






CASE STUDY

Action plan proposal to obtain triple certification in a natural gas transportation company

Cintia Guerra Bueno¹, Jorge Lucas Costa Pinheiro¹, Wagner da Silveira Marques¹, Telma Fidelis Fragoso da Silva¹
Alberto Eduardo Besser Freitag¹

¹Candido Mendes University (UCAM), Rio de Janeiro, RJ, Brazil.

How to cite: Bueno, C. G. et al. (2024), Action plan proposal to obtain triple certification in a natural gas transportation company", *Brazilian Journal of Operations and Production Management*, Vol. 21, No. 3, e20242131. <https://doi.org/10.14488/BJOPM.2131.2024>

ABSTRACT

Goal: for large gas transportation companies, it is of strategic relevance to be compliant with ISO 9001, ISO 45001, and ISO 14001 certifications, acknowledging their Integrated Management System (IMS). Based on this context, the purpose of this study was to propose an action plan to obtain triple certification for a Brazilian natural gas transportation company.

Design / Methodology / Approach: the methodology comprised research of applied nature, exploratory and descriptive objectives, qualitative approach, with a single case study investigation strategy, and data collected through triangulation, combining documents, interviews, and field observation.

Results: First, an action plan, which enabled the company to achieve triple certification in ISO 9001, ISO 45001, and ISO 14001 standards. Second, a table correlating seventeen IMS elements with technical and academic literature, and guidance documents of the studied company, making it easier to visualize interdependencies.

Limitations of the investigation: The main one is the generalization limit of the conclusions, models or theories developed from a single case study, used in this work. These limitations do not reduce the importance of the results found, since the proposed action plan enabled the natural gas transportation company to obtain the desired triple certification.

Practical implications: the proposed action plan may support other companies to achieve triple certification.

Originality / Value: no research has been identified in the international literature that deals with triple certification for companies operating in the natural gas transportation market, specifically, the correlation of IMS elements with literature references and guidance documents of the studied company.

Keywords: Integrated management system; Certification; ISO 9001; ISO 45001; ISO 14001.

1 INTRODUCTION

The global demand for natural gas is expected to continue growing in the coming years, especially considering that this raw material is being evaluated as a fuel to promote energy transition (EPE, 2020). Among the possibilities studied worldwide, highlights go to the replacement of more polluting fuels (such as oil derivatives) allowing their substitution or future complementation by sources with lower emissions of greenhouse gases - GHG (biomass, biomethane, hydrogen) and / or coupling to abatement initiatives such as carbon capture and storage (CCS).

In Brazil, the current demand for natural gas is focused on industrial and thermoelectric use. The thermoelectric demand has a more variable consumption profile, while the industrial demand

Financial support: None.

Conflict of interest: The authors have no conflict of interest to declare.

Corresponding author: abesser@uol.com.br

Received: 18 January 2024.

Accepted: 21 August 2024.

Editor: Osvaldo Luiz Gonsalves Quelhas.



This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

is associated with volumes with a stable profile, serving the iron and steel, chemical and petrochemical industry. This demand is in the states of São Paulo and Rio de Janeiro, close to the existing transportation and distribution networks. Besides the use of natural gas for electricity generation and industrial consumption, the fuel still has several applications, among which are highlighted the residential use, automotive and cogeneration. Although there is the role of "free consumer", most of the gas delivered to the final consumer is done by the distributors (EPE, 2020).

Gas is obtained by drilling exploration fields on ocean and continental platforms. After being obtained, it is processed and then transported through a system of gas pipelines. The pipeline infrastructure for natural gas transportation is composed of reception points, delivery points, interconnection stations, compression stations, among others. These facilities, in addition to assuring the operationalization of gas transportation, ensure its safety and protection (ANP, 2020).

Given the global scenario in which natural gas is inserted, it is of strategic relevance that large gas transportation companies are in compliance with the certifications that acknowledge their management system, specifically ISO 9001, ISO 45001 and ISO 14001, ensuring high levels of quality for the products delivered, since the oil and gas industry is exposed to high risks and many strict legal requirements, especially those related to Quality, Health, Safety and Environment (QHSE) and business continuity, requiring high levels of controls focused on operational safety in general. Thus, it is important for large gas transportation companies having an Integrated Management System (IMS) in place with the above-mentioned certifications.

There are some studies on the subject of IMS, such as Vieira and França (2021), who proposed a model for evaluation of the QHSE IMS in a maritime support company, Fernandes et al. (2015) dealing with the required steps to implement an IMS, Mançú et al. (2020) who presented a matrix model for diagnosis and performance evaluation of IMS for QHSE, Gerônimo and Lenzi (2021) who conducted a systematic literature review on knowledge management practices in IMS, Souza and Georges (2020) who developed a study about IMS certifications in environment and workplace safety and sustainability, and Soares (2019) who discussed IMS as a form of management strategy. It is important to highlight that to date no research has been identified in the international literature that deals with ISO 9001, ISO 45001, and ISO 14001 certifications to acknowledge the IMS of companies operating in the natural gas transportation market, what justifies this research.

Many companies adopt internal assessments, audits, and systems for the management of legal requirements, as a thermometer to gauge their compliance with QHSE issues, which leads to the following research question: "How to assess the level of adequacy and integration of the management system of a natural gas transportation company?" This study aims to answer this question by proposing an action plan for obtaining ISO 9001, ISO 45001, and ISO 14001 certifications for a Brazilian natural gas transportation company, which is the objective of the work.

This introductory section is followed by a literature review on ISO 9001, ISO 45001, and ISO 14001 standards and IMS elements from the studied company, the methodology, a case study, results, and discussion, especially the proposed action plan for obtaining triple certification, and conclusion, followed by references.

2 LITERATURE REVIEW

Initially, a brief explanation of the ISO 9001, ISO 45001 and ISO 14001 standards will be presented, based on Pires (2016).

The ISO 9001:2015: Quality Management System standard contributes to the development strategy of process management that will impact the final product/service, providing customer satisfaction for a certified company. This certification brings national and international recognition for the quality of company processes, as it characterizes that the company has good internal management practices (people management, optimization, and controlled costs), with customers, suppliers, and therefore implies in offering a product of quality.

The ISO 14001:2015: Environmental Management System standard addresses the requirements that companies need to meet to strategically structure themselves in the development of actions linked to environmental protection and sustainability, with the establishment of environmental policies being practiced, meeting the needs of environment, organization, and stakeholders.

The ISO 45001:2018: Occupational Health and Safety Management System standard was developed based on data, which estimated that 2.3 million workers died annually due to occupational diseases and accidents (ILO, 2021). Thus, ISO 45001 sought to focus its requirements on improving the processes of companies that wish to have this certification, regarding the issues of Occupational Health and Safety (OHS) of workers directly involved in its processes and others who may be affected by the activities practiced by the company. The method of this certification would be to focus on preventive actions, with the identification of risks and opportunities; and after that, on their management. As a result, the prevention of incidents, injuries, and occupational diseases can be achieved, provided by a healthier and safer work environment.

Next, research related to seventeen elements of the Brazilian natural gas transportation company's IMS will be described in secondary sections.

