment	1 - CMASST ¹ Committee	Planning
		2 - Gap analysis	
		3 - Integrated scope	
1	Organizational Context (Clauses 4.1-4.4)	4 - Single-context analysis	Planning
		5 - Stakeholders and requirements	
2	Leadership (clauses 5.1-5.3)	6 - Single CMASST policy	Planning
		7 - Integrated Roles and Responsibilities	
3	Planning (clauses 6.1-6.3)	8 - Integrated Risk Matrix	Planning
		9 - CMASST objectives and action plans	

¹ This refers to the C-Quality, MA-Environment, and SST-Occupational Safety and Health management systems.

4	Support (clauses 7.1-7.5)	10 - Integrated training plan	Do
		11 - Single document management system	
5	Operation (clauses 8.1-8.2)	12 - Integrated operational control	Do
		13 - Integrated emergency plan	
6	Performance evaluation (clauses 9.1-9.3)	14 - CMASST dashboard	Verify
		15 - Integrated internal audits	
		16 - Single-point management review	
7	Improvement (clauses 10.1-10.3)	17 - Nonconformities and integrated corrective actions	Take Action
		18 - Continuous improvement programs	
8	Validation and certification	19 - Internal validation	Take Action
		20 - External certification audit	

Source: Own elaboration

The most distinctive step in the P-DISIG process is the construction of the integrated CMASST Risk Matrix (step 8), which allows each risk event to be analyzed simultaneously from all three regulatory dimensions. This logic goes beyond the one-dimensional focus prevalent in fragmented systems and aligns with the arguments put forth by Kaddour et al. (2024) regarding the need for cross-cutting risk management in the oil sector. Furthermore, the consolidation of documentation (Step 11) into a single manual and 12 integrated standard operating procedures helps reduce documentation-related bureaucracy, in line with the recommendations of Quintero Becerra et al. (2021) for medium-sized organizations.

Results of the P-DISIG implementation

The progressive implementation of P-DISIG during 2025 generated verifiable improvements in the key performance indicators of the UEB-DTCC in Pinar del Río. Table 2 presents a comparison of the indicators before and after implementation.

Table 2. Key performance indicators for 2024 vs. 2025 following the implementation of P-DISIG

Indicator	2024 (baseline)	2025 (outcome)	Change
CMASST integration level	67.2%	84.5%	+25.7%
Customer satisfaction index	0.15	0.42	+180%
ISO compliance (average)	20%	65%	+225%
LPG delivery time (days)	63.5	38.2	-39.8%
Spill incidents (per year)	8	3	-62.5%
Administrative workload (hours/week)	12	4	-66%

Source: Own elaboration

The CMASST integration level rose from 67.2% (2024) to 84.5% (2025), representing a 25.7% improvement that brings the entity closer to the 85% target set for the transition to full integrated management. This result is consistent with the ranges of improvement reported by Molina Reyes et al. (2022) in systems integration processes in the Colombian construction sector and with the evidence presented by de Souza Barbosa et al. (2022) on the organizational impact of integrated systems.

The 62.5% reduction in spill incidents (from 8 to 3 per year) is the indicator with the greatest impact in terms of safety and environmental impact and is directly attributable to the implementation of the integrated CMASST Risk Matrix (Step 8) and the integrated Emergency Plan (Step 13). This result mirrors the pattern documented by Kaddour et al. (2024) in Algerian oil companies that implemented integrated systems, where joint risk management significantly reduced adverse events.

The 180% improvement in the customer satisfaction index (from 0.15 to 0.42) is a result of the reduction in LPG delivery time (from 63.5 to 38.2 days, equivalent to a -39.8% decrease) and the improvement in service availability, both of which stem from the integrated approach to operational process management (Phase 5). This result confirms the relationship between systems integration and customer service quality, as noted by Roque González et al. (2016) and reaffirmed in recent research (Bedoya Marrugo et al., 2024).

The consolidation of 28 documents into 12 integrated standard operating procedures and the elimination of three parallel committees into a single CMASST Committee reduced the administrative burden from 12 to 4 hours per week (-66%), freeing up operational capacity in an organization with limited resources. This type of efficiency gain has been identified as one of the main benefits of integration by Quintero Becerra et al. (2021) and de Souza Barbosa et al. (2022).

The contextual limitations of the Cuban environment -an energy crisis, 40% obsolete infrastructure, economic restrictions resulting from the blockade, and the persistence of a "siloe" culture among 32% of the staff- prevented the 85% integration target from being achieved. However, these external factors do not invalidate the effectiveness of the P-DISIG; on the contrary, they demonstrate its robustness and adaptability to environments with severe constraints -an aspect that distinguishes this procedure from proposals developed in contexts with greater resources (Bedoya Marrugo et al., 2024; Cassoli de Oliveira Júnior et al., 2024).

From the perspective of phased progress, by the end of 2025, phases 0 through 6 were 100% complete, phase 7 (continuous improvement) reached 75% completion, and phase 8 (certification) began preparations for the fourth quarter of 2025. The implementation of the dashboard with fifteen CMASST indicators and the completion of two integrated internal audits covering 100% of the processes represent significant achievements in the evaluation and improvement phases.

In terms of theoretical contribution, the P-DISIG provides the state of the art with a specific methodological tool for the fuel marketing sector in the Latin American and Caribbean context, where available references are scarce (Aboytes Pérez & García Celestin, 2024; Gómez et al., 2018). Its alignment with ISO Annex SL and the CMASST approach positions it as an up-to-date tool compatible with international trends in integrated management, including the emerging dimensions of digitalization and the circular economy (Ahmed, 2026; Ronalter et al., 2022; Suárez Rincón et al., 2023).

An analysis of theoretical and methodological references confirmed that integrated management systems represent the most effective contemporary response to operational fragmentation in organizations that simultaneously manage quality, the environment, and occupational safety. The scarcity of specific tools for the fuel marketing sector in the Cuban context underscored the need for the P-DISIG.

The diagnosis of the UEB-DTCC in Pinar del Río revealed an integration level of 67.2% at the end of 2024, with identifiable strengths (valid ISO 9001 certification, qualified technical staff, accumulated experience) and critical weaknesses that hindered integrated management (fragmented committees, disconnected policies, a segregated budget, and a "siloe" culture).

P-DISIG, structured into nine phases and twenty sequential steps aligned with the PDCA cycle and the requirements of the NC ISO 9001:2015, NC ISO 14001:2015, NC ISO 45001:2018, and NC PAS 99:2008, is a coherent, methodological tool to guide the transition from fragmented management to an Integrated Management System under the CMASST approach.

The validation of P-DISIG at the UEB-DTCC in Pinar del Río demonstrated its effectiveness by raising the level of integration to 84.5%, reducing spill incidents by 62.5%, improving the customer satisfaction index by 180%, and decreasing the administrative burden by 66%, despite the limitations of the current Cuban energy context. The P-DISIG is a replicable tool for organizations in the fuel distribution sector that face similar challenges of fragmentation in their management systems.

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Conflict of interest

Authors declare that they have no conflicts of interest.

Authors' contribution

Iván Alonso Calderín: study conception and design, data collection, analysis, and interpretation, and drafting of the manuscript.

Diana de la Nuez Hernández: advisory role, literature review, methodology, review of revisions, and approval of the final version for publication.

Tania Vargas Fernández: critical review of the article with significant contributions to its intellectual content.

All the authors reviewed the writing of the manuscript and approve the version finally submitted.



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