Artículo científico

ANALYSIS OF FACTORS THAT AFFECT THE ENVIRONMENTAL PERFORMANCE OF COMPANIES CERTIFIED IN ISO 14001

ANÁLISIS DE LOS FACTORES QUE AFECTAN EL DESEMPEÑO AMBIENTAL DE LAS EMPRESAS CERTIFICADAS EN ISO 14001

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Abstract

This paper analyzes the most relevant factors that affect the environmental performance of companies certified in ISO 14001. Based on literature review and structural analysis with the Micmac Godet methodology, we identify 30 factors that determine the efficacy of an organization's environmental performance. The review shows that the implementation of the standard does not guarantee a proper functioning *per se*, since the Environmental Management System (EMS) depends on factors that are endogenous and exogenous to the organizations and require continuous and coherent maintenance policies over time. The structural analysis allows identifying nine key factors (training of staff, external pressures, maintenance of the EMS, the environmental maturity of the organization, legal requirements, management commitment, managers' stance towards the environment, performance indicators and fines and sanctions), being the maintenance of the system the most critical factor. We discuss some conceptual relationships among these relevant factors of interest for EMS managers, within a systemic perspective.

Keywords: environmental performance, environmental management systems, international certifications.

Resumen

Este artículo analiza los factores más relevantes que afectan el desempeño ambiental de las empresas certificadas en ISO 14001. Con base en la revisión de la literatura y el análisis estructural con la metodología Micmac Godet, identificamos 30 factores que determinan la eficacia del desempeño ambiental de una organización. La revisión muestra que la implementación de la norma no garantiza *per se* un buen funcionamiento, ya que el Sistema de Gestión Ambiental (SGA) depende de factores que son endógenos y exógenos a las organizaciones y requieren políticas de mantenimiento continuas y coherentes en el tiempo. El análisis estructural

permite identificar factores clave como costos adicionales, mejora de imagen, capacitación del personal y compromiso de la gerencia con el SGA, siendo el mantenimiento del sistema el aspecto crítico identificado a lo largo del proceso. Discutimos algunas relaciones conceptuales entre los factores de interés más relevantes para los gerentes de EMS, dentro de una perspectiva dinámica de sistemas.

Palabras clave: **certificaciones internacionales, desempeño ambiental, sistemas de gestión ambiental. .**

Introduction

Environmental Management Systems (EMS) allows the design, implementation and monitoring of improvement measures to minimize impacts on the environment. The most recognized environmental management standard is ISO 14001, which comes with several requirements that companies must meet to become certified. Although ISO 14001 is widely recognized, some authors question the benefits and effectiveness of adopting this standard to improve environmental performance. However, despite the large number of studies on the environmental performance of companies, little information exists about the factors that have the greatest impact on the evolution of such performance (Liu et al., 2019).

Few documents have conducted a thorough analysis of the factors that may influence the environmental performance of certified companies (Acuña et al., 2017), while others have ranked the five main lines of research related to environmental performance as business, government, economy, technology, and society. Most studies have only focused on reviewing the administrative and economic benefits of the model and its implementation (Bravi et al., 2020).

This paper analyzes the reported impact of thirty factors in the environmental performance of certified companies in ISO 14001. The analysis is based on a literature review and uses the cross-impacts matrix multiplication applied to Classification (Micmac) method to identify the main factors that could affect directly or indirectly the environmental performance of certified companies. The review synthesizes information gathered from scientific research that includes primary data to support the validity of the conclusions of individual studies and identify uncertainties and knowledge gaps (Ferreira González et al., 2011). The Micmac methodology (Godet & Durance, 2007) allows categorizing the factors identified on a Cartesian plane of dependencies. This categorization serves as a basis to propose a conceptual model to understand the interactions of these factors on the environmental performance of organizations.

Theoretical background

ISO 14001 defines environmental performance as the set of measurable results of an organization's environmental management. The indicators provide knowledge of the initial state and evolution of environmental transformation. Indicators are the basis of analysis and decision-making by the organization. Some environmental indicators are gas emissions, water consumption, waste production, energy consumption, among others. An EMS can be defined as a set of interrelated elements that work together to effectively and efficiently manage the activities, products and services of an organization that have an impact on the environment (Escobar Cárdenas, 2009). The certifying entities grant an external seal that certifies the conformity of companies that meet the standard. This seal and the conditions of use are exclusive to each certifying body.

Some aspects of corporate environmental management that affect environmental performance, such as organizational (management unit), economic (the absence of environmental investment), technological (age of equipment), and context (environmental legislation) factors, are usually studied separately.

Furthermore, recent studies point out the incidence of factors in other environmental management instruments such as environmental performance practices, corporate social responsibility, environmental accounting policies, and demands of interest groups, that are related to the scope of a circular economy of companies. Several studies emphasize stakeholders (community, customers, suppliers, competitors) as agents of change in the environmental performance of a company. Other studies, such as those by Acuña et al. (2017), mention factors focused on personnel, leadership, and the structure of the organization (such as management commitment, corporate image, and lack of information) as limitations of an environmental management system but without going deeper into the topic.

The literature has explored several factors in the case of certified companies but in a fragmented way. Examples of these are the study by Viranda et al. (2020), which analyzes management commitment in manufacturing companies in Indonesia, or the study by Del Brío González and Junquera (2002), which analyzes success factors of ISO 14001, such as customer interest. Although there is research that provides basic information on factors (Lozano Sulca, 2020), there is no complete analysis of how they could be classified in relation to their influence on the organization's management system.

With this research what is desired is to provide a comprehensive framework of the factors that can affect the environmental performance of an organization. It analyses together the factors that have hitherto been studied separately in other investigations without establishing any relationship.

This research provides a preliminary analysis and classification of factors to guide managers in making decisions about ISO 14001 certification.

