



Diagnosis of Initial Conditions for the Implementation of the Integrated Management System in the Companies of the Land Cargo Transportation in the City of Barranquilla (Colombia)

Genett Jimenez¹(✉), Laxmi Novoa¹, Laura Ramos¹, Jairo Martinez^{2,3},
and Cesar Alvarino^{2,3}

¹ Department of Industrial Processes Engineering, Engineering Faculty,
Institución Universitaria ITSA, Barranquilla, Colombia
gjimenez@itsa.edu.co, laxmi.novoa_95@hotmail.es,
lavarape@gmail.com

² Economic Sciences Faculty, Corporación Universitaria Latinoamericana CUL,
Barranquilla, Colombia
jairoluis2007@gmail.com

³ Engineering Faculty, Systems Engineering Program, Corporación Universitaria
Latinoamericana CUL, Barranquilla, Colombia
cesaraugustoalvarinocruz@gmail.com

Abstract. The land cargo transportation represents one of the links in the logistics chain of great importance at the regional, national and global levels, due to its impact not only at an economic level but also at a social level. However, this sector shows operational deficiencies that affect not better productivity and competitiveness levels are obtained compared with other regions and countries. It is there where Integrated Management Systems become an alternative to support companies in achieving these objectives, especially in companies in this sector, where no diagnostic studies had found in the implementation of these management systems. This article presents a methodology for diagnosing the initial conditions for the application of Integrated Management Systems in companies belonging to the cargo logistics sector of the city of Barranquilla, taking into account the standards ISO 9001, ISO 14001, OHSAS 18001 and BASC. First, an instrument for measurement and diagnosis was constructed and statistically valid. Afterward, the general profile of the companies in the sector was described and categorized into four differentiated groups according to their level of performance, and the GAPS or percentage differences between the standard and the results obtained calculated. Finally, improvement plans proposed for the critical variables identified. The results show the importance in the application of diagnostic tools and the improvement of the conditions for the implementation of Integrated Management Systems, through a reliable data measurement and analysis instrument, with a Cronbach alpha of 0,96.

Keywords: Standardization · Integrated management systems
Land transportation · Cargo logistics · Continuous improvement
Productivity · Competitiveness · Data analysis

1 Introduction

The land cargo transportation is a critical component of the logistics and supply chain of a country [1] since it seeks to minimize costs, time and assurance the delivery of products to customers in optimal conditions. Despite being an essential sector in the economy, it has problems that diminish not only the competitiveness of companies but also that of regions and countries, as in the case of Colombia. In this sense, the primary deficiencies related to the high logistic costs and the delay in the transport infrastructure [2, 3], the limited use of information and communication technologies and the non-application of business management methodologies [4].

Therefore, one of the keys to strengthening the land cargo logistics sector is through integrated management systems in its supply chain [5], through the design and implementation of strategies to improve its value chain, which allows them to guarantee the safety of human talent, the protection of the environment, control and security of commercial activities at national and international level, with a direct impact on productivity, quality and the relationship with interest groups.

In this sense, different researchers founded in the scientific literature related to the theory of Integrity Management Systems and their application in various industries. However, the evidence regarding the conditions and current behavior of companies in the land cargo transportation in the implementation of this methodology is limited and little explored.

The remainder of this paper is organized as follows: First, in Sect. 2, a brief literature review relating to theory and application of integrated management systems in different companies and sectors is presented. Then, in Sect. 3, illustrates the proposed methodology. Subsequently, in Sect. 4, describes and analyzes the results with the description of the companies in the cargo logistics sector, the diagnosis of initial conditions and the improvement proposals taking into account the key variables that affect the implementation of the Integrated Management System based on standards ISO 9001, ISO 14001, OHSAS 18001 and BASC. Finally, in Sect. 5 presents the conclusions and future work emanating from this study.

2 Integrated Management System: A Brief Literature Review

An Integrated Management System (IMS) is defined by [6] as a system that “integrates all of an organization’s systems and processes into one complete framework, enabling an organization to work as a single unit with unified objectives.” Authors like Garvin [7], Beckmerhagen et al. [8] and Llanes et al. [9] recognize the importance of integrated management as the degree of alignment of the organization in a single standard of administration, to achieve the efficiency, efficiency and flexibility planned.

In this sense, we reviewed the reported scientific literature where different academic articles showing the associated benefits for companies of the use of the Integrated Management System, such as the reduction of costs, the optimization of resources and the improvement of the corporate image [10, 11]. At the level of state of the art, the literature has reported scientific articles and academic works that analyze the factors, barriers, and integrated practices in management systems [12], as well as the development of diagnosis [13] and evaluation models of integrated management systems, considering the degree of maturity in the implementation in companies [14].

Also, we found studies that application of Integrated Management Systems - IMS in different companies, since biotechnological centers [15], thermoelectric companies [16]. Other applied works, explore some topics about the IMS like the most common elements and functions integrated in the certified Brazilian companies [17], the relationship between the level of integration and corporate benefits [18], the use of standardized methods for integration [19–21] and the impact of the level of integration of management systems on innovation capabilities of products and processes [22].

As a result of the review of the scientific literature, the academic literature on the integration of management systems applied to the cargo transportation sector is small and poorly developed [23]. Therefore, this research contributes to increasing the scientific literature and provides a methodology for diagnostic and improve the productivity, competitiveness, and sustainability of the industry.

3 Methodology

The methodology approach used in this work [24] is described as follows. The project is framed within the analytical and descriptive study; given the collected data were analyzed, with the purpose of diagnosing the behavior of the companies in this sector and finally, design improvement proposals. In this regard, a methodology comprised of three stages has been developed with the foresight to be applied in other industries. Figure 1 shows the methodological design with the phases of the project, the procedure used to perform the entire investigative process, and the techniques used.

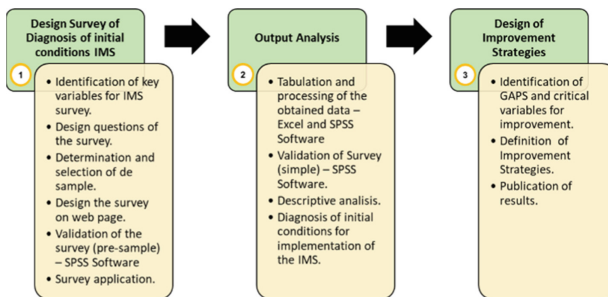


Fig. 1. Methodological framework for diagnosis of initial conditions for the implementation of the integrated management system

For the data collection, a survey for diagnosis of initial conditions for implementation of the IMS was designed based on international standards ISO 9001, ISO 14001, OHSAS 18001 and BASC. This instrument consists of two items, as shown in Fig. 2. In the first item, general aspects or profile of the companies were analyzed, such as antiquity, size, type of company, export orientation, certification, and the standard applied. Likewise, companies asked about the use of strategic planning tools, as support in the design and implementation of integrated management systems. In the second item, the objective is to diagnose the conditions of the companies concerning the

application of Integrated Management Systems, to identify the critical variables in each company and the sector in general and design improvement proposals. This item consists of four components that evaluate the elements for the integration of management systems [24] and the cycle of continuous improvement for an integrated management system [25, 26] (refer to Fig. 2).

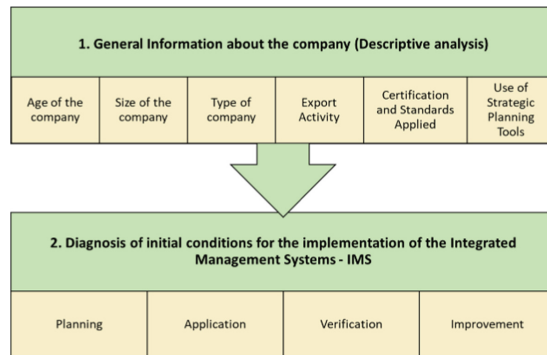


Fig. 2. Structure of the survey for diagnosis of the integrated management system

The survey was applied to a sample of 25 companies in the city of Barranquilla using Eq. 1 for the calculation of the sample size ($p = 0,5$; $q = 0,5$; $e = 0,05$; $k = 1.96$; $N = 27$). The results of reliability analysis demonstrated a good level of confidence of the survey [27], with a Cronbach alpha of 0,97.

$$n = \frac{k^2 * p * q * N}{(e^2 * (N - 1)) + k^2 * p * q} \tag{1}$$

4 Results

4.1 Descriptive Analysis

In Table 1, are observed the main general characteristics found in the companies of the land cargo transportation:

Table 1. General information and productive profile

General data	Characteristics
Age of the company	Companies with more than ten years old predominate, 88% are between 10 and 20 years old
Size of the company	52% of the companies analyzed belong to the SME segment (Small and medium enterprises), and 48% are big companies
Export activity	32% of companies operate on a national and international scale

In Fig. 3a, b, and c, the results show that 56% of the companies analyzed use standards in management systems, but it is evident the potential that exists for companies to implement and certify their processes using the Integrated Management System. In the other hand, the implementation of integrated management systems is not still at a mature level in the sector since 64% of companies have management standards between 0–5 years and 36% of 6–10 years. The leading criteria implemented by the companies are BASC - Business Alliance for Secure Commerce and Quality Management System ISO 9001 while the least applied are the Occupational Health and Safety Management Systems OHSAS 18001 and Environmental Management System ISO 14001.

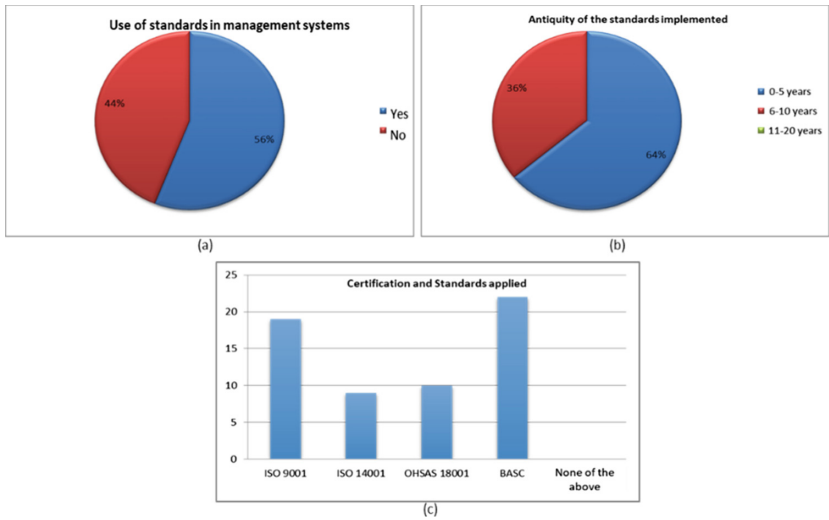


Fig. 3. Results obtained from the descriptive analysis: use of standards in management systems (a), the antiquity of the standards implemented (b), and certification and standards applied (c)

4.2 Diagnosis of Initial Conditions for the Implementation of the Integrated Management System - IMS

Table 2 shows a comparative analysis between the maximum scores of the diagnosis of initial conditions in IMS each of the variables (obtained from the multiplication of the number of questions by the Likert score scale) and the results obtained by the companies, according to the size of the company. The results show that big and medium-sized companies have better initial conditions for the implementation of the IMS, with an 86% and 75% respectively in comparison with small companies, with 43% of compliance.

In the other hand, the variables associated with planning and improvement, present a 70% of compliance while the variables of verification and application, with a 68% and 66% respectively. In this regard, there is necessary to establish priority improvement plans, considering the variables of the IMS diagnosis.

Table 2. Results of diagnosis of initial conditions in IMS

	Variables				
	Planning	Application	Verification	Improvement	Score
Top score	30	30	25	10	95
Score obtained (big companies)	26	26	22	8	82
Score obtained (medium companies)	23	22	18	8	70
Score obtained (small companies)	13	13	11	4	41
Total average	21	20	17	7	65
% of compliance	70%	66%	68%	70%	68%

4.3 Improvement Proposals for the Implementation of Integrated Management Systems

To support the implementation of Integrated Management Systems in the companies of the sector, we designed a series of strategies with the aim of underpinning the processes of continuous improvement and corporate sustainability. These strategies were proposed for each of the variables of the diagnosis, considering the type of company and its critical elements. However, improvement proposals can be generated for each of the companies. The summary of the strategies are shown in Table 3:

Table 3. Improvement proposals

Variables	Improvement proposals	Size of company		
		Big	Medium	Small
Planning	Define management responsibilities regarding Health and Safety at work, quality, BASC, and Environment		x	x
	Design and implement an integrated written policy about Health and Safety at work, Quality, BASC, and Environment		x	x
Application	Develop and implement training actions in the implementation of the integrated management system	x	x	x
	Design of procedures, processes or conditions in safety and health at work and environment		x	x
	Periodic reviews of the implementation status and progress of the integrated management system	x		x
Verification	Define mechanisms for data analysis of operations and processes, about the Integrated Management System	x	x	x
	Implement strategies for communication of results on the performance of the integrated management system, to collaborators and stakeholders	x	x	x
	Define and implement a program of integrated audits	x	x	x
Improvement	Implement programs to support continuous improvement and innovation in companies based on IMS	x	x	x
	Establish methods for evaluating the performance of the integrated management system, such as revisions by management, accountability, among others		x	x

5 Conclusions and Future Works

In this paper, a methodology was proposed for the diagnosis of initial conditions to improve the implementation of the IMS in the Companies of the Land Cargo Transportation based on criteria of quality, environmental management, safety and health at work, and security in logistics operations. The results demonstrated that the implementation of integrated management systems is not still at a mature level in the sector, being the big companies the leaders in the adoption this standard mainly BASC and ISO 9001. Besides, we identified the critical variables that affect the implementation of IMS (planning and evaluation), with compliance percentages lower than 70%. In this sense, we proposed a series of strategies to improve the levels of implementation for the companies in IMS.

This research enriches the scientific literature and contributes to the evidence base related to the use of methodologies for diagnosis and improvement of IMS. Nonetheless, it is necessary the commitment of the senior management and collaborators, define a plan of implementation with responsible, schedules and assign the resources. In this regard, as future work, the diagnostic of initial conditions in IMS will be applied to the selected companies in order to perform a multivariate analysis, evaluate the levels of performance and maturity of requirements for the implementation of the IMS and establish a correlational analyzes between variables and characteristics such as the size of the company, antiquity, and export activity, among others.

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