2.1 Leadership, commitment, and responsibility

Tavares (2019) studied the IMS of Quality (ISO 9001, ISO 14001, and ISO 45001), and the contribution of these three standards to sustainable development and sustainability of companies. A Google Forms questionnaire was applied to a group of decision-makers such as economic agents and some private and public entities operating in Portugal, with the aim of carrying out the identification of challenges in implementing and certifying the IMS.

The involvement and commitment of top management and leadership in the processes of creation and implementation of the OHS policy and objectives, is one of the minimum requirements for the certification process to be fulfilled, according to ISO 45001 standard (Pires, 2016). The research of Araujo and França (2015) addressed a proposal for implementation of an IMS in a small family business, located in the municipality of Duque de Caxias in Rio de Janeiro state. The biggest challenge was to adapt the culture of the organization and its services to customer demands, and achieve excellence, also maintaining competitiveness in the market in which it operates.

2.2 Actions to address risks and opportunities

The market requires that companies' services and products carry with them commitment and compliance not only with international quality standards, sustainability, environment, but also protection of the physical and emotional integrity of their employees. Thus, the implementation of an IMS in QHSE, in addition to meeting these contributions, aims to comply with legal requirements to avoid risks to health and safety of employees of a company, adding value to the organizational culture, especially regarding the development of a safety culture. According to Pires (2016), an important factor addressed by ISO 45001 standard is to increase the awareness of the dangers and risks related to employees' health and safety, by means of training, communication, and an increase in the disclosure of information for a concrete instruction about OHS.

2.3 Objectives

Fernandes et al. (2015) conducted a comparative study between fourteen cases and detailed all the necessary steps for implementation of an IMS, related to standards ISO 9001, 14001, SA 8000 and OHSAS 18001. As a result, a compilation of the cited cases and the stages of implementation of an IMS used by each studied company were presented, as well as the benefits that the organizations would have with the implementation of a management system, since it allows the identification and fulfillment of all needs and expectations awaited by their customers and by all the involved parties.

The implementation of an IMS can be seen as an extraordinary tool, as it enables the use of sustainable development principles in the organization's value chain (Santos et al., 2018). Thus, companies that seek sustainability automatically align their purposes and strategic orientation with the various normative requirements of the three ISOs studied in this paper. Given this fact, certification of the concerned standards expresses not only an internal corporate development, but an importance for society. Bertolino and Couto (2019) argue that the IMS is a form of management that is both effective and efficient, contributing to competitiveness in an organized and sustainable way for the companies that use it. According to Schneider (2015), the tools used in the search for competitive intelligence are a differential for quality customer service and overcoming competitors.

2.4 Design and construction of the facility

The ISO 26000 standard presents a definition on Social Responsibility considered as basis by many companies and by different authors (Faria et al., 2019). In it, by valuing the responsibility of an organization in face of its impacts and decisions, the Brazilian Association of Technical Standards (ABNT) emphasizes an inherent value to the social license to operate (SLO) process: the necessary action by companies in relation to the impacts caused by their facilities, operations, activities, and decisions that evidences the relationship between corporate social responsibility and SLO. According to Martins et al. (2018), ISO 17359 gives an example of parameters by machine type, such as temperature, pressure, fluid flow, noise, vibration, oil characteristic and speed for pumps. Laboratories that have a management system based on ABNT NBR ISO/IEC 17025 must have maintenance plans for their instruments, as well as maintenance records of the maintenance that was already made (Arenhart et al., 2020).

2.5 Resources and infrastructure

The scenario established between the alignment of sustainability practices of an IMS in Environment, Health, Safety and Social Responsibility was examined by Souza and Georges (2020). In their work, the benefits, and opportunities that the implementation of an IMS offers to companies were analyzed, especially regarding sustainability. The authors concluded that an IMS, in addition to improving production processes, contributes to the adequacy of compliance with legal requirements mandatory by companies, favors the optimization of resources, ensures quality for the customer, and helps operations to occur in a less polluting way.

2.6 Competence, training, and awareness

A point considered important in the research of Viera and Junior (2020), was about the relevance of each part of the organization being aware of its role in the management system. As a result, the authors presented the main factors for the implementation of an Occupational Safety and Health Management System (OSHMS) and its alignment with the requirements of ISO 45001 standard. The certification process develops competencies in professionals involved with certification activities and other employees who will perform their daily routines in a certified company (Schneider, 2015).

2.7 Communication and engagement

The organization must promote the entire communication process of the IMS, disclose, make available and monitor compliance with the IMS policy in conjunction with the workforce, as well as maintain external, internal and stakeholder communication, whose record must be made and kept with maintenance, retention, availability, and control of documented information (Santos et al., 2018; Bertolino and Couto, 2019). According to ISO 45001 (ABNT, 2018), internal communication is essential to drive and "ensure that its communication processes enable workers to contribute to continuous improvement".

2.8 Documented information management

Gerônimo and Lenzi (2021) investigated the best knowledge management practices that assist in the implementation of an IMS. The method presented was the critical analysis of the reported articles, in which they highlighted the knowledge management practices that assist in the implementation and maintenance of an IMS. Finally, according to the authors, the results showed a lack of literature, which reinforces the importance of this study.

2.9 Supplier Procurement and Management

Baldassin and da Silva (2021) presented a proposal for supplier assessment, measuring whether suppliers meet ISO 14001 and ISO 45001 standards. As a result, the authors believe to have contributed with the development and validation of an instrument to be used by contracting companies, to validate if, in fact, suppliers meet both ISO standards.

2.10 Operation and Maintenance

For Bertolino and Couto (2019), the implementation of ISO does not aim to bureaucratize companies' processes, bring rigidity, or have the certification in a decorative way. The main goal is to make the IMS be used to bring quality to process management and flexibility to meet the needs of stakeholders, supporting the good operation of the organization.

2.11 Commercialization

Oenning-Soares et al. (2020) cite Christmann and Taylor (2006), which note that suppliers are more likely to choose certification when clients consider management system standards important, leading suppliers to seek certification to secure clients and strengthen their role within the supply chain. The authors argue that buyers rely on ISO certification as a screening device to identify potential suppliers, creating increased preference for certified suppliers.

2.12 Change Management

As per ISO 9001 (ABNT, 2015a), "the organization shall critically analyze and control changes for

production or provision of services to the extent necessary to continuously ensure conformity with requirements". Bertolino and Couto (2019) also point out that impacts may occur on the IMS if changes are made to processes in a manner or unplanned manner. What may lead to potential risk to the health and safety of workers, as well as environmental impacts.

2.13 Emergency Readiness and Response

According to Neto et al. (2019), the ISO-based management system has been growing in organizations. Many have been implementing more than one management system in a simultaneous and integrated way. The constructive collaboration achieved by integrating these systems seeks the satisfaction of stakeholders, protection of the environment, the health and safety of employees, and the control of social impacts that the organization may generate, increasing responsiveness. Thus, the satisfaction of all those who are directly and indirectly involved in the processes can be guaranteed.

2.14 Monitoring, measuring, analysis and evaluation

Bertolino and Couto (2019) emphasize that monitoring and measurement "is an elementary condition to demonstrate the full functioning and effectiveness of an IMS, where the main objective is to identify process steps in the ISO 9001 view, as well as activities from the ISO 14001 and 45001 view".

2.15 Performance

Soares (2019) reported a research based on sampling of twelve companies, focusing on issues related to the production process. The author observed that an IMS influences the improvement of performance indicators, regarding quality and safety of companies located in the so-called Manaus Industrial Pole, located in the north of Brazil.

Vieira and França (2021) presented a model for evaluation of the Quality, Health, Safety and Environment Integrated Management System (QHSEIMS), applied in a maritime support company. They concluded that compliance with legal regulations is important for QHSE performance, associated with employee participation and involvement of the top corporate leadership, which then takes assertive decisions more easily.

The main steps of implementing an OSHMS, based on the international standard ISO 45001, were described by Viera and Junior (2020). The authors argued that during system implementation, diverse strategies can be used to structure the management system. They emphasized that the commitment of top management would be the key point for satisfactory performance of the system, regardless of the adopted strategy.

2.16 Incident and non-conformity management

The Integrated Quality, Safety, Environment and Occupational Safety Management System evaluation model, presented by Vieira and França (2021) and applied in a maritime support company, showed that the result of the evaluation pointed to a good index of conformities, which could be used as a diagnosis for certification of the three standards integrally (ISO 9001, 14001 and 45001).

2.17 Continuous Improvement

According to Napoleão (2018), PDCA (Plan, Do, Check, Act) is a globally recognized method as a continuous improvement tool. It can be used for process improvement, treatment of non-conformities, implementation of standards, and others. Mançú et al. (2020) analyzed the integration and correspondence between the four phases of the PDCA cycle, identified by the authors in sections 4, 5, 6, 7, 8, 9 and 10 of the ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 management systems. The result reported was the structuring of a correspondence matrix model divided into the PDCA cycle phases, with the integration of the above-mentioned sections and their common and specific certifiable requirements of the QHSE management systems that characterized the IMS, composed of 75 requirements and 172 management practices and operating practices.

The certification process tends to contribute to the promotion of continuous improvement and reliability of production systems. Therefore, the quality of the product/service can also be positively impacted, which generates value to the entire integration process. The IMS provides significant tools for the achievement of continuous improvement in processes, employees, communities, and

planet (Souza and Georges, 2020).

The IMS deals by integrating the elements of the three standards: ISO 9001, ISO 14001 and 45001 (Bertolino and Couto, 2019), as shown in Figure 1. It ensures that the specific and individual requirements of each system are met in an integrated manner and independently. The main objective of the IMS is to guarantee to the company the means to plan, develop, check, correct, critically evaluate, and improve its activities related to processes and services quality, which can contribute to the optimization and management of a company. This process is understood as continuous improvement, and it is carried out through PDCA, a method that follows and monitors the results.

According to ISO 14001, the PDCA cycle enables an organization to ensure that the processes inherent to its business are adequately resourced and managed, and that improvement opportunities are identified, and actions taken. The following is the representation of the structure of each standard in the PDCA cycle, extracted from the standards themselves. The ISO 9001 (Figure 2), ISO 14001 (Figure 3) and ISO 45001 (Figure 4) standards already bring in their representations the integration of the clauses with the corresponding PDCA cycle. The numbers in parentheses refer to the sections of the respective standards.

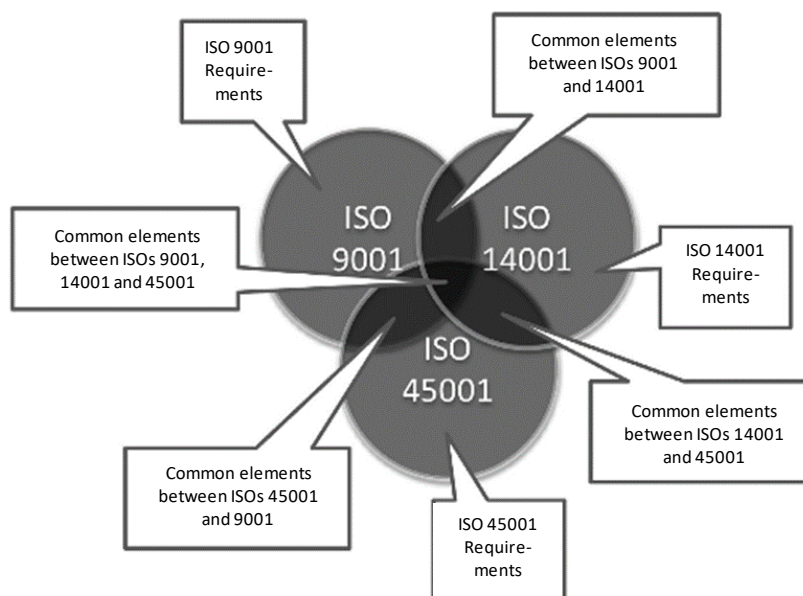


Figure 1 - Diagram of interaction between normative requirements
Source: Bertolino and Couto (2019).

In this work, the steps of the PDCA cycles shown in Figures 2, 3 and 4, will be correlated to the common elements of the three ISO standards analyzed in the proposed action plan to obtain ISO 9001, ISO 45001, and ISO 14001 certifications for a natural gas transportation company. They have common elements, similar or even identical, as shown in Figure 1, whose scheme is related to the triple certification studied in this research.

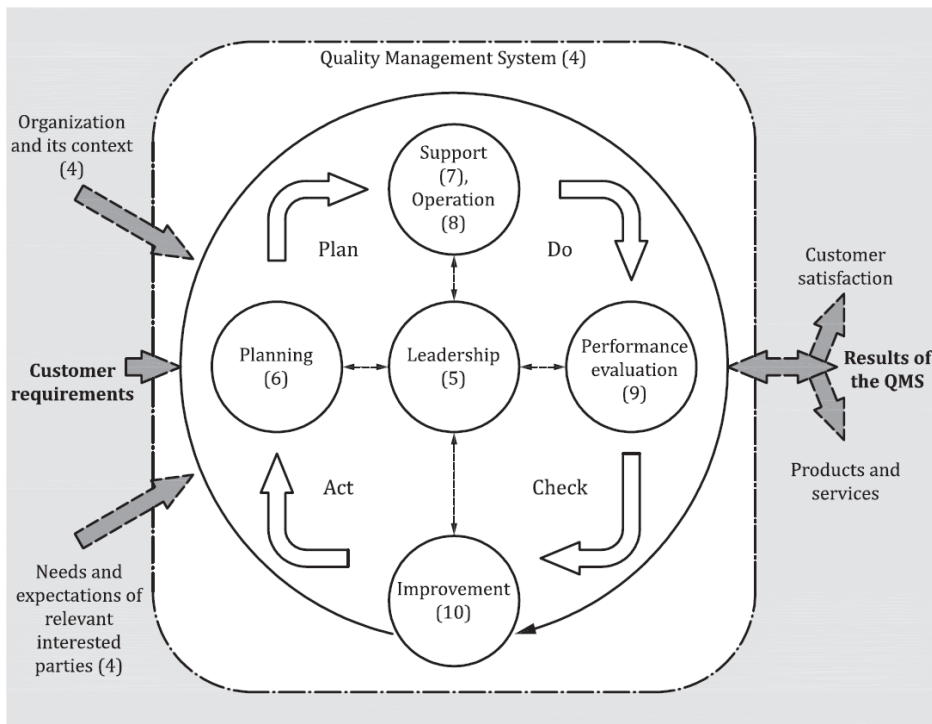


Figure 2 - Representation of the structure of ISO 9001 in the PDCA cycle
 Source: ABNT (2015a)/ISO 9001

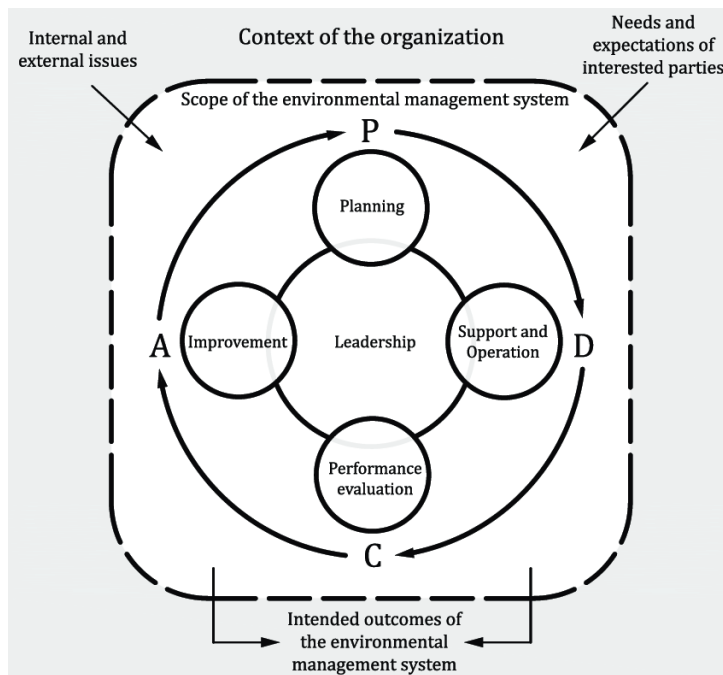


Figure 3 - Representation of the structure of ISO 14001 in the PDCA cycle
 Source: ABNT (2015b)/ISO 14001

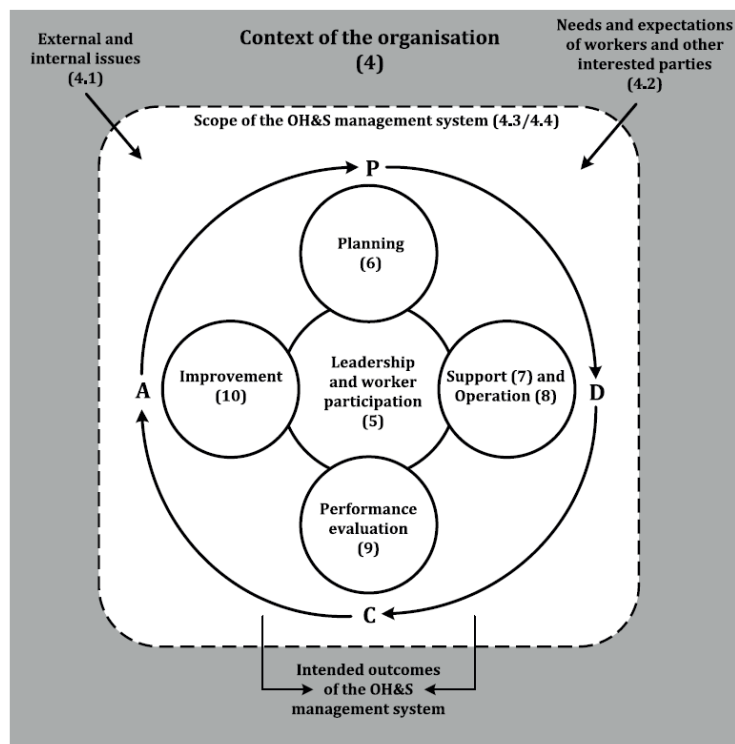


Figure 4 - Representation of the structure of ISO 45001 in the PDCA cycle
Source: ABNT (2018)/ISO 45001

3 METHOD

The main objective of the methodology is to explain the entire set of methods used, data collection instruments, the way they were analyzed, and the path taken from the beginning to the end of the study, to inform the reader of the general work construction process and achieve the proposed end of the investigation (Fonseca and Moraes, 2017).

3.1 Research classification

This study follows the classification proposed by Turrioni and Mello (2012) for scientific research in production engineering: nature, objectives, approach, and method.

- a) Nature: applied research, characterized by its practical interest, that is, that the results are applied or used immediately in the solution of problems that occur. The action plan developed for triple certification was used in the analyzed company.
- b) Research objectives: exploratory and descriptive. Exploratory because they aim to provide greater familiarity with the problem to make it explicit or to build hypotheses. It involves a bibliographical survey and interviews with people who have had practical experience of the problem being investigated. Data collection was carried out through observation, interviews, and document evaluation, taking advantage of the fact that one of the authors works at the company. Descriptive because it outlines what it is and aims to describe the characteristics of a particular population or phenomenon or to establish relationships between variables. It involves the use of standardized data collection techniques, such as questionnaires and systematic observation. A specific situation was analyzed, such as the organization's action plan to implement the IMS and obtain triple certification. Attention is also drawn to the consulted bibliographic information and, especially, the emphasis that was given to the crossing of documentary reports with the applicability of the three standards - ISO 9001, ISO 14001, and ISO 45001, adopted for the desired certification and the IMS.
- c) Approach: qualitative, which considers that there is a dynamic relationship between the real world and the subject, that is, an inseparable link between the objective world and the subjectivity of the subject that cannot be translated into numbers. It does not require the use of statistical methods and techniques. The natural environment is the direct source for data collection and the researcher is the key instrument. When studying the implementation of the IMS, the benefits generated by the implementation process were analyzed, as well as the resources used in the process, observing human behavior, since it makes the systematic change of culture and the abandonment of old

practices.

- d) Method: case study, which involves the in-depth and exhaustive study of one or a few objects in such a way as to allow a broad and detailed knowledge of them. The case study is used in many situations to contribute to our knowledge of individual, group, organizational, social, political, and related phenomena, and begins with a review of the literature (Yin, 2015). Of the four existing types of case studies, this research adopted as its research strategy the single case study, particularly the common case, in which the goal is to capture the circumstances and conditions of an everyday situation because of the lessons it can provide about social processes related to some theoretical interest.

In general, convenience, access to data and geographical proximity are the main criteria for selecting the case, which applies to this research, where one of the authors works at the studied company.

3.2 Data collection techniques

According to Voss et al. (2002), an underlying principle in case study data collection is triangulation, that is, the combination of different methods to study the same phenomenon. Woodside and Wilson (2003) state that triangulation often includes direct observation of the researcher in the case environment, probing through questioning of the case participants for explanations and interpretations of the operational data, and analysis of written documents and the locations where the case study environment takes place. Triangulation in this work was achieved through interviews, observation, and archival information (documentation), as described below.

- a) Interviews: there were several conversations with the professional who led the certification process, using the researcher's diary for records. The aim was to obtain information about the origin of the primary requirement for implementing the certification process, how the group of internal auditors was selected, the development of the implementation schedule and the implementation of the main points to meet the requirements of the ISO standards, the content of the meetings to meet the schedule (review of processes, training of employees), the main topics to be addressed in the workshop and feedback after the event, the preparation of the areas involved in the audit to respond to the certification body in the external audit, and the action taken in the processes following the results of the internal audit.
- b) Participant observation: one of the authors of this paper is a Health and Safety Analyst at the Brazilian natural gas transportation company. She is part of the Health, Safety and Environment sector, which managed the entire triple certification process, participating and monitoring the actions. The author is also a member of the internal auditor's team, where she has audited sectors of the company's headquarters, documents and the operational areas of the bases involved in the certification. She works on the IMS and the tools involved in the process, such as dealing with the Non-Conformity (NC) action plan and improvements, using a system called "ObraSoft" where the NCs are managed.
- c) Archival information (documentation): Various documents aligned to the theme were analyzed, including legal documentation and reports from the Health, Safety and Environment area, minutes of meetings, procedures, manuals, company forms, as well as internal and external audit reports, follow-up of nonconformity records and analysis of action plans, among others.

The IMS, which is being implemented, establishes the policies, objectives, and processes to achieve the company's goals, also considering the external and internal issues pertinent to its purpose and that affect its ability to achieve the results intended by this system. Policies that integrate the IMS: POL-001 Code of Professional Ethical Conduct, POL-002 Anti-Bribery and Anti-Corruption, POL-003 Sustainability, POL-004 Financial Investments, POL-005 Counterparty Credit Risk Management, POL-006 Information Security, POL-007 Supplies, POL-008 Image Crisis Management, POL-010 Information Disclosure, POL-011 Internal Audit, POL-012 Related Party Transactions and, POL-013 Positive Environment and Workplace.

The management of the processes and of the IMS can be achieved by using the PDCA cycle, with a general focus on risk-taking mentality, to take advantage of opportunities and prevent undesirable outcomes. The IMS is structured through 17 elements: 1) Leadership, commitment and responsibility, 2) Actions to address risks and opportunities, 3) Objectives and goals, 4) Design and construction of the facility, 5) Resources and infrastructure, 6) Competence, training and awareness, 7) Communication and engagement, 8) Documented information management, 9) Supplier Procurement and Management, 10) Operation and maintenance, 11) Commercialization,

12) Change Management, 13) Emergency Readiness and Response, 14) Monitoring, measuring, analysis and evaluation, 15) Performance, 16) Incident and non-conformity management and, 17) Continuous Improvement.

Each of these elements is based on a certain requirement of ISO 9001, ISO 14001, and ISO 45001 standards, but what deserves attention is continuous improvement. The commitment towards continuous improvement should be encouraged at all levels of the organization.

3.3 Investigation procedures

According to Marconi and Lakatos (2019), the procedures are characterized as more concrete steps of the investigation. Interaction for implementation took place through periodically scheduled meetings with the external consultancy. The consultancy was based at the company's offices. Apart from the meetings, whenever necessary, those directly involved in the certification process accessed the consultancy. At the certification audit, the consultants participated as observers. Other meetings took place with the internal areas for alignment. Many follow-ups took place with the company's departments after the results of the internal audit and after the Gap Analysis. These two processes enabled failures to be filtered out, for example by pointing out procedures, forms and other documentation that should be improved. It's worth noting that the company had been preparing for a future certification process since it was founded in 2017. All the documentation already existed; it was just improved to meet certification requirements.

4 RESULTS AND DISCUSSION

The results are described in secondary sections, first the action plan for obtaining triple certification and second, a correlation between seventeen IMS elements, references from the literature, and documents from the studied company.

4.1 Action plan proposal to obtain ISO 9001, ISO 14001 and ISO 45000 certifications

The action plan was designed to be carried out through the following steps:

- a) Internal Audit: An audit carried out by the studied company on its own initiative, known as a first-party audit to evaluate and survey improvements in its processes.
- b) GAP Analysis: Verification audits can be carried out by the body that is going to certify the company, or another body that is qualified to assess the company's management system, showing the main faults for correction before starting the certification process. This was chosen by the studied company to identify improvements in the process and in documents. In this case, the company wanted to know the opinion of a third party (a specialist in the process), apart from the consultancy it had hired.
- c) Audit phase 1: It covers the certification process, with the phase 1 audit being for verifying the Management System documents only. All the optional phases were carried out by the company to ensure that it was on the right path for obtaining the certifications.
- d) Certification Audit: It is a mandatory process that includes a cycle of maintenance over three years, with each maintenance being annual.

The main milestones for obtaining triple certification of the IMS by the natural gas transportation company are shown in Figure 5.

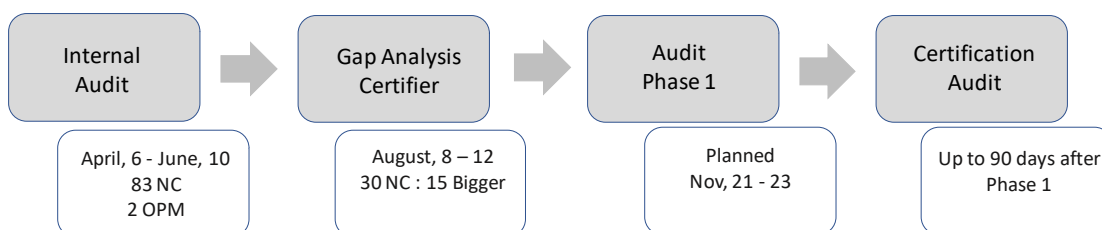


Figure 5 - Main milestones to obtain certification

Source: Designed from internal reports of the studied company (2022).

4.2 Internal Audit

In compliance with the internal audit program, between the months of April and June 2022, internal audits were carried out to verify the compliance of the natural gas transportation company

with the IMS and promote continuous improvement, established from previously disclosed criteria and premises. The team of trained internal auditors, when analyzing the company's documents and operational processes, raised a total of 83 Non-Conformities (NC). These were reported and recorded in an internal tool for managing NC. For the treatment of 83 NC, 259 unfolded corrective actions were generated (Figure 6).

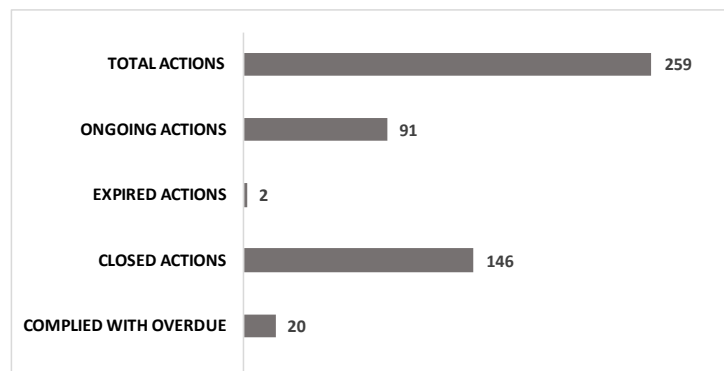


Figure 6 - Overall Status - Internal Audit

Source: Designed from internal reports of the studied company (2022)

For the advisory and consulting services in the implementation of the IMS based on the ABNT NBR ISO standards applicable to the aspects of quality, environment, safety, and occupational health (ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018), a company was hired on a temporary basis for a period of 12 months. The focus of the contract was to provide support for the improvement of procedures, manuals and forms for Health, Safety and Environment and other areas of the company, as well as to develop the creation of new documents to adapt the system to the needs of the company.

Being the main premise of the contracted company, the structuring to optimize material and human resources of the natural gas transportation company and rationalize the time to be spent in its implementation, the hired company proposed the following scope that was carried out:

- a) Initial assessment: initial evaluation of the existing documentation in the company's management system, to identify the guidelines that meet the normative requirements under consideration, and define which ones need to be revised and adapted, and which ones should be developed;
- b) Elaboration/adequacy of the corporate structure: this stage was characterized by the structuring of the documentation at the corporate level and applicable to all units. The documentation must compose the Manual of the Integrated Management System, contemplating in its attachments the specific guidelines for each undertaking, if necessary;
- c) Implementation: this stage comprises the continuous work of consultants, with a Project Management Office (PMO) for management and monitoring reports, allied to support in the preparation of procedures and forms, in general, and subsequent guidance for implementation in the company's various departments and undertakings, including monitoring and verification of the records generated.

4.3 Gap Analysis - Certifying Agency

In August 2022, the certifying company conducted the so-called Gap Analysis, which is an evaluation of the company's IMS. Although this assessment is performed by the certification body, it is not part of the certification audits. The objective is to carry out a specific audit, to diagnose whether the existing management system is prepared for a certification, in this case the integrated multi-site according to international accreditation rules (ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018).

The Gap Analysis took place as follows: (i) all the requirements of the previously mentioned standards were analyzed and the company's compliance with each one was verified; (ii) it was carried out in a documental form and with visits to the operational areas, focusing on the IMS; and (iii) the evaluations mentioned in item ii lasted one week. In a final report issued by the certifier, a total of 30 findings were identified, 15 of which were major Non-Conformities (NC). For the treatment of these NC, 150 unfolded corrective actions were generated. Figure 7 shows the status of the external audit procedures.

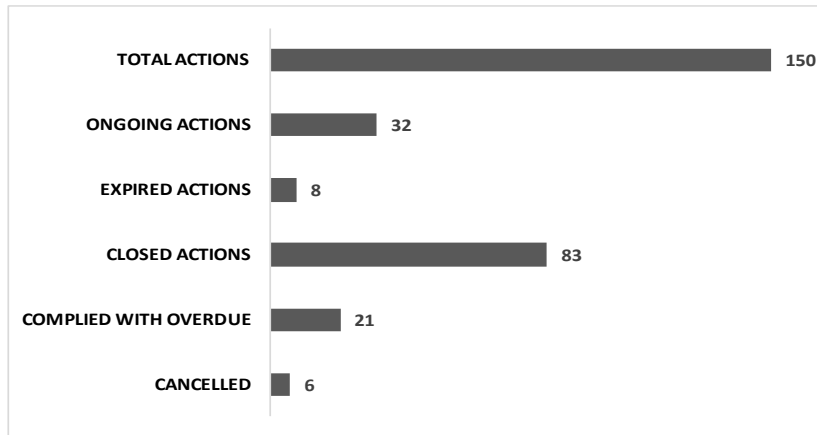


Figure 7 - Overall Status - External Audit

Source: Designed from internal reports of the studied company (2022)

4.4 Phase 1 audit or initial audit

The phase 1 audit or initial audit, has its scope focused on document verification, encompassing policy establishment, scope confirmation and analysis of the internal audit process. It is analyzed whether the company has an audit plan, the records of its reports are checked, the existence of a schedule for conducting the audits is verified, and finally, the evidence of the company's record and monitoring of treatment of Non-Conformities generated in the development of the process and its critical analysis is confirmed.

4.5 Phase 2 audit or certification audit

In phase 2 the auditor visits the company and conducts interviews with the teams, to evaluate the development of the IMS. In this stage it is verified if the documentation presented in phase 1 is in conformity and applicable to the processes that are being analyzed in phase 2.

It is worth mentioning that the theme being studied is an action plan proposal for obtaining ISO 9001, ISO 14001, and ISO 45001 certifications. The development of the certification process was finalized in the phase 1 audit. This phase gives an overview of the diagnosis of the management system implementation. It is not the scope of this work to develop the theme of maintenance audits that occur in the 2nd and 3rd year of certification.

The triple certification for "natural gas transport in pipelines" was obtained through certificates BR039720 (ISO 9001:2015), BR039721 (ISO 14001:2015) and BR039722 (ISO 45001:2018), issued by BV (2022) on March 27, 2023, valid until March 26, 2026.

4.6 Correlation between IMS elements, references, and documents

To seek better understanding of how the 17 IMS elements are treated, they were correlated to references from the literature, as well as to documents prepared by the studied company, to meet the requirements that are imposed for the certification process in ISO 9001, ISO 14001, and ISO 45001 standards (Table 1).

Table 1 - Correlation between IMS elements, references, and documents

IMS Elements	References	Documents
1-Leadership, commitment, and responsibility	Tavares (2019), Pires (2016), Araujo and França (2015)	POL-003 – Sustainability; PRO-SM-029 – Non-conformity Management and Corrective Action; PRO-ME-007 - Customer Satisfaction Survey; PRO-ME-009 - Non-conformity Gas Management; ITC-CC-006 - Gas Quality
2-Actions to address risks and opportunities	Pires (2016)	PRO-SM 010 - Hazard and Risk Management; PRO-SM-034 - Environmental aspects and impacts management; PRO-SM-001 - Legal Requirements Management Guidelines; PRO-SM-027 - Environmental Licensing; NOR-024 - Risk Management; PRO-SM-030 - Critical Analysis; PRO-SM-044 - Behavioral Audit; PRO-GE-007 - Regulatory obligations

IMS Elements	References	Documents
3-Objectives	Fernandes et al. (2015), Santos et al. (2018), Bertolino and Couto (2019), Schneider (2015)	PRO-SM-030 – IMS Critical Analysis; NOR-030 - Management System Objectives and Goals
4- Design and construction of the facility	Faria et al. (2019), Martins et al. (2018), Arenhart et al. (2020)	NOR-PR-026 – Project Development and Approval Rules; PRO-PR-002 – Contracting Projects; PRO-PR-003 – Designing Projects; PRO-PR-004 – Implement Projects; PRO-PR-005 – Managing Contracts; PRO-PR-006 – Closing Projects
5-Resources and infrastructure	Souza and Georges (2020)	PRO-SM-031 - HSE Inspections; PRO-SM-010 - Hazard and Risk Management; PRO-SM-034 - Environmental Aspects and Impacts Management
6-Competence, training, and awareness	Viera and Junior (2020), Schneider (2015)	PRO-GG-005 - Training System; NOR-013 - People and Management; PRO-SM-009 - Golden Rules; PRO-SM-022 - Daily Health, Safety and Environmental Dialog; PRO-SM-044 - Behavioral Audit
7-Communication and engagement	Santos et al. (2018), Bertolino and Couto (2019), ABNT (2018)	FORM-SM-141 - Stakeholder Management; FORM-GG-006 - Stakeholder Communication Matrix; Company website, LinkedIn and Intranet page; HSE corporate email; Monthly communication meetings; Confidential channel; CIPA - Internal Commission for Accident Prevention
8-Documented information management	Gerônimo and Lenzi (2021)	NOR-010 - Documented Information; ITR-ENG-001 Managing Documentation
9-Supplier Procurement and Management	Baldassin and da Silva (2021)	NOR-022 - Goods and Services Acquisitions; PRO-GP-005 - Supplier Performance Evaluation
10-Operation and maintenance	Bertolino and Couto (2019)	PRO-SM-005 - Waste Management; PRO-SM-006 - Air Emissions and Environmental Noise Management; PRO-SM-007 - Water Resources and Wastewater Management; PRO-SM-009 Golden Rules; PRO-SM-033 - Chemical Products; PRO-CC-001 – Operational Control Center Management; PRO-PP-001 – Scheduling and Natural Gas Transportation Process
11- Commercialization	Oenning-Soares et al. (2020), Christmann and Taylor (2006)	PRO-CO-005 - Public Call
12-Change Management	ABNT (2015a); Bertolino and Couto (2019)	PRO-SM-021 - Change Management Guidelines
13-Emergency Readiness and Response	Neto et al. (2019)	PRO-SM-035 - Operational Units Emergency Response Plan; PRO-SM-004 - Headquarters Emergency Response Plan; ITR-CC-005 - Control Center Action in Emergency Response

IMS Elements	References	Documents
14-Monitoring, measuring, analysis and evaluation	Bertolino and Couto (2019)	PRO-SM-002 - IMS Audit Management; PRO-ME-021 - Dimensional Inspection of Measurement Equipment; ITR-GO-016 - Inspection in Pipelines and Surface Installations; PRO-MI-008 - Inspection in Surface Installations; MAN-ME-001 - Measurement Management System; PRO-ME-010 - Requirements for Metrological Proof and Traceability to IMS; PRO-ME-008 - MMS Software Validation; PRO-ME-015 - Methodology Analysis of the Metrological Proofing Intervals; PRO-ME-023 Management of instrument calibrations and inspections performed by third parties; PRO-ME-021 Dimensional Inspection of Measurement Equipment
15-Performance	Soares (2019), Vieira and França (2021), Viera and Junior (2020)	PRO-SM-028 Sustainability Indicators Management; PRO-SM-030 - IMS Critical Analysis
16-Incident and non-conformity management	Vieira and França (2021)	PRO-SM-008 - Incident Management; PRO-SM-029 - Non-conformity Management and Corrective Action
17-Continuous Improvement	Napoleão (2018), Mançú et al. (2020), Souza and Georges (2020), Bertolino and Couto (2019)	POL-003 - Sustainability

Source: Designed from internal reports of the studied company (2023)

Table 1 aims to facilitate the visualization of internal policies and procedures that involve the IMS elements of the natural gas transportation company studied in this research and often directly correlates them to ISO standards, which proves that the processes in fact are listed in line with the proposed standards for certification explained in this paper.

5 CONCLUSION

For large natural gas transportation companies, it is of strategic importance to be compliant with ISO 9001, ISO 45001, and ISO 14001 certifications, which acknowledge their IMS. This has justified the development of this study, whose purpose was to propose an action plan to obtain triple certification for a Brazilian natural gas transportation company.

The benefits of obtaining triple certification are significant for companies when implemented in a compliant manner, as they ensure the commitment of the company and its employees to continuous improvement. Compliance with ISO, which is an internationally recognized standard, ensures quality in processes, controls, and deliveries. Thus, compliance with legislation, controls, and prevention practices for Health, Safety and Environment and the business, becomes more effective and continuous. Good practices should be recognized as those that present benefits, as well as significant and sustainable returns over time. These should be recorded and shared to promote organizational learning.

There must be a systematic application of the PDCA cycle concepts. In this way the IMS is not just a mere control and monitoring process, but a comprehensive program that involves its employees, customers, suppliers (goods and services, including subcontracted ones), and other stakeholders, with a focus on continuous improvement.

The implementation of certification in natural gas transportation companies is considered a distinctive feature in the market, which contributes to a distinguished company, achieving competitive advantage over other companies in the same business segment. It was verified that the implementation of the IMS is being considered as a business strategy for the studied natural gas transportation company. At this moment it is perceivable the achievement of good practices in Health, Safety, Environment, and increased interaction between the departments. This has generated improvement in the performance of all practices applied to the IMS.

The main contribution of this work for theory is the correlation of IMS elements with literature

references and guidance documents of the studied natural gas transportation company. For practice, the proposed action plan may support other companies to achieve triple certification in ISO 9001, ISO 45001, and ISO 14001 standards.

The single case study, research method used in this work, has limitations. The main one is the generalization limit of the conclusions, models or theories developed from it. These limitations do not reduce the importance of the results found, since the proposed action plan enabled the natural gas transportation company to obtain the desired triple certification.

Regarding generalization, there is an opportunity to explore how the findings might extend beyond the specific case study context, potentially offering insights into broader applicability across similar industries or contexts. In terms of theoretical depth, while the practical application is commendable, further engagement with theoretical frameworks could deepen the academic contribution of a future study, offering a more nuanced understanding of IMS integration within organizational practices. Finally, in relation to innovation and perspectives, encouraging the exploration of innovative practices within the IMS framework could introduce new dimensions to the study. Additionally, adopting interdisciplinary perspectives may enhance the manuscript's relevance, providing a richer, more comprehensive analysis.

REFERENCES

- ABNT - Brazilian Association of Technical Standards (2015a), NBR ISO 9001. Quality management systems - requirements with guidelines for use, Rio de Janeiro.
- ABNT - Brazilian Association of Technical Standards (2015b), NBR ISO 14001. Environmental Management System - requirements with guidelines for use, Rio de Janeiro.
- ABNT - Brazilian Association of Technical Standards (2018), NBR ISO 45001. Occupational Health and Safety Management System - requirements with guidelines for use, Rio de Janeiro.
- ANP - National Agency of Petroleum, Natural Gas and Biofuels, Transport pipelines (2020), Retrieved from <https://www.gov.br/anp/pt-br/assuntos/movimentacao-estocagem-e-comercializacao-de-gas-natural/transporte-de-gas-natural/gasodutos-transporte>
- Araujo, S.P.D. and França, S.L.B. (2015), "Analysis of critical success factors in the process of implementing an integrated management system in a small family business", in CNEG 2015 - XI Congresso Nacional de Excelência em Gestão, Retrieved from https://cneg.org/anais/artigo.php?e=CNEG2015MBA&c=T_15_071M
- Arenhart, R.S., Pizzolato, M., Mendes, A.A. and Braghirolli, L. (2020), "Contribution evaluation of the maintenance plans based on reliability centered maintenance for measuring instruments in Public Higher Education Institutions", Brazilian Journal of Operations & Production Management, Vol. 17, No. 2. <https://doi.org/10.14488/BJOPM.2020.020>
- Baldassin, F. and da Silva, E.M. (2021), "Proposal for a Supplier Evaluation Tool to Meet ISO 14001 and ISO 45001 Standards", in ConBRepro 2021 - APREPRO, Retrieved from <https://aprepro.org.br/conbrepro/2021/anais>
- Bertolino, M.T. and Couto, M. (2019), Integrated management systems ISO 9001, ISO 14001 and ISO 45001: quality, environmental and occupational health and safety management with a focus on results, 1. Ed. Rio de Janeiro: Qualitymark.
- BV - Bureau Veritas (2022), Retrieved from <https://br.lead.bureauveritas.com/uma-breve-historia-da-iso>
- Christmann, P. and Taylor, G. (2006), "Firm self-regulation through international certifiable standards: Determinants of symbolic versus substantive implementation", Journal of International Business Studies, Vol. 37, No. 6, pp. 863-78. <https://doi.org/10.1057/palgrave.jibs.8400231>
- EPE - Energy Research Company (2020), Natural Gas Demand in the National and International Markets: Horizon 2020 - 2030, Ministério das Minas e Energia, Retrieved from <https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-490/topico-531/EPE,%202020%20-%20Nota%20T%C3%A9cnica%20Demanda%20de%20G%C3%A1s%20Natural%20vFinal.pdf>
- Faria, M.C.S., Neto, J.V. and Quelhas, A.D. (2019), "Social license to operate - the perspective of professionals from Brazilian extractive companies", Brazilian Journal of Operations & Production Management, 16, pp 448-461. <https://doi.org/10.14488/BJOPM.2019.v16.n3.a8>
- Fernandes, J.L.S., Busanello, F., Polacinski, E., Godoy, L.P., Losekann, A.G. and Lorenzetti, D.B. (2015), "Steps required for implantation of an integrated management system", Revista de Administração da Universidade Federal de Santa Maria, vol. 8, núm. 1, março, pp. 60-72.

