

Implementation of an integrated management system under the PDCA Cycle to optimize service quality, operational safety and environmental performance of a boutique hotel in the city of Cartagena de Indias

Summary

This project proposes the design of an Integrated Management System (IMS) for a boutique hotel in Cartagena de Indias, based on the PDCA cycle methodology to ensure continuous improvement. Given the need to standardize processes and reduce operational variability, the research adopts a mixed descriptive-propositive approach, encompassing the dimensions of Quality (ISO 9001), Occupational Health and Safety (ISO 45001), and Environmental Management (ISO 14001). Through the application of tools such as checklists, the Nordic Questionnaire, and an environmental aspects matrix, the current situation of the 30 employees in the sample was diagnosed in order to formulate protocols and key performance indicators (KPIs) that optimize guest satisfaction and prevent biomechanical risks. Implementation is projected over four months with a budget of COP \$6,500,000, guaranteeing the economic and operational sustainability of the organization in the Caribbean tourism market.

Keywords: integrated management system (IMS), central axis of the project that combines quality, environment and safety

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Introduction

The boutique hotel industry in Cartagena de Indias is at a critical juncture. There is a 20% variation in quality standards, leading to customer dissatisfaction due to a lack of clear processes.¹ This negatively impacts the health of workers, who suffer from fatigue and musculoskeletal problems due to inadequate occupational risk management.² Furthermore, the improper disposal of waste and effluents is damaging the marine ecosystem.³ The underlying problem is the absence of an Integrated Management System (IMS) that connects continuous improvement, customer service, risk prevention, and environmental responsibility. The core of the problem is the absence of an Integrated Management System (IMS) that connects continuous improvement, customer service, risk prevention, and environmental responsibility.⁴ Without this integration, quality efforts remain isolated and fail to foster a strong organizational culture.

According to Reason,⁵ healthcare organizations often operate in a state of “denied vulnerability,” where a lack of incident reporting is mistaken for safety, preventing the improvement cycle from being fueled by real data to prevent staff burnout. Senge⁶ argues that organizations fail because they focus on optimizing parts (e.g., only nursing or waste management) rather than understanding the interrelationships of the whole, which explains why an SME can be cost-efficient but deficient in occupational health and environmental stewardship.

This results in increased absenteeism, legal risks, and a loss of market share for the industry.⁷ The underlying problem is the lack of an Integrated Management System that connects continuous improvement, customer service, risk prevention, and environmental responsibility.⁴ This leads to increased absenteeism, legal risks,

and a loss of market share for the company in the tourism sector.⁷ If left unaddressed, the situation will worsen: the company will lose competitiveness, labor problems will become chronic, and sustainability will be compromised (ISO, 2024). However, a solution exists: implementing the PDCA cycle, which will improve quality, protect workers, and safeguard the environment.⁸

Capello and Aminzadeh⁹ argue that optimizing decision-making processes in sustainability and ESG (Environmental, Social, and Governance) depends on an integrated digital approach. The underlying problem of the disconnect between customer service and risk prevention lies in the fact that organizations often treat these elements as separate silos, ignoring that social criteria (such as occupational health) and environmental criteria (such as waste management) are, in reality, indicators of the same ethical and operational efficiency. A robust Integrated Management System (IMS) allows environmental and risk reduction regulations to become active management tools, transforming regulatory compliance into a competitive advantage based on transparency and governance.

In addition to the above, the lack of technological integration prevents continuous improvement and environmental responsibility from coexisting. According to Aminzadeh,¹⁰ natural resource management and sustainability now require a multidisciplinary “Engineered System” that uses Deep Learning to connect data from diverse sources. The absence of an Integrated Management System (IMS) in SMEs is not only an administrative failure but also a technical inability to process “SURE complexity” (Scale, Uncertainty, Resolution, and Environment), which fragments the organizational response to occupational and environmental risks. By not integrating advanced analytics tools, companies fail to transform raw data into

resource models that link worker health with operational efficiency and ecological impact.

Finally, the concept of Transfer Learning proposed by Capello & Aminzadeh⁹ offers a solution to the problem of discontinuity in continuous improvement. In healthcare SMEs, the lack of an integrated system prevents leveraging lessons learned in one area (e.g., biosafety) for application in another (such as marine effluent management). This lack of an organizational “learning operator” makes the PDCA cycle inefficient, increasing costs and reducing the reliability of interventions. Integration should not be viewed merely as a set of manuals, but as a knowledge engine that allows for the migration of optimal solutions across domains, reducing staff fatigue through self-adjusting processes based on accumulated prior experience.

How does the implementation of an Integrated Management System (IMS) based on the PDCA cycle allow for optimizing service quality, reducing biomechanical risks, and mitigating environmental impacts in a boutique hotel in the city of Cartagena de Indias during the period 2025-2026?

This research is key because it seeks to reduce instability in Cartagena’s tourism services, where a lack of standardization affects competitiveness.¹ At the social and safety levels, the implementation of an Integrated Management System (IMS) is crucial for reducing workers’ health problems, as the service sector exposes them to risks that affect their well-being.² Regarding the environment, the project is fundamental for meeting sustainability standards in coastal areas and preventing damage to the ecosystem.³ From a technical standpoint, the use of the PDCA cycle allows for a shift from reactive to preventative measures, continuously improving and strengthening the hotel’s profitability and image.⁴ Legally, this also protects the organization from penalties for non-compliance with safety and environmental protection regulations in Colombia.¹⁰

Internationally, studies such as that by García et al.¹ have demonstrated that implementing the PDCA cycle in boutique hotels in Spain reduced variability in customer service processes by 30% through the standardization of activities in the “Do” phase. Similarly, ISO (2024) indicates in its global tourism report that organizations integrating ISO 9001, 14001, and 45001 (“Check”) standards reduce their operating costs by 15% thanks to the reduction of waste and workplace accidents.

In the Colombian national context, Pérez⁴ concluded in his study on Integrated Management Systems that tourism companies using continuous improvement (“ACT”) achieve greater environmental sustainability by aligning their policies with Law 99 of 1993. On the other hand, Sánchez and Torres⁷ analyzed boutique hotels in Cartagena, revealing that 65% of them exhibit a disconnect between occupational safety protocols and the quality perceived by guests, confirming the need for a systemic approach to HSEQ. Finally, Rodríguez² highlights that proactive management of biomechanical risks under the PDCA cycle reduces work-related disabilities by 40% in hotel operational areas.

PDCA Cycle (Continuous Improvement): This is a four-stage iterative methodology that enables self-management and process control. In the Integrated Management System (IMS), it acts as the driving force that ensures quality, environmental, and safety objectives are not static but evolve based on audit results.⁸ Alongside this is the Integrated Management System (IMS): an organizational structure that unifies the requirements of ISO 9001, 14001, and 45001 standards. Its relationship with PDCA is complete, as it uses a single

cycle to manage three distinct dimensions, optimizing resources and time.⁴ Another widely applied concept in this area is HSEQ (Health, Safety, Environment, and Quality), which involves a management model that prioritizes health, safety, the environment, and quality. It is integrated into the PDCA cycle through the planning of preventive controls for workers and the environment, their implementation, and the verification of their legal compliance.¹¹ To validate the above, the process of process standardization is necessary, which consists of unifying criteria for task execution. Within the PDCA cycle, this belongs to the “Do” phase, ensuring that hotel service is consistent and does not depend on improvisation.¹ For this purpose, the environmental aspect is considered an element of hotel activities (for example, water consumption) that interacts with the environment. PDCA allows for “Checking” through indicators to determine whether consumption aligns with the proposed sustainability objectives.³ Regarding high-value situations, such as recognized biomechanical risk—the probability of suffering adverse events due to awkward postures—present in the company’s reality in every activity and task, the PDCA cycle identifies this risk in the “Plan” phase and controls it in the “Do” phase through active rest programs and the ergonomic design of workstations.² Finally, corrective actions influence the decision made to eliminate the cause of a nonconformity. This is the central focus of the “Act” phase, as it closes the cycle by transforming a detected error into an opportunity for improvement for the hotel.¹²

To legally justify the implementation of our Integrated Management System, we relied on five key regulations in Colombia. First, regarding Occupational Health and Safety, Decree 1072 of 2015 clearly establishes in Article 2.2.4.6.8 that “The employer must apply the PDCA cycle for the continuous improvement of the Occupational Health and Safety Management System.” Regarding the environmental dimension, Decree 1076 of 2015, in Article 2.2.7A.1.3, requires that establishments, in this case our boutique hotel, must “implement environmental management systems for the prevention and control of pollution” in the environment.^{13,14} Furthermore, to measure our progress, Resolution 0312 of 2019, in Article 24, requires an annual self-assessment, which will serve as the starting point for the improvement plan based on the PDCA cycle.¹⁰ On the other hand, at a structural level, Law 99 of 1993, in its Article 1, establishes that national economic development “will be guided by universal principles and sustainable development” and the protection of the ecosystem.¹⁵ Finally, to guarantee quality in our operational processes, we align ourselves with the Colombian Technical Standard NTC-ISO 9001:2015, which, in its Introduction 0.3.2, specifies that “the PDCA cycle allows an organization to ensure that its processes have the appropriate resources and management”.⁸

Methodology

This descriptive-propositive and documentary research, under a qualitative approach, sought not only to diagnose the state of the boutique hotel in Cartagena de Indias, but also to propose an alternative structural solution based on international management system regulations.

Research design

A non-experimental, cross-sectional design was used, allowing data collection at a single point in time to describe regulatory compliance variables, health conditions, and environmental aspects without deliberately manipulating the hotel’s operating environment. To ensure alignment with Deming’s continuous improvement model, the methodology was segmented into four operational phases:

- a) Diagnostic Phase (Plan): Initial compliance with the requirements of ISO 9001:2015 and ISO 14001:2015 standards was evaluated to establish the baseline for integration and subsequently design of the Proposal (Act): Based on the gaps identified, actions were formulated to monitor continuous improvement.
- b) Data Collection Techniques and Instruments
- c) Direct Observation: For the analysis of workflows in critical areas.
- d) Checklists: Validated instruments for auditing standards in different management systems.

Results

To assess the status of operational processes, biomechanical risks, and environmental aspects of the boutique hotel, an integrated diagnostic flowchart is used. This flowchart follows the PDCA cycle logic (specifically the planning/checking phase up to diagnosis) and complies with the HSEQ regulations established for the project.

Flowchart: Integrated HSEQ Diagnosis (ISO 9001, 45001, 14001)

This process allows us to identify the gap (gap analysis) between the current critical situation and Colombian legal and technical standards.

Stage 1: Preparation for diagnosis

Start: Decision to implement the SGI based on the PDCA cycle.

Action: Definition of scope (Operational areas: Reception, Cleaning, Kitchen, Maintenance).

Selection of standardized checklists.

Stage 2: Implementation of the dimensional assessment

Quality dimension (ISO 9001:2015):

Evaluation: Variability in service (García et al., 2022).

Checkpoint: Are there standard operating procedures (SOPs)?

Safety and health dimension (ISO 45001 / Dec. 1072):

Evaluation: Biomechanical risks and fatigue (Rodríguez, 2024).

Control point: Application of self-assessment according to Resolution 0312 of 2019.

Environmental dimension (ISO 14001 / Dec. 1076):

Evaluation: Waste and spill management (MinAmbiente, 2024).

Control point: Identification of environmental aspects and impacts in the marine ecosystem.

Stage 3: Analysis of the results

Decision: Does it comply with legal and technical standards?

YES: Keep it and document it as a “Fortress”.

DO NOT: Classify as “Non-conformity” or “Opportunity for improvement”.

Stage 4: Closing the diagnosis and exiting

Action: Consolidation of results in a reference report.

Result: Prioritization of corrective actions (“Act” phase) to reduce absenteeism and loss of market share.

End: Start of SGI planning for 2025-2026.

Technical proposal that integrates the components of the PDCA cycle applied to the boutique hotel of Cartagena, in accordance with the Integrated Management structure (HSEQ) and current Colombian regulations.

This Table 1 details the operational, control and improvement phases for the period 2025-2026.

Table 1 Implementation scheme: Integrated management system (IMS)

PDCA phase	Technical activity (component)	Description of the execution	Expected result/Key performance indicator (KPI)
To make (standardize)	Service protocols, waste management and active breaks	Creation of standardized procedure manuals for customer service, solid waste disposal routes, and workplace exercise schedules.	20% reduction in service variability and decrease in biomechanical risk.
Verify (Monitor)	Establishing key performance indicators (KPIs)	Monthly measurement of: Customer Satisfaction Index (NPS), rate of workplace accidents/illnesses and cubic meters of water/energy saved.	Legal compliance report (Res. 0312) and detection of operational deviations.
Act (Optimize)	Continuous improvement plan and corrective actions	Implementation of adjustments based on the results of the previous phase. Closure of "Non-conformities" detected in the environmental and safety audits.	Closing sustainability gaps and providing legal protection from regulatory bodies.

The dynamics of the PDCA cycle in a boutique hotel in Cartagena

Implementing an Integrated Management System (IMS) using the PDCA (Plan, Do, Check, Act) methodology is not simply a bureaucratic requirement, but a survival strategy for the boutique hotel sector in Cartagena. The dynamics of this system lie in its interconnected and cyclical nature.

In the Standardization (Do) phase, the hotel moves beyond improvisation. By developing clear customer service protocols, it

directly addresses the guest dissatisfaction mentioned by García et al.¹ Simultaneously, by integrating active rest programs and waste management plans, the hotel protects its most valuable asset—its employees—and its most critical environment: the marine ecosystem.

The transition to monitoring (verification) allows management to make data-driven decisions, not assumptions. KPIs act as a thermometer, measuring organizational health, from the reduction of biomechanical incidents to the efficiency in the use of natural resources required by Decree 1076 of 2015.

Finally, the Optimization (Action) phase closes the cycle by transforming errors into institutional learning. This “Continuous Improvement” dynamic ensures that the hotel not only complies with current legislation but can also adapt to the demands of the 2026 tourism market, thus guaranteeing competitiveness, profitability, and socio-environmental responsibility.^{16,17}

Project conclusions

Reducing variability: Standardizing processes in the “execution” phase is the main tool for eliminating the 20% variation in quality standards, guaranteeing a consistent and competitive service.

Mitigation of occupational risks: Proactive management of biomechanical risks through the PDCA cycle has the potential to reduce disabilities by up to 40%, directly improving the physical well-being of operational staff.

Sustainability and Ecosystem: The SGI allows the hotel to move from a negative impact on the marine ecosystem to responsible management of spills and waste, complying with Law 99 of 1993 and protecting the coastal environment of Cartagena.

Operational efficiency: Integrating ISO 9001, 14001 and 45001 standards into a single management cycle allows for an estimated 15% reduction in operating costs through resource optimization and accident prevention.

Legal protection and continuity: Strict compliance with Decrees 1072 and 1076 of 2015, validated through the self-assessment of Resolution 0312, protects the hotel from legal sanctions and guarantees its long-term permanence in the international tourism market.

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Conflicts of interest

The authors declare no competing interests.

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