Methodology

The research is mixed exploratory (qualitative and quantitative). The exploratory analysis, based on a literature review, allowed us to identify factors that are normally addressed in a fragmentary way. Subsequently, the identified factors were classified into dependency categories with the Micmac method (Godet & Durance, 2007), which is based on the qualitative judgment of the relationships between variables of an organizational system by experts. This analysis allows the key factors of the problem to be graphically identified.

Literature review

The literature review considered the methodologies proposed by Beltrán Galvis (2005), Godet and Durance (2007), retrieving scientific documents from databases Dialnet, Redalyc, Scielo, Redib Web of Science, Scopus, ScienceDirect, and from repositories such as SSRN and Wiley Online Library. The review focused on articles that shed light on the main factors that could, directly or indirectly, affect the environmental performance of ISO 14 001 certified companies.

The articles were selected according to the following criteria:

Inclusion:
- Publications between 2000 and 2022.
- Studies of the difficulties of implementing the standard.
- Studies of the impact of environmental management on companies.
- Studies of the feasibility of adopting ISO.

Exclusion
- Studies of economic benefits of the standard and not of the company's environmental performance.
- Basic implementation studies of ISO 14001.
- Studies that involve the standard, but not environmental performance.

According to the protocol, after reading the title, 93 articles were considered appropriate. 14 were discarded when reading the abstract. Finally, 79 articles met the inclusion criteria and were selected to carry out the literature review. The search algorithms included keywords as environmental performance, factors affecting environmental performance of certified companies, and boolean combinations such as factors AND Environmental performance AND ISO 14001. The review considered articles in English, Spanish and Portuguese (revisions, book chapters, graduate thesis) published between 2000 and 2021, whose title referred to ISO 14001 criticism, companies and ISO 14001 certification, viability of ISO 14001, and factors in

companies certified with ISO 14001. We excluded articles related to the benefits of adopting ISO 14001, that referred mostly to the implementation phase of the standard, or that did not address the environmental performance as the main issue.

From each selected article, we extracted the size of the sample, the country, the identified factors that affected the environmental performance, the sampling techniques employed by the authors, and the disciplines of research involved. With this information, we made a comparative analysis among articles, identifying the frequency of appearance of each factor in the discussions. To Rank the factors according to their importance, we used the Micmac method (Godet & Durance, 2007), which allows qualitative analysis of the relationships between the variables that make up a system within a company or organization, supported by the qualitative judgement of actors and experts.

Micmac method

The Micmac method has three phases. The first phase lists and defines the variables to avoid duplication. The second phase organizes the variables in a "structural matrix of variables", in which each of the variables must meet at a cross-section with the others included in the analysis. The third phase is the evaluation carried out by experts, who compare the variables by pairs to determine whether there is a relationship of direct influence between them. The relationships may be non-existent (0), weak (1), medium (2), strong (3) or potential (P).

With all the matrices obtained from the participating experts, we consolidated a single table with the mean or mode of each factor, depending on the criterion considered. These results are incorporated into the ®MICMAC software, which projects the results into an influence and dependency graph. The distribution obtained allows the identification of several categories of variables, characterized by their relationship with other variables and according to their location within the boundaries of the system. (Figure 3). Table 1 describes the professional profiles of the panel of Colombian experts with experience in environmental management.

To develop the organization's prospective model, we contacted five Colombian professionals who are experts in corporate environmental management (see table 1). These experts independently filled out the variable dependency matrix that is the basis of Micmac.

Table 1
Panel of experts

Field of Experience/Academic Training	Work experience (years)	Age (yeas)
University Professor, specialist in environmental management and protection with a master's degree in global planning	15	52
Independent consultant with experience in environmental management	5	32
University Professor with a master's degree in environmental engineering with experience in environmental sustainability projects	10	38
Director of the integrated management system with experience in administration and a master's degree in integrated management systems	12	42
Internal auditor of Health Safety Environment and Quality (HSEQ) in management systems	8	28

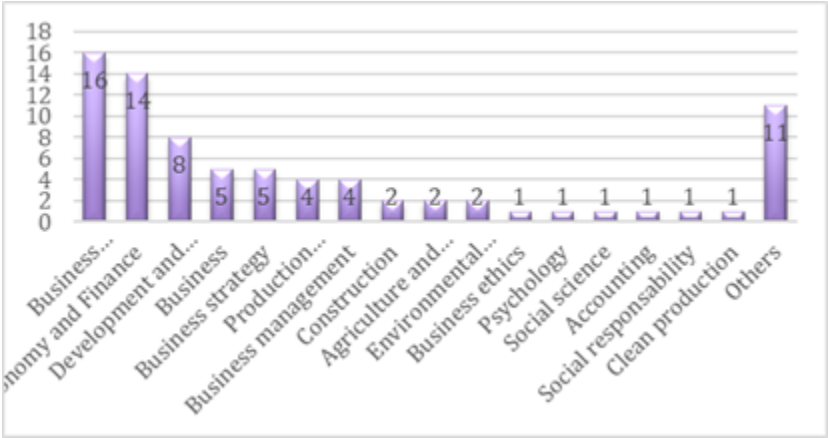
Results

Articles by academic area or discipline

Of the 79 articles selected, 48 used surveys and 8 used interviews for data collection. 18 of the articles worked on the topic through statistical analysis and 5 used the systematic literature review to compile the information.

We identified 79 articles related to the topic of interest, with 16 belonging to the area of business and business administration, 14 to economics, 8 to development and environment, and 4 to production engineering (Figure 1). Most of the reviewed articles come from Brazil (15), Spain (14) and Colombia (7) with a smaller contribution from other countries such as Venezuela (4), Canada (4), England (3), India (3), United States (3), China (4), Saudi Arabia, Pakistan, and Morocco (1).

Figure 1
Distribution of articles by academic disciplines



Identified factors

In the documents analyzed, the evaluation of environmental performance follows several approaches: non-compliance with the requirements of the standard, the assessment of efficiency on the part of managers and comparisons between certified and non-certified companies (Arimura et al., 2016). A high number of the articles reviewed use quantitative analysis techniques to study the environmental performance of companies based on databases and few apply qualitative analysis. Table 2 presents the 30 factors identified in the literature review that may influence the environmental performance of companies certified in the environmental management model. The table includes the number of articles that consider each factor, grouped according to five major categories. Absolute frequency is the number of articles that mention a specific factor, whereas the relative frequency is the absolute frequency over the total number of articles as a percentage. From these factors, additional resources and costs (15%), external pressures (stakeholders) (10%), corporate image (9%), management commitment (5%) and training (5%) are the most cited factors in the literature.

Table 2
Factors affecting environmental performance, organized by frequency of appearance in articles

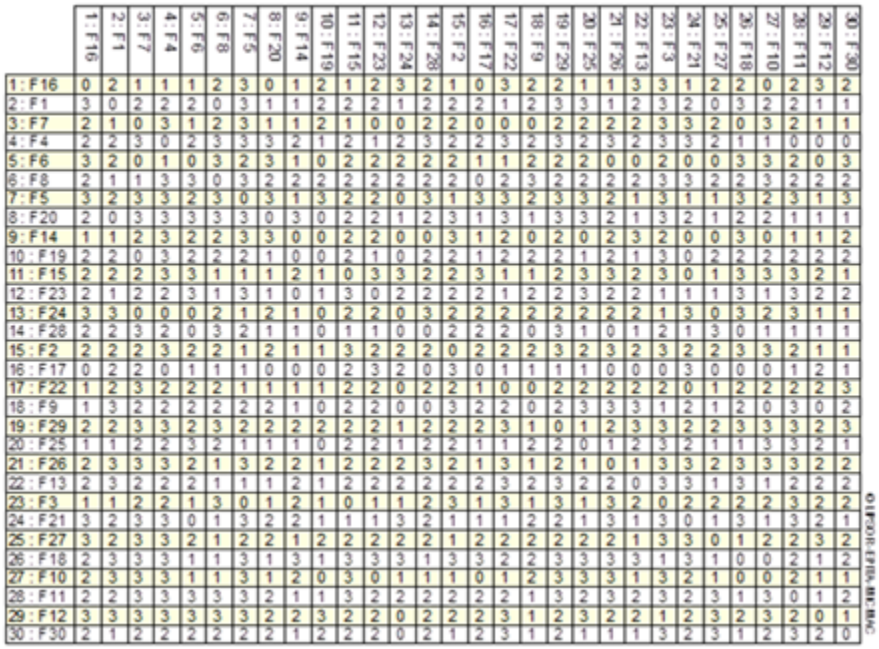
Category	Factor	Frequency		Authors
		Abs.	Rel.	
Stakeholders	External pressures (F2)	18	10%	(Darnall et al., 2001; Escobar Cárdenas, 2009; Boiral, 2011; Mungai et al., 2020), Heras-Saizarbitoria et al., 2020; Mas-Machuca & Marimon, 2019; Ferrón Vílchez et al., 2012; (Acuña et al., 2017); Cañón-de-Francia & Garcés-Ayerbe, 2009.
	Corporate image (F3)	16	9%	
	Community (F14)	5	3%	
	Institutional pressures (F13)	6	3%	
	Total	**45**	**25%**	
Company characteristics	System maintenance (F29)	1	1%	(Pérez Uribe & Bejarano, 2008); (Oliveira & Muñiz Serra Pinheiro, 2010); Pérez Uribe & Bejarano, 2008; 2012; Horváthová, 2020; (Christini et al., 2004; Del Brío González & Junquera, 2002)
	Organization's structure (27)	2	1%	
	Communication (F20)	3	2%	
	Equipment (F19)	3	2%	
	Size of the company (F12)	6	3%	
	Costs of consultancy (F25)	2	1%	
	Additional resources and costs (F1)	26	15%	
	Total	**43**	**25%**	
Processes	Life Cycle Assessment (LCA)(F30)	1	1%	Wang & Mao, 2020; Peixe et al., 2019; Murmura et al., 2018; Boiral, 2011; Vargas Bejarano, 2002.
	Increase in paperwork (F17)	4	2%	
	Time (F16)	4	2%	
	Maturity of the certification (F11)	6	3%	
	Auditing failures (F9)	7	4%	
	Assessment methodology (F6)	8	5%	
	Performance indicators (F8)	7	4%	
	Total	**37**	**21%**	
Human resources	Training (F5)	8	5%	Neumayer & Perkins, 2004; Bravi et al., 2020; Lannelongue Nieto, 2011.
	Staff (F7)	7	4%	
	Incentives (F10)	6	3%	
	Identification of roles (F28)	2	1%	
	Internalization of the standard (F22)	3	2%	
	Motivation (F21)	3	2%	
	Total	**29**	**17%**	
Compliance with standard	Delays from authorities (F24)	2	1%	Blackman, 2012
	Legal requirements (F15)	5	3%	
	Fines and sanctions (F18)	4	2%	
	Changes in legislation (F23)	2	1%	
	Total	**13**	**7%**	
Leadership	Managers commitment (F4)	9	5%	(Arimura et al., 2016)
	Managers stance towards the environment (F26)	2	1%	
	Total	**11**	**6%**	

Micmac Analysis

Figure 2 shows the aggregated results of the structural matrix, based on the mean or mode of each factor. The Micmac method resulted in the classification of the 30 factors in eight categories in the plane of influences and dependencies, as shown in Figure 3.

Figure 2

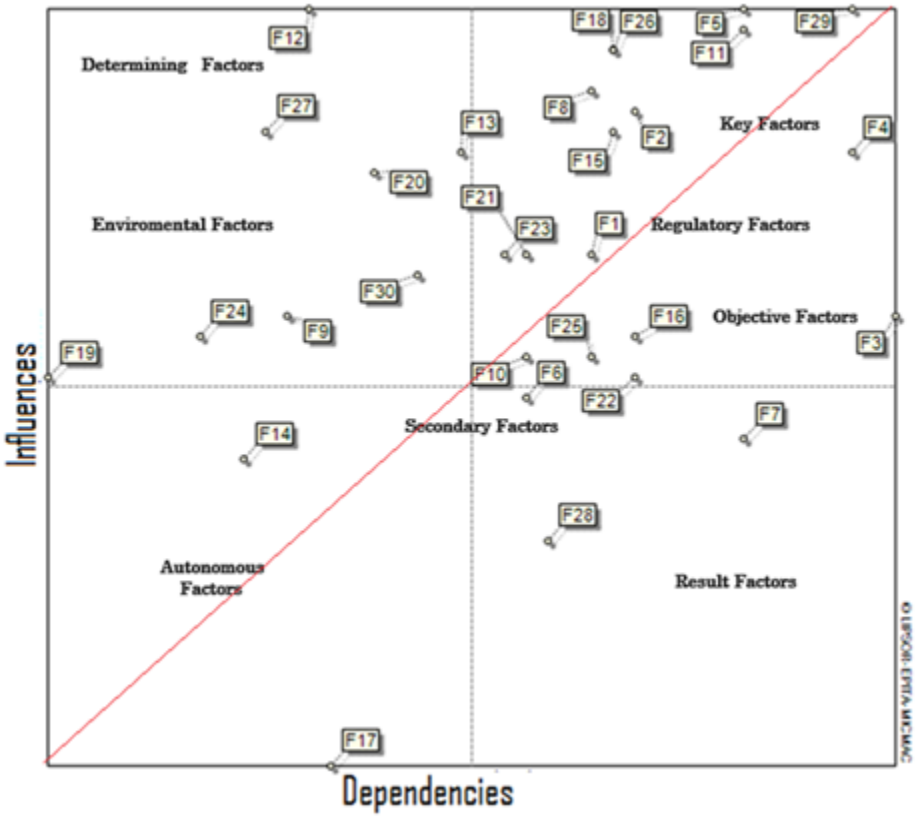
Structural matrix of relations between factors with the aggregated numbers given by the experts



	1 : F16	2 : F1	3 : F7	4 : F4	5 : F6	6 : F8	7 : F5	8 : F20	9 : F14	10 : F19	11 : F15	12 : F23	13 : F24	14 : F28	15 : F2	16 : F17	17 : F22	18 : F9	19 : F29	20 : F25	21 : F26	22 : F13	23 : F3	24 : F21	25 : F27	26 : F18	27 : F10	28 : F11	29 : F12	30 : F30
1 : F16	0	2	1	1	1	2	3	0	1	2	1	2	3	2	1	0	3	2	2	1	1	3	3	1	2	2	0	2	3	2
2 : F1	3	0	2	2	2	0	3	1	1	2	2	2	1	2	2	2	1	2	3	3	1	2	3	2	0	3	2	2	1	1
3 : F7	2	1	0	3	1	2	3	1	1	2	1	0	0	2	2	0	0	0	2	2	2	2	3	3	2	0	3	2	1	1
4 : F4	2	2	3	0	2	3	3	3	2	1	2	1	2	3	2	2	3	2	3	2	3	2	3	3	2	1	1	0	0	0
5 : F6	3	2	0	1	0	3	2	3	1	0	2	2	2	2	2	1	1	2	2	2	0	0	2	0	0	3	3	2	0	3
6 : F8	2	1	1	3	3	0	3	2	2	2	2	2	2	2	2	0	2	3	2	2	2	2	3	3	2	2	3	2	2	2
7 : F5	3	2	3	3	2	3	0	3	1	3	2	2	0	3	1	3	3	2	3	3	2	1	3	1	1	3	2	3	1	3
8 : F20	2	0	3	3	3	3	3	0	3	0	2	2	1	2	3	1	3	1	3	3	2	1	3	2	1	2	2	1	1	1
9 : F14	1	1	2	3	2	2	3	3	0	0	2	2	0	0	3	1	2	0	2	0	2	3	2	0	0	3	0	1	1	2
10 : F19	2	2	0	3	2	2	2	1	0	0	2	1	0	2	2	1	2	2	2	1	2	1	3	0	2	2	2	2	2	2
11 : F15	2	2	2	3	3	1	1	1	2	1	0	3	3	2	2	3	1	1	2	3	3	2	3	0	1	3	3	3	2	1
12 : F23	2	1	2	2	3	1	3	1	0	1	3	0	2	2	2	2	1	2	2	3	2	2	1	1	1	3	1	3	2	2
13 : F24	3	3	0	0	0	2	1	2	1	0	2	2	0	3	2	2	2	2	2	2	2	2	1	3	0	3	2	3	1	1
14 : F28	2	2	3	2	0	3	2	1	1	0	1	1	0	0	2	2	2	0	3	1	0	1	2	1	3	0	1	1	1	1
15 : F2	2	2	2	3	2	2	1	2	1	1	3	2	2	2	0	2	2	2	3	2	3	2	3	2	2	3	3	2	1	1
16 : F17	0	2	2	0	1	1	1	0	0	0	2	3	2	0	3	0	1	1	1	1	0	0	0	3	0	0	0	1	2	1
17 : F22	1	2	3	2	2	2	1	1	1	1	2	2	0	2	2	1	0	0	2	2	2	2	2	0	1	2	2	2	2	3
18 : F9	1	3	2	2	2	2	2	2	1	0	2	2	0	0	3	2	2	0	2	3	3	3	1	2	1	2	0	3	0	2
19 : F29	2	2	3	3	2	3	2	2	2	2	2	2	1	2	2	2	3	1	0	1	2	3	3	2	2	3	3	3	2	3
20 : F25	1	1	2	2	3	2	1	1	1	0	2	2	1	2	2	1	1	2	2	0	1	2	3	2	1	1	3	3	2	1
21 : F26	2	3	3	3	2	1	3	2	2	1	2	2	2	3	2	1	3	1	2	1	0	1	3	3	2	3	3	3	2	2
22 : F13	2	3	2	2	2	1	1	1	2	1	2	2	2	2	2	2	3	2	3	2	2	0	3	3	1	3	1	2	2	2
23 : F3	1	1	2	2	1	3	0	1	2	1	0	1	1	2	3	1	3	1	3	1	3	2	0	2	2	2	2	3	2	2
24 : F21	3	2	3	3	0	1	3	2	2	1	1	1	1	3	2	1	1	1	2	2	1	3	1	3	0	1	3	1	3	2
25 : F27	3	2	3	3	2	1	2	2	1	2	2	2	2	2	1	2	2	2	2	2	2	1	3	3	0	1	2	2	3	2
26 : F18	2	3	3	3	1	1	3	1	3	1	3	3	3	1	3	3	2	2	3	3	3	3	1	3	1	0	0	2	1	2
27 : F10	2	3	3	3	1	1	3	1	2	0	3	0	1	1	1	0	1	2	3	3	3	1	3	2	1	0	0	2	1	1
28 : F11	2	2	3	3	3	3	3	2	1	1	3	2	2	2	2	2	2	1	3	2	3	2	3	2	3	1	3	0	1	2
29 : F12	3	3	3	3	3	3	3	2	2	3	2	2	0	2	2	2	3	1	2	3	2	2	1	2	3	2	3	2	0	1
30 : F30	2	1	2	2	2	2	2	2	1	2	2	2	0	2	1	2	3	1	2	1	1	1	3	2	3	1	2	3	2	0

Source: the authors

Figure 3
Categories of factors according to the result provided by the Micmac analysis (after Godet & Durance, 2007)



Source: the authors

Key Factors

Key factors (v.gr. challenge variables) are in the upper right area. These factors are highly moving and dependent. They disrupt the normal functioning of the system and over determine the system itself. They are unstable by nature and match the challenges of the system. In this category, we identify nine factors.

a. *Training (F5)* is a process through which employees acquire, update, or develop knowledge, skills, and attitudes within the companies. The lack of training and development actions in environmental issues affect the environmental performance of the organization and its ability to meet its environmental objectives, which demonstrates non-compliance with the requirements of ISO 14001. However, some organizations plead difficulties meeting this ISO 14001 recommendation, such as the high rotational rate of employees (Jabbour et al., 2013).
b. *External pressures (F2)* The concerns of organizations about the environmental pressures of interest groups could stem from customer requirements in the design and manufacture of environmental products, as well as from government requirements (Díez Martín et al., 2008). Related to external pressures, data from various multilateral entities show how international trade is the key element influencing the dynamics of the expansion of the standard instead of genuine environmental concern, with the most active companies in international business being the most likely to be certified.
c. *System maintenance (F29)*. The maintenance requires a set of practices for tracking, monitoring and, above all, adapting to the contexts in which each organization operates. Therefore, companies should

review every technical aspect of the EMS, such as waste management, purification of atmospheric emissions, technological adaptations, and relevant environmental verification for certification, among others, depending largely on the characteristics of each company. Implementing the standard, carrying out internal audits and achieving the maintenance of ISO requirements demand time of the company (Pérez Uribe & Bejarano, 2008). System maintenance is the factor that moves further away in the upper right of the Cartesian plane, becoming the factor that requires more attention in relation to the key factors.

d. *The environmental maturity of the organization (F11)* refers mainly to mastering the management processes through time (effectiveness), performance and efficient management of resources. Based on the ISO 14001 standard, EMS maturity can lead to effective control of environmental aspects, impacts, improvement of the environmental maturity levels of the company, acting as a tool for sustainability (Marimon et al., 2010). Other factors related to the level of maturity of industrial companies with ISO 14001 certification include the participation in the carbon market, dissemination of their information, having a project to reduce water consumption as well as having a professional management model, counting with insurance related to environmental accidents (Peixe et al., 2019).
e. *Legal requirements (F10)* are the set of mandatory laws, general and specific, applying to each organization. Any company with EMS must comply with them to avoid penalties, this being one of the main factors to support the ad option of the ISO 14001 standard (Mas-Machuca & Marimon, 2019). Without the identification of legal and technical requirements relevant for operations in the organization, it is not possible to achieve any environmental policies.
f. *Management commitment (F4)* relates to the obligations and responsibilities that the top management acquires in the implementation and maintenance of management systems. Management must spread confidence so that the structure of the EMS is present and remains in both procedures and formats, so it must allocate the resources necessary for its proper functioning (Pérez Uribe & Bejarano, 2008). This lack of commitment and conviction is reflected in the superficiality of the ISO standard and its implementation in certain organizations (Boiral, 2011), which may directly cause the EMS to devoid an effective impact on the environmental performance.
g. *Managers stance towards the environment (F26)* can be classified into several categories: altruistic, positive, positive without plans, apathetic, negative, and hostile (Calduch Rubio, 2016). An altruistic or positive attitude is extremely valuable, since it protects the environment, and the manager is convinced not only of its direct contribution to the organization but also to the conservation and improvement of the environment. Despite the importance of this component, the literature reports that the level of commitment at managerial levels is low. This lack of attitude and conviction reflects the superficiality of the implementation of management systems in certain organizations (Boiral, 2011).
h. *Performance indicators (F8* Indicators are an essential tool for environmental performance and the development of continuous improvement in an organization. From the results of the indicators, it can be determined if the company has seen improvement or not in its management and environmental performance. The way the indicators behaved in prior years would allow explaining why some companies with certain characteristics decide to be certified and others in the same situation do not. Therefore, a methodology to define environmental indicators that allow measuring the environmental performance of organizations should be inclusive and consider aspects of the processes of the organization and its environment to become a tool that effectively influences organizational performance in the environmental area.
i. *Fines (F18) are the pecuniary sanctions of administrative type imposed on the violator of a rule.* They consist of a determined sum of money and meets both the criteria of reasonableness and proportionality and the guides of administrative actions. Blackman (2012) and Horváthová (2020) point out that regulatory fines motivate the EMS certification.

Objective factors

The objective factors, located in the center, are very dependent and moderately mobile, with a high margin of maneuver about other factors. According to the Micmac analysis, the only objective factor is the corporate image.

a. *Corporate image (F3)* From an environmental perspective, this factor reflects the way society perceives the company's environmental performance. Several authors recognize this factor as one of the most relevant for organizations to adopt environmental management models. Haslinda and Chang (2010) report that the most important benefit of implementing ISO 14001 is the improvement of the company's corporate image. According to Wang & Mao (2020) the certified EMS improves the company's marketing and management efficiency, despite the burden of the system's operative costs.

Regulatory factors

These factors, located in the central zone of the influence-dependency plane, give way to achieving compliance with the challenging factors and are what determine the functioning of the system under normal conditions. In this category, we find three factors: additional costs, motivation, and environmental legislation.

a. *The additional cost (F1)* The high costs associated with the implementation of ISO 14001 still represent a main barrier to the adoption of EMS. In general, the cost of ISO 14001 certification can range between US$10,000 and US$128,000, depending on the size of the company (He et al., 2015). Companies must ensure the continuity of the implemented EMS over time and its effective impact on environmental performance, through a set of practices of tracking, monitoring, and adaptation to the contexts in which each organization operates. These practices need funding and human resources to make the system sustainable (Pérez Uribe & Bejarano, 2008).
b. *Motivation (F21)* Companies often have more external than internal motivations. External motivations include business opportunities favored by corporate image, recognition and prestige given by the certification to participate in new markets. Internal motivations include the logistical improvement of waste management in the organization (Sánchez Galeano, 2020).
c. *Changes in environmental legislation (F23)* can make it difficult to comply with current environmental regulations. In addition, the lack of coordination between the different government agencies, a very weak institutional capacity, and the lack of access to information contribute to this factor, affecting the application of environmental management systems in companies.

Result factors

These factors, little mobile, highly dependent, are often descriptive indicators of the evolution of the system addressed through the dependent factors in the system.

a. *Identification of roles (F28)* in a team may lead the system through the appropriate training of the staff and the assignation of responsibilities with good levels of motivation (Lannelongue Nieto, 2011). The adoption of an EMS influences the design of the company's structure, such as the jobs in the organization. If choosing people without the necessary skills, the company's environmental performance may be flawed.
b. *The change in culture (F7)* heavily influences environmental management practices (Arimura et al., 2016). The change in culture expected of employees at several levels of assimilation and organizational predisposition, makes the ISO 14001 standard difficult to assimilate by some organizations. In fact,

Murmura et al. (2018) show that one of the main barriers for the proper functioning of the EMS in large companies is cultural change.

c. *The methodology of impact assessment (F6) refers to the identification and evaluation of impacts* generated by the processes of elaboration of the company's products or services indicate that some companies do not know the magnitude of the impacts they cause. Similarly, Gómez and Rodríguez (2011) did not find a significant relationship between the certification of ISO 14001 and the reduction of pollutant emission rates of a company, which may indicate that the adoption of the standard improves administrative or economic outcomes but not necessarily reduces the impact of the emissions.

Secondary factors

These are complementary to regulatory factors. Acting on them means changing regulatory factors, which also affects the evolution of challenging factors. The analysis conducted in this study allowed identifying three secondary factors: time, consultancy costs, and incentives.

a. *The time (F16)* relates to the period required to reach the certification (usually between 8 and 19 months). This time is decisive in the adoption of the standard. Time is the factor that requires more attention for the implementation of the EMS (Babakri et al., 2003) since the company requires to invest time of many people during the certification process.
b. *Consultancy costs (F25)* refer to the total value of professional services provided by a consultant. Moreover, investors associate certification with below-cost profit expectations. One possible reason for this association is the capital market, given that investors perceive ISO 14001 certification as more reactive than proactive (Cañón-de-Francia & Garcés-Ayerbe, 2009). In addition, some authors argue that the improvement of environmental performance implies two kinds of costs. On the one hand, the cost of implementation and external verification. On the other hand, the cost of realizing the necessary investments for the application of the continuous improvement of the performance.
c. *The incentives (F10)* seek to link the interests or motivations of the employees with the goals of the company. Regarding external incentives, companies are more likely to adopt ISO 14001 when they find strong incentives to do so (Neumayer & Perkins, 2004), which is why, according to Mungai et al. (2020), the government should subsidize the implementation of EMS to allow access to external experts who are crucial to improving the environmental performance of companies. Within this framework, narrow profit margins mean that some companies perceive ISO 14001 as a disincentive to their organizational performance.
d. *Internalization (F22)* Ferrón Vílchez (2017) refers to the internalization of the standard as to interiorize. That is, adopting the EMS in a real way instead of in a symbolic way. Guédez Mozur et al. (2003) states that only in the companies where the senior management is committed to the implementation and development of EMS, the internalization of the system occurs in each of the processes, thereby significantly improving its environmental performance.

Autonomous factors

The autonomous factors locate near the origin, are not very influential or moving, and are little dependent. Two factors belong to this category: the community and the increase in paperwork and documentation.

a. *The Community (F14)* The community plays an important role in the environmental performance of companies, especially in the area of influence where the organization operates, becoming part of the interest group that can exert strong pressures to enjoy a good environmental quality (Guédez Mozur et al., 2003).

b. *The increase in paperwork and documentation (F17)* is one of the most significant considerations in the adoption of management systems, as all processes and procedures require documentation, thus increasing the amount of paperwork. According to Haslinda and Chang (2010), paperwork can be very challenging at an employee level as there is a greater workload, and changes in the way they perform their tasks, particularly with the additional documentation and procedures to follow that can be very bureaucratic and often unnecessary.

Environmental factors

The environmental factors are in the upper left part of the plane. The eight factors in this category are organizational structure, communication, quality in the audits, slowness in the environmental procedures, life cycle analysis, institutional pressures, and teams in the organization.

a. *The organizational structure (F27)* is an intentional disposition of activities, in which each person assumes a role at the best possible performance. In some cases, because of the adoption of ISO 14001, the structure is modified, and its relationships with suppliers and customers must be adjusted (Darnall et al., 2001) in a way that the environmental management ultimately tends to be more closely integrated into the organizational structure.
b. *Communication (F20)* Companies are in a permanent state of communication for both what they say or not to their target audiences: investors, shareholders, employees, consumers, suppliers, media, and public opinion. Internet and social media have brought the relationship between companies and their stakeholders to a close state of proximity that sometimes turns into a one-on-one dialogue, especially when talking about customer service (Berceruelo & Equipo de Estudio de Comunicación, 2016).
c. *Auditing failure (F9)* by third party auditors allows some companies to obtain standard certification without continuously meeting the requirements. Essential issues such as the role of consultants, auditors, other stakeholders, and employee perceptions are clearly ignored. This means that the auditing does not yield relevant information for improving the processes associated with the environmental management of the company and therefore, misses the opportunity to use an enriching element of the standard such as the preventive and corrective actions (Escobar Cárdenas, 2009) to improve the environmental performance of the company.
d. *Slow environmental procedures (F24)* An environmental procedure, which should normally take only ninety days, in some cases, has taken up to three years. The delays add to the lack of structure in environmental agencies, which are slow to respond to demands. The need to contract specialized services for lack of information from environmental agencies and the excess or duplication of reports become difficulties with the EMS and therefore can have a significant impact on the environmental performance of the organization.
e. *The life cycle analysis (F30)* incorporated in the 2015 version of ISO 14001, refers to the consideration of the environmental impact of all the activities of the company throughout the life cycle of the product and/or service provided, encompassing all needs for environmental analysis and assessment at each stage. Some authors point out that companies making the transition from the ISO 14001 2005 to the 2015 version have had difficulties regarding the aspects of the LCA. The difficulty in understanding this concept will also affect its application and the realization of the benefits associated with an organization's environmental performance.
f. *Institutional pressures (F13)* are common manifestations or interest by some groups that try to influence decisions of their own members or those of governmental organizations or institutions that manage the environmental area. Some studies have shown how various institutional pressures can drive the effectiveness of management practices and standards such as ISO 14001, without indicating if these

pressures are successful. For Cañón-de-Francia & Garcés-Ayerbe (2009), the market can see ISO 14001 certification as a standard adopted in response to institutional pressure rather than a standard that guarantees self-regulation-flexibility and anticipation in the environmental adaptation process.

g. *The equipment (F19)* refers to the set of instruments used for measurement, control and monitoring of the processes taking place in the company, as well as the different technologies the organization is equipped with to face environmental problems. Modernization, calibration, and maintenance are some of the barriers that certain companies have when it comes to equipment. Both the monitoring and measurement of the environmental performance of the organization depend on calibrated equipment to determine the environmental management indicators.

Determining factors

Determining factors locate in the upper left zone of the influence-dependence plane. These are factors that, according to their evolution throughout the study period, work as brakes or motors for the system. They are a little dependent and very moving - influencing.

a. *The size of the company (F12)* may be very large (global and very complex enterprises), large, medium, small, and very small (micro-enterprises) companies. According to Christini et al. (2004), the size of a company limits its ability to establish an EMS. For Arocena et al. (2021), the size of the company and the degree of environmental awareness of society (EAS) are the two factors that moderate the effect of ISO 14001 on the company's performance.

Proposal of an environmental performance evaluation model discussion

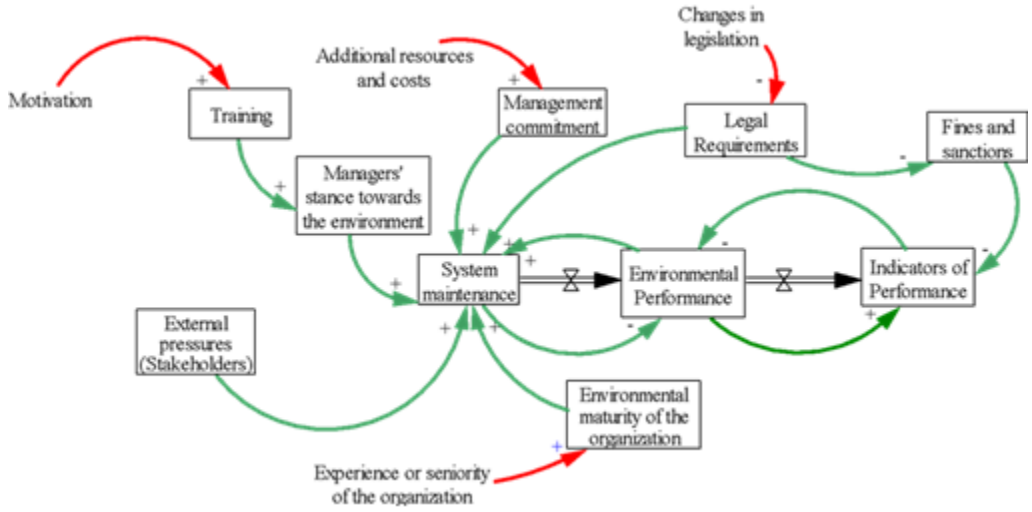
Of the nine key factors that were identified with Micmac, only four coincide with the factors most cited in the literature: director's commitment, performance indicators, training, and external pressures.

The commitment of the director, according to Pérez Uribe & Bejarano, (2008), is the factor that allocates the necessary resources for the operation of the EMS and allows the development of measurement instruments for environmental indicators. In this sense, the training factor is one of the most adopted in companies. The lack of training can generate non-compliance with the requirements of the ISO 14001 standard. External pressures are related to the company's concern for the requirements of stakeholders, as stated by Díez Martín (2008). In the literature reviewed, the factor of additional costs is the most frequently cited and Micmac classifies it as a regulatory factor. Therefore, acting on this factor largely determines the proper functioning of the system.

System maintenance is a key factor that is presented in Micmac as the problem factor of the system, to which it is necessary to pay greater attention, depending largely on the characteristics of each company. Implementing the standard, carrying out internal audits, and maintaining ISO requirements requires an investment of time by many people in the company (Pérez Uribe & Bejarano, 2008). Scientific literature addresses 30 factors identified as relevant for the environmental performance of organizations certified in ISO 14001 in a fragmented way, evidencing the lack of holistic studies on the subject. A high number of papers analyze the behavioral change of environmental performance over time based only on the review of environmental indicators of the company. This can lead to biased outcomes, given that many companies do not have a fully developed indicator system. Other studies focus specifically on examining the environmental performance by only linking it to the company's economic outcomes (Wagner, 2010).

Based on the structural analysis, in Figure 4 we propose a model with a logical syntax of causality, which highlights the positive and negative interactions of the nine key factors with other regulatory, objective, and environmental factors, in achieving the environmental performance of the organizations.

Figure 4
Causal diagram with the interrelations



Source: the authors

For the model, the manager's commitment affects the maintenance of the EMS in the first causal loop. This loop supports the adoption of the EMS by the entire structural and organizational machinery of the organization and enables the improvement of environmental performance. Otherwise, the structure of the model could not guarantee an effective environmental performance, generating negative effects on the organization. As suggested by Amir et al. (2020), greater management dedication can lead to better performance.

This training leads to the assumption that managers are responsible for devoting effective time to fostering organizational environments. However, it is very common to find that the responsibility for implementing and maintaining the model lies with middle management. This level of management does not have enough authority to guarantee the dynamism of the process (Escobar Cárdenas, 2009), but can adversely affect the environmental performance of the organization.

Therefore, the lack of environmental maturity of the company, which manifests itself as the experience or seniority of the organization in the field, and the consolidation of the adopted management standard, may impair the maintenance of the EMS. More years of experience will have a positive effect on system maintenance and thereby the possibility to fulfill a notable environmental performance. Maintenance requires constant training in the handling of their environmental management, considering that in some cases, the environmental maturity of the company does not imply its evolution. The lack of environmental maturity supposes possible non-compliances to the legal normativity and probable failure to improve its environmental performance.

The reviewed articles also evince that external pressures have driven the adoption of environmental management models with a positive influence of ISO 14001 and EMS certifications on corporate environmental performance. Agents such as clients, suppliers, the community, and other companies exert these external pressures through actions of social responsibility, the requirement of certification, petitions, complaints, and claims. The awareness of the top management to the actions of interest groups is required for the model to work. External pressures generally have a positive impact on environmental performance as they lead the company to try to maintain a corporate social responsibility that brings benefits in its relationship with customers, workers, and suppliers (Barroso Tanoira, 2009).

In the cycle of management of Figure 4, the indicators will be positive if the performance of the company presents effective results or negative otherwise in each period. The aim of these indicators is to provide information on the degree of compliance with the proposed goals in the environmental area. As pointed out by Heras-Saizarbitoria et al. (2020), the lack of improvement of indicators by companies may lead to a rather symbolic adoption of environmental management systems. An organization with low compliance rates is subject to fines and penalties, which may produce even more results that are negative and affect the indicators themselves.

The size of the company conditions the company's maturity by increasing the administrative burden, especially in large companies, leading to an increase in the number of obligations. This means involving managers and employees to carry out a greater system internalization and thus to develop maturity, unlike small businesses that lack structured and mature environmental management. Therefore, small businesses with limited resources should focus more on monitoring environmental indicators. In this context, top managers view the additional costs associated with the management model reluctantly, as they imply more resources.

In the proposed model, employee motivation in training significantly improves work performance, influencing the organization's environmental indicators. Although a direct relationship between work motivation and performance has been demonstrated, there are several reasons for workers to leave training programs incomplete, making essential to know how to motivate them to reflect their training in environmental practices and therefore in the improvement of environmental performance (Muchtar, 2017). Increasingly strict legislation and the progressive requirement to report on environmental contingencies in annual accounts, in addition to society's growing concern about environmental issues, has placed companies in a situation where they need more information of their environmental impacts to put in practice strategies of corporate environmental responsibility (Calduch Rubio, 2016).

Consequently, for the model to evolve, it is necessary for companies to exert greater control of the key factors identified in this study. In short, the model begins to fail when there is evidence of a deterioration in the maintenance of the system, whose outputs will be poor environmental indicators and therefore poor environmental performance.

Conclusion

In this article, we identified 30 factors reported in the literature that have a significant impact on the environmental performance of companies certified in ISO 14001. The analysis supported by Micmac experts allowed these factors to be classified into dependent, influential and key in performance. They were classified into six categories (external pressures, company characteristics, processes, human resources, compliance with standards and leadership), with only nine of the factors considered key to performance: staff training, external pressures, maintenance of the EMS, the environmental maturity of the organization, legal requirements, management commitment, the position of managers towards the environment, performance indicators and fines and sanctions.

The analysis showed how implementation costs, employee motivation and changes in legislation affect the results of key factors. Therefore, we suggest the periodic evaluation of these three factors within organizations, going beyond the mere collection of performance indicators.

The proposed model, based on key and regulatory factors, allows a better understanding of the variables that influence a system and can serve as a reliable guide for the successful environmental performance of companies.

There are some causal factors such as motivation, additional costs, changes in legislation and the experience of the organization that can positively or negatively affect the key factors and also the environmental management system.

The proposed model opens an opportunity for future empirical studies on the interactions of these factors within certified companies that will reveal how valid the connections suggested in this article are.

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ANALYSIS OF FACTORS THAT AFFECT THE ENVIRONMENTAL PERFORMANCE OF COMPANIES CERTIFIED IN ISO 14001

ANÁLISIS DE LOS FACTORES QUE AFECTAN EL DESEMPEÑO AMBIENTAL DE LAS EMPRESAS CERTIFICADAS EN ISO 14001

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