- <https://doi.org/10.5902/198346596286>
- Fonseca, J.J.S.D. and Moraes, A.M.D. (2017), *Scientific Research Methodology*, 1. ed. Sobral, cap. 1, p. 102-126 e 117, Retrieved from https://dirin.s3.amazonaws.com/drive_materias/1649850285.pdf
- Gerônimo, B.M. and Lenzi, G.G. (2021), "Knowledge Management Practices in Integrated Management System: a systematic review", in *ConBRepro 2021 - APREPRO*, Retrieved from <https://aprepro.org.br/conbrepro/2021/anais/>
- ILO - International Labor Organization (2021), WHO: Almost 2 million people die each year from work-related causes, Retrieved from https://www.ilo.org/brasilia/noticias/WCMS_820318/lang-pt/index.htm
- Mançú, R.J.D.S., Gouveia, L.B. and Cordeiro, S.D.S.B. (2020), "Diagnostic and performance evaluation matrix model of integrated management systems (SGI) for quality, environment, safety and health at work", *Brazilian Journal of Business*, Curitiba, v. 2, n. 2, p.1090-1114, abr./jun. <https://doi.org/10.34140/bjbv2n2-019>
- Marconi, M.D.A. and Lakatos, E.M. (2019), *Fundamentals of scientific methodology*, 8.ed. São Paulo: Atlas.
- Martins, F.B., Cardoso, R., Tamella, I., Colombo, D. and Matos, B.A. de. (2018), "Applying CBM and PHM concepts with reliability approach for blowout preventer (BOP): a literature review", *Brazilian Journal of Operations & Production Management*, 15, pp 78-95. <https://doi.org/10.14488/BJOPM.2018.v15.n1.a8>
- Napoleão, B.M. (2018), What is PDCA. Quality tools, Retrieved from <https://ferramentasdaqualidade.org/pdca/>
- Neto, J.B.D.M.R., Tavares, J.D.C. and Hoffmann, S.C. (2019), *Integrated Management Systems: Quality, Environment, Social Responsibility, Safety and Health at Work*, São Paulo – SP: Editora Senac, São Paulo.
- Oenning-Soares, E.J., Oliveira, L.A.B., Melo, F.J.C., Xavier, L.A. and Medeiros, D.D. (2020), "Sugarcane companies' preferences for certified suppliers in the supply chain", *Brazilian Journal of Operations & Production Management*, Vol. 17, No. 4. <https://doi.org/10.14488/BJOPM.2020.047>
- Pires, A.R. (2016), *Quality Management Systems - Environment, Safety, Social Responsibility, Industry and Services*, 2ª edição. Lisboa: Edições Silabo.
- Santos, G., Almeida, L., Ramos, D.G.G., Carvalho, F.J.D.F., Sá, J.C., Baptista, J.S., Costa, J., Guedes, J.C., Freixo, J., Pereira, M., Correia, H., Oliveira, O.J.D., Barbosa, L.C.F.M., Lopes, N., Manso, V., Seabra, S. and Carnide, M. (2018), *Integrated Management Systems: Quality, Environment and Safety*, 3. Ed., Revista e Aumentada. Engebook, Porto.
- Schneider, E.I. (2015), *The evolution of quality management systems*, Centro Universitário Uninter - São Paulo.
- Soares, F.R. (2019), *Integrated Management System - IMS as a form of management strategy*. Amazon Data Institute - IDAAM, Retrieved from <http://repositorio.idaam.edu.br/jspui/handle/prefix/533>
- Souza, P.H.M.D. and Georges, M.R.R. (2020), "Integrated Environmental and Occupational Safety Management Systems and Sustainability: A study on certifications in the context of business operations", *Revista Nacional de Gerenciamento de Cidades*, v.08, n. 64. <https://doi.org/10.17271/2318847286420202566>
- Tavares, C.L. (2019), *Integrated Quality, Environmental and Occupational Health and Safety Management Systems (SIGQASST) - Contribution to Corporate Sustainability*, Final Master's Work - Dissertation for the degree of Master in Quality and Environmental Engineering, ISEL - Instituto Superior de Engenharia de Lisboa, Departmental Area of Chemical Engineering, Lisboa, Portugal, Retrieved from <https://repositorio.ipl.pt/handle/10400.21/10449>
- Turrioni, J.B. and Mello, C.H.P. (2012), *Research methodology in production engineering: strategies, methods, and techniques for conducting quantitative and qualitative research*, Programa de Pós-graduação em Engenharia de Produção, Universidade Federal de Itajubá, Itajubá.
- Vieira, A.A. and Junior, C.P. (2020), "Strategy for implementing an occupational safety and health management system based on ISO 45001", *Research, Society and Development*, V.9, p. 1-18. <https://doi.org/10.33448/rsd-v9i7.3778>
- Vieira, M.C.D. and França, S.L.B. (2021), "Model for Assessment of the Integrated Management System of Quality, Environment, Health and Safety in Maritime Support Company", *Navus*, V.11,

n.7, p. 01-18, jan. /dez. <https://doi.org/10.22279/navus.2021.v11.p01-18.1628>

Voss, C., Tsiriktsis, N. and Frohlich, M. (2002), "Case research in operations management", *International Journal of Operations & Production Management*, v. 22, n.2, p. 195-219. <https://doi.org/10.1108/01443570210414329>

Woodside, A.G. and Wilson, E.J. (2003), "Case studies research methods for theory building", *Journal of Business and Industrial Marketing*, v. 18, n. 6/7, p. 493-508. <http://dx.doi.org/10.1108/08858620310492374>

Yin, R.K. (2015), *Case studies: planning and methods*, 5. Ed. Porto Alegre: Bookman.

Author contributions: CGB: Conceptualization, data curation, investigation, project administration; JLCP: Conceptualization, Project administration; WSM: Methodology, Supervision; TFFS: Validation; AEBF: Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing;