



Component Analysis to Design an Integral Sustainability Model for Micro, Small, and Medium-Sized Enterprises

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Abstract— *Micro, small, and medium enterprises (MSMEs) are the engine of economic, environmental, and social stability in many countries but recently MSMEs have been facing instability in their sales and, production, and feature a decrease in employment that generates negative growth in the gross domestic product in emerging countries. Also, along with governmental entities, they are expected to be aware of the importance of developing sustainable models to improve production systems within the framework of sustainable development. Considering there is abundant literature on multiple sustainable models, their effective implementation in production systems is a debate topic as there is no standard guide to the processes and activities that should be followed in their adoption. The objective of this study is to design an integral sustainability model for MSMEs through the analysis of the interrelationships and dependencies of sustainability factors and a perception analysis evaluating 327 MSMEs in Colombia, using the design science research and case study as a research method. The analysis of the results has been exposed as results of a doctoral thesis which indicates that the MSMEs that were studied presented significant variations and similarities in the use of the adoption of sustainable strategies, which allowed the identification of weaknesses and strengths to focus efforts on the development of productive systems aligned with environmental sustainability.*

Keywords-- *Micro, small and medium enterprises; sustainable models; sustainable companies.*

I. INTRODUCTION

In the last two decades, concern and attention to environmental problems caused by the industrial sector continue to increase considerably, especially in emerging countries that have many micro, small, and medium-sized enterprises (MSMEs). For this reason, the declaration of sustainable development issue was d in the report "Our common future" also known as the Brundtland Report. The term sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [1].

Since the declaration of sustainable development, multiple interpretations and guidelines have emerged that allow for achieving business sustainability, as is the case of the 2030 Agenda for Sustainable Development approved in 2015 by the United Nations general assembly [2]. This agenda establishes a series of objectives for the consensual construction of a

development model that provides the well-being of people and the sustainability of the planet. However, the path for the MSMEs sector is not an easy one, given that the plan is ambitious and presents several considerable challenges.

In this way, environmental degradation, the 2030 agenda, and sustainable development have led world leaders, managers, and academics, to rethink new productive and economic models that allow the implementation of new strategies to minimize environmental impacts and increase productivity and quality of the product or service. In the literature review, several strategies range from productive, economic, social, and environmental improvement, such as green manufacturing [3], circular economy [4, 5] sustainable business models [6], and standards systems [7], among others. However, the way to carry out these strategies becomes complex when applying them in the MSMEs sector. Also, it is difficult for most MSMEs to achieve sustainability and profitability at the same time.

Consequently, the following research question is: What are the interrelationships between the elements and factors of sustainability models? To answer this question, the main objective is to develop a comprehensive sustainability model adapted to MSMEs through the analysis of production and sustainability factors. The analysis of the results has been exposed as results of a doctoral thesis were based on the methodology of research science design and case study. Also, the contribution of this research is: First, the design of a new integral model that combines a series of productive and environmental strategies that allow companies to have a route of achievement to sustainable development. Second, research to have an overview of the situation of MSMEs in Colombia about the proposed model. Finally, the model allows decision-makers in the industry to satisfy market needs without affecting the environment.

The paper is organized as follows. Section II provides the theoretical concepts. Section III describes the methodology. Section IV has presented the design of a comprehensive sustainability model. The results and discussion are presented in Section V, and conclusions are drawn in Section VI.

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II. THEORETICAL CONCEPTS

A. Corporate sustainability

Over the last few decades, there have been concerns and challenges to achieving sustainable development that integrates political, economic, environmental, and social aspects through the compliance of protocols, conventions, and international agreements. However, globalization and emerging issues have been increasing due to new challenges. Growing businesses face a range of technical problems. As a business grows, several difficulties and opportunities demand different solutions [8]. These new challenges include technologies with artificial intelligence, in innovative products, government regulations, economic recessions, and the capacity to use ecosystem services by enterprises.

In this sense, many aspects or factors have motivated the development of sustainability in the business sphere. The authors [9] sets out five elements established by the needs, requirements, and challenges that companies have to fulfill sustainability in the era of globalization. These are energy efficiency, emerging trade, sustainable value chains, business models, and information technologies that aim to make companies achieve a transformation to industry 4.0.

Therefore, for leaders and managers to contribute to those factors, it has been studied the concepts of corporate sustainability such a strategy that allows the creation of economic, environmental, and social value to increase the well-being of present and future generations [10, 11]. According to the author [6], corporate sustainability refers to the strategic systems that transform organizational management into a set of activities that contribute to sustainable development. Namely, enterprises should efficiently produce their products minimizing environmental impacts.

In the literature review, there are different studies on corporate sustainability and sustainability models in MSMEs. In order to analyse research directly addressing these topics, the Scopus database was used, so in searching the databases Scopus and Web of Science (WoS), the equation “(sustain* AND management*) AND ((model*) OR (framework*)) AND ((sMEs OR (small AND medium AND sized AND enterprises) OR (small AND business)))” was applied in the search fields Title-ABS KEY (Scopus) and TOPIC (WoS).

The search equation above yielded 247 articles in Scopus and 262 in WoS. Therefore, it was considered necessary to unify the list of scientific articles issued in the last five years by comparing the following fields: Keywords, summary, authors, country, journal, and affiliation information. The list of papers was systematized in CSV and HTML files and then processed in the programming language Python, to standardize the keywords (i.e., synonym unification and information

refinement). For example, the keywords “small business” and “SMEs” were unified as “small and medium-sized enterprises”. In addition, the articles were stratified according to the keyword combinations defined in the search equation. Out of the 507 articles analysed, 226 were found to contain some words from the equation in their summary or keywords.

After exporting the information from Python, the results were displayed in a VOS viewer software package version 1.6.15, which allows the identification of the most relevant research clusters [12]. Fig. 1 highlights the three major clusters of keywords associated with the subject of study, plus a cluster that is embedded in the large one.

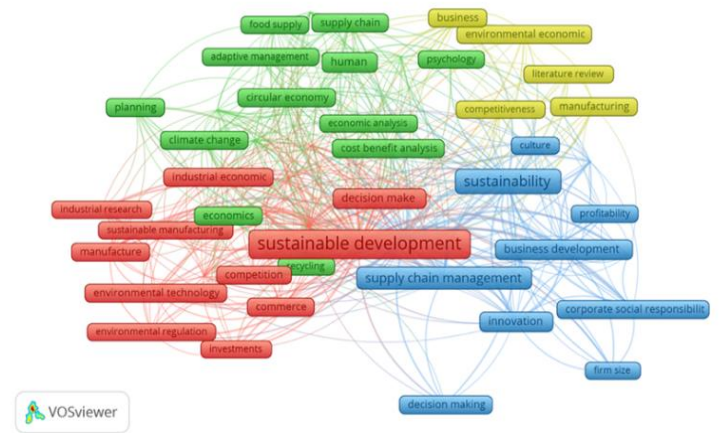


Fig. 1 Clusters of author keywords

As shown in Fig. 1 “sustainable development” is naturally the central word in the map of key topics, which are, in turn, associated with other focal topics. These key topics have been classified into three main clusters: Focusing on strategic management, Cluster 1 (red) highlights environmental regulations, technology, economy, competitiveness, industrial research, sustainable manufacturing, trade, investment, and decision-making. Cluster 2 (green) focuses on sustainable tools and practices such as circular economy, recycling, cost-benefit analysis, planning, climate change and adaptive resource management, and adaptive environmental management assessment. In turn, cluster 3 (blue) focuses on business development as seen from the perspective of human resources in a sustainable value chain, which includes corporate social responsibility, innovation, culture, profitability, and decision-making. Although reduced in the number of key topics, the remaining cluster (yellow) focuses on business, literature review, competitiveness, manufacturing, and environmental economics, all of which are included in at least one of the three main clusters.

As a result of this analysis, three clusters were defined: i) Cluster 1. Management systems for sustainable development decision-making, which highlights the importance of defining

the different risks, challenges, approaches, elements, and characteristics involved in this type of decision in SMEs; ii) Cluster 2. Sustainable Tools and Practices, wherein different types of strategies and tools that have been applied to SMEs are analysed, showing their benefits and implementation barriers; iii) Cluster 3. Social Responsibility and Knowledge Management, underpinning the link between corporate economic and environmental components and the social aspect of the labour force, thus guaranteeing that the systems and procedures of the operational activities comply with the social. After identifying each topic's different clusters, the most relevant information was extracted to establish the parts of the model that we propose.

Cluster 1. Management systems for sustainable development decision-making: The studies analyzed in this cluster deal with SMEs in their search for industrial development 4.0, for which they are making use of new management systems intended to reach a sustainable balance between internal and external factors. This is the case of the scientific research of reference [13], which introduces a decision model that allows identifying the economic, ecological, social, technical, and political risks that arise during the implementation of Industry 4.0. Although this scientific research integrates its results with the dimensions of sustainability, it attracts criticism by extrapolating its results to more general considerations on risk analysis, since it only evaluates 14 German companies. Just as well, it can be said to lack detail on how these risks can be adequately counteracted in different contexts. Also, Research by C. H. Hsu et al.[14] shows that improving business management and performance as a function of sustainability constitutes a growth and development opportunity. However, it is difficult for SMEs to achieve sustainability due to economic resource availability limitations. In correspondence with that, this author shows how to effectively use the resources of SMEs and prioritize performance factors through the Balanced Scorecard (BSC). However, this research does not consider that depending on the type of SME, it can develop its sustainability criteria and appropriate performance indicators that allow it to prioritize its goals and critical indicators.

In addition, the scientific research of P. R. Crowe et al. [15] introduces different lines of collaborative management and adaptive design linking SMEs, scholars, citizens, and local governments. Likewise, a study conducted by T. B. Long et al. [16] explores and identifies critical success factors and barriers for the transition from traditional to sustainable business models by evaluating 14 SMEs in a particular sector. This author determined that the primary drivers correspond to business collaboration, a clear vision of the business, continuous innovation, a sustainable base, profitability, and fortuitous external events that emerge as critical success factors. However, due to the limited number of evaluated companies, it

may be necessary to confirm whether the factors in question are applicable in different contexts.

Cluster 2. Sustainable Tools and Practices: several studies have emphasized that, due to the particular features of SMEs, they make multiple efforts to implement sustainable tools and practices, which is an arduous task for them [17]. Research carried out by H. T. S. Caldera et al.[18] on Lean and Green thinking has shed some light on this problem. Intended for continuous improvement of ecological contexts, this approach addresses problems such as waste management, overproduction, waiting, transportation, defects, excessive use of ecosystem services, garbage, pollution, and industrial safety deficiencies, among others. The mentioned author develops a model based on strategic facilitators for sustainable business practices, intended to guide SMEs toward the use of Lean and Green strategies. In practical terms, the model recommends internal process changes, improvement of employee attitudes and perceptions, optimization measures, financial incentives, and a support network to connect industrial SMEs with environmental sustainability experts. G. C. Oliveira Neto et al. [19] highlight that, when it comes to implementing Cleaner Production, SMEs have to face several barriers that prevent the transition to sustainability. These can be financial, economic, cultural, technological, legislative, governmental, or organizational in nature.

Cluster 3. Social Responsibility and Knowledge Management: the study developed by C. C. Nakamba et al. [20] examines how social sustainability is considered in supply chain management, with the aim of identifying key future research perspectives. These authors synthesize some trends and research implications in the framework of corporate social responsibility: Existing pressures on social sustainability implementation by different actors of the supply chain; the development of measurement units to assess corporate social aspects (e.g., decent working conditions, incentives, wages and satisfaction among employees and customers, among others); and the development of tools and strategies to integrate social risk management into hiring and supplier selection decisions.

The lack of sustainable social responsibility in the internal processes of the companies have become a must when it comes to improving workers' behavioural ethics. This is supported through the acquisition of environmental, social, and economic knowledge, the latter being transformed into results that contribute to the improvement and sustainable development of the company.

After defining and highlighting a general panorama of each cluster, it was necessary to propose theoretical and common variables for the papers that address this research, that is explained in section IV. The main research gaps as currently identified are: i) The lack of a methodology to implement simplified sustainability models that do not require long periods of time to evaluate the return on investment by SMEs; ii) The

comprehensive assessment of sustainability must include social aspects such as knowledge management and environmental culture. However, this dimension is rarely considered or evaluated; iii) It is necessary to strengthen learning and communication programs to implement sustainable models among the actors of the value chain; iv) Lack of sustainable maturity models that allow establishing a gradual route for implementing environmental, social and economic strategies; v) Lack of information technology tools for managing and monitoring sustainability in SMEs; vi) Scarcity of sustainable models validated through data analysis.

III. METHODOLOGY

This study is descriptive and exploratory research that integrates qualitative and quantitative analysis. The methodology used is based on *Design science research* [21] that consists of establishing a general research framework, designing an innovative and useful model for solving a particular problem through different phases and activities. In addition, the use of the *Case study* [22] is proposed, this method is a valuable scientific research tool that allows validating the model through the behavior of the companies involved in this research study. Fig. 2 shows the phases used for the development of the research.

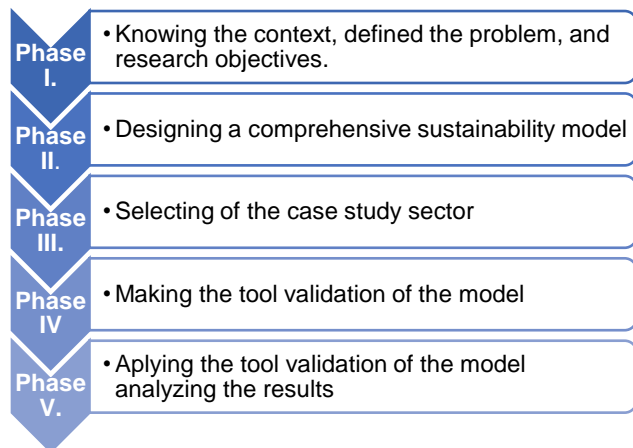


Fig. 2. Phases of research study

It is highlighted that in the case study, the data is obtained through a variety of sources, such as management and management reports, interviews, reports, data collection tools, type of survey that allows validating the model proposed in next section, each of the activities developed for each stage is explained below. As it can be seen in Table 1, the first activity is the definition of the problem were used issue trees and Ichikawa diagrams:

TABLE 1

Phase I
Activity 1.1. Definition of the problem: The lack of strategic models integrating management systems, sustainable practices, social responsibility, and environmental knowledge management for workers in accordance with the needs of Colombian SMEs.

Activity 1.2. Specific sector analysis: SMEs of the services, manufacture and construction services in Colombia.
Activity 1.3 Definition of the objectives and research question: What are necessary conditions for SMEs to improve their economic efficiency indicators, minimize their negative environmental impacts and have their employees adopt a more sustainable responsible behavior?
Activity 1.4 Definition of requirements: Literature reviews and bibliometric analyses to provide insight into the environmental, economic, and social approaches of the current SMEs environmental sustainability models.

The state of the art is defined, based on the bibliometric analysis carried out in the relevance cycle. As it can be seen in Table. 2, the first activity is the "definition of the state of the art", which provides the knowledge background of the process, and is followed by the selection of the models that allow analyzing the research gap, so the activities that phases II involve was:

TABLE 2

Phase II
Activity 2.1. Definition of the state of the art: The literature review evidences few sustainability models integrating knowledge management strategies, environmental practices, and management systems according to the needs of SMEs.
Activity 2.2. Selection of the main models: The main sustainability models identified in each approach.
Activity 2.3. Research gap analysis.
Activity 2.4. Identification of ideas for the design of the model: A list of concepts, components and factors is extracted from the literature review, based on which their integration into the integral sustainability model.

Table 3. summarizes the activities corresponding to phase III.

TABLE 3

Phase III
Activity 3.1. Identification of inputs and outputs, all the components and factors that are referenced in the state of the art are taken as inputs. For their part, the outputs correspond to the most representative ones.
Activity 3.2. List of components, factors, and interactions: The factors and components resulting are listed in order of importance (high, medium, or low, according to the objective of each sustainability dimension) and classified by author
Activity 3.3 SMEs of the services, manufacture and construction services in Colombia were studied.

Table 4. summarizes the activities corresponding to the phase IV.

TABLE 4

Phase IV
Activity 4.1. Construction and evaluation of the model: The design activity starts the schematization and construction of

the integral sustainability model for SMEs, resulting in a first draft of it. After the first two design proposals, the design was redefined since more requirements and relationships between the factors were considered. Then, “definition of components” activity was re-iterated, resulting in the model shown in section IV.

As it can be seen in Table 5, the last activity is the applying the tool validation of the model analyzing the results as shown in table 5, phase V.

TABLE V

Phase V

Activities 5.1, The model was applied, for it to be evaluated later. This activity was based on the Case study methodologies [22] Computational intelligence experimental design [23].
Activities 5.2, The data were statistically analyzed and corroborated against the research objectives and questions, which must be answered to assure that the proposed model fulfills its function.

IV. DESIGN AN INTEGRAL SUSTAINABILITY MODEL

The integral sustainability model proposed for MSMEs in Colombia is defined as a set of components which not only belong to the dimensions of sustainable development but are also correlated with the relevance given by each identified factor, $G = (Ds, F, C, A)$, represented in equation (1).

$$ISM - S = \{f_i(a_k, c_j) : f \in Ds, c \in C, a \in A | i, j, k > 0, k = j, i \neq k, j\} \quad (1)$$

Where:

Ds- denotes the dimension of sustainable development.

F- denotes the set of factors belonging to the dimensions of sustainable development, wherein f_i corresponds to the i -th factor, as represented in equation (2).

$$F = \{f_i : f \in Ds, i > 0\} \quad (2)$$

C- denotes the set of components belonging to an author, wherein c_j corresponds to the j -th component, as represented in equation (3).

$$C = \{c_j : c \in f_i \text{ and } c \in A, j > 0\} \quad (3)$$

A- denotes the set of authors proposing a given component associated to the sustainable development factors of the literature review, wherein a_k corresponds to a particular author, as represented in Equation 4.

$$A = \{a_k : a > 0 \text{ and } a < 5\} \quad (4)$$

As to the selection of the components, an importance correlation is calculated by summing up the most relevant ones

and selecting those that are higher than 4, as represented in equation (5):

$$ISM - S = \{csms_i \sum(a_k, c_j) \geq 4\} \quad (5)$$

In general, the proposed model contains these elements:

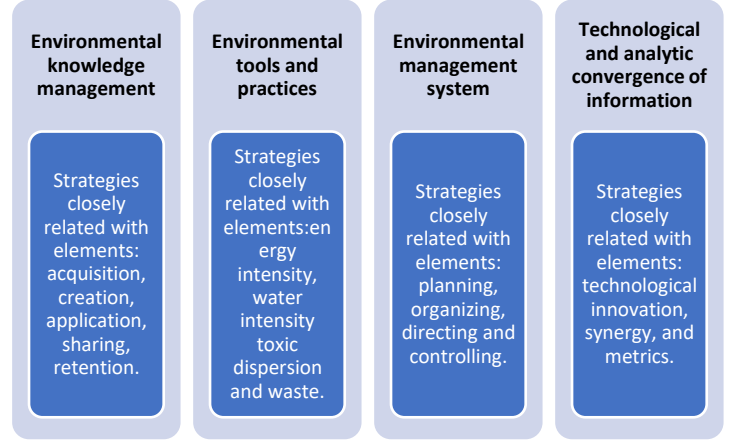


Fig. 3. Integral sustainability model for MSMEs

- *Environmental knowledge management*

This factor is supported by the following components: Costs, profitability, capacity, requirements, coverage, and competitiveness, which are considered internal elements that make it difficult for SMEs to adopt sustainable strategies and practices. On the other hand, it must be acknowledged that this system represents an increase in business and operational costs and entrepreneurs do not yet perceive any link between organizational improvement and business performance on sustainable issues when investing in environmental sustainability.

- *Environmental tools and practices*

This factor is supported by process-analysis-related components which, coupled to exhaustive policy, mission, organizational and environmental values revisions, are intended to achieve incremental improvements or transformations. Subsequently, the components “environmental impact assessment” and “identification of the company's own environmental goals and objectives” are proposed since they may influence the fulfillment of sustainable development objectives (SDAs) through internal organizational operations.

- *Environmental management system*

This factor is supported by the education and knowledge transfer components, the employees being the main active resource capable of gathering training and creativity to promote innovative and competitive elements in the company. In this way, training, technical assistance, and teaching of the implementation of sustainable strategies and practices continue

to be fundamental for the environmental and social management of employees.

- *Technological and analytic convergence of information*

This factor is supported by the components “technological innovation”, “synergy” and “metrics”. This set of components is aligned with the need these companies still have in the sense of knowing how to use any type of data generated in their internal operations to make value-creating decisions and obtain the information that is relevant to the current situation of the company [24].

V. RESULTS AND DISCUSSION

The results of the proposed model are validated through the case study method. In this way, Colombia's MSMEs are used. The results are exposed in [25], [26]. The contact details of the small enterprises participating in the case study are obtained through the Orbis® database. This database is characterized by “[...] including information from some 360 million companies around the world”. It is the resource for obtaining data from companies” [18]. By using Orbis®, a list of more than 3500 active MSMEs in different cities is obtained, in which 1350 MSMEs with incorrect contact details are eliminated. In addition, a population size of 2150 MSMEs is calculated, with a 95% confidence level and a 5% margin of error, giving a result of a sample size of 327 MSMEs to be evaluated.

A survey was designed to determine the behavior of different productive sectors concerning the factors of the integral sustainable model. The questions of the study are designed based on the elements that were identified in each of the factors. The survey has four specific sections: Section 1. General information about the MSMEs evaluated. Section 2. Integrated sustainable strategies that it has been divided into three factors to assess: Environmental knowledge management, Sustainability practices, and Management systems. Section 3. Analysis of barriers to adopting sustainable practices and strategies.

Following are the data obtained from the survey conducted on the Colombia MSMEs:

A. Section 1. General information about the enterprises.

As shown in Fig.4, the number of companies that participated in the case study, it has been distributed by economic activities:

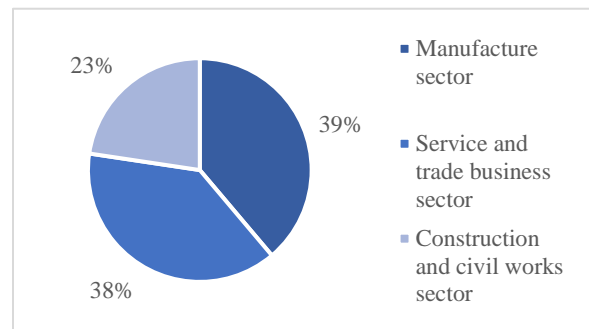


Fig. 4. Economic activities of the evaluated MSMEs

The results show that the manufacturing sector had the most significant representation in this research, with 39% of the sampled enterprises, followed by service the sector with 38%; and construction and civil works sector with 23% of the sampled enterprises. Also, another general information about the evaluated companies is the low participation in the national cluster association, which only covers 12.8% of the sample.

The remaining 87.2% manifested not being in any type of business clusters. So, the few enterprises that are associated in the national clusters are member of the Colombian Association of Micro, Small and Medium Enterprises (Asociación Colombiana de las Micro, Pequeñas y Medianas Empresas - ACOPI), the Colombian Chamber of Construction industries (Cámara Colombiana de la Construcción -CAMACOL), the Colombian Hotel Association (Asociación Hotelera Colombiana - ASOTELCA), and the Hotel and Tourism Association of Colombia (Asociación Hotelera y Turística de Colombia - COTELCO).

B. Section 2. Integrated sustainable strategies.

This section discusses how MSMEs could affect their production lines or services by three elements of knowledge management: environmental education and training programs, documentation of traditional knowledge, and the use of environmental experience to improve their internal processes. As shown in Fig. 5 a total of 74% MSMEs affirm that their employees have trained in environmental issues, but around 26% of MSMEs indicate that they allocate limited educational resources for employee training programs.

Furthermore, Fig. 5 shows that 59% MSMEs say that they have documents or reports on all operational procedures that the company carries out. These documents are vital for knowledge management because they allow the definition, structure,

retention, and sharing of knowledge and experience of employees [27]. However, 41% of MSMEs which answer negatively assert that they haven't documented the processes that registered in the company, this would not allow them to have a record of the updating of employee knowledge and business information.

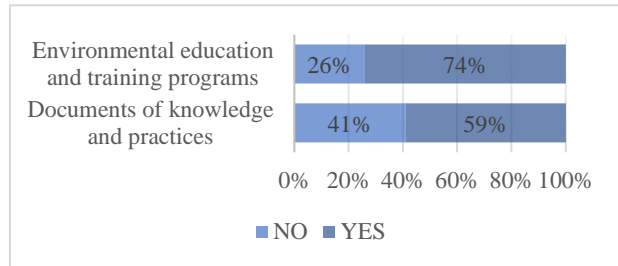


Fig. 5. Management of environmental knowledge

On the other hand, as shown in Fig. 6, only 12% of MSMEs say they strongly agree, and 33% of MSMEs assume that they agree to state that environmental knowledge used to improve the internal production process of the company. Still, a total of 24% of MSMEs respond undecided with that statement. So, it necessary to incentive the benefit of the management of knowledge as a rise in employee productivity. As apply the environmental knowledge become more and more common in MSMEs, and if a company can create a knowledge-sharing culture in their workplace, employee productivity will rise.

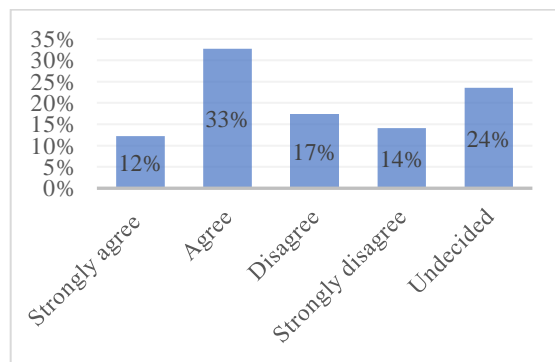


Fig. 6. The environmental knowledge used to improve the internal processes of the company.

In this section, it has evaluated if the MSMEs adopt some sustainability practices, such as liquid waste management, solid waste management, energy efficiency, water efficiency, noise reduction, and indicators control thought an environment methods or guideline. As shown in Fig. 7, it is evident that the many MSMEs do not use sustainability guidelines or environmental methods within their mission. In fact, according to the results, 80% of MSMEs affirm that they have no

environmental systems inside the company, which would not allow them to develop rules and sustainability objectives. However, 20% of MSMEs claim that they have a sustainability guideline.

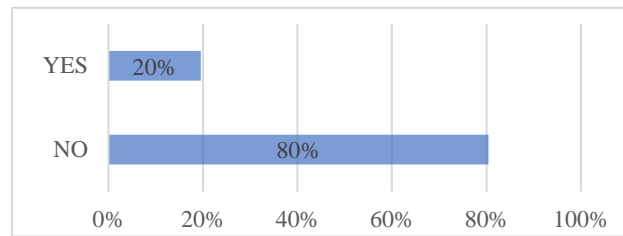


Fig. 7. SMEs that have sustainability guidelines.

In addition, as shown in Fig. 8, around 50% of MSMEs affirm that they do not carry out environmental practices related to noise control, energy and water efficiency, and liquid waste management. However, solid waste management is the activity they do most.

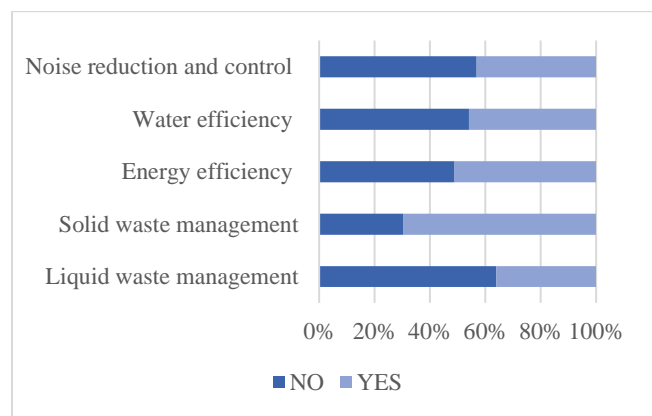


Fig. 8. Implementation of sustainability management practices.

An environmental and business management system consists of a collection of internal policies, indicator evaluations, and implementation activities. The focus in this section was on the implementation of an environmental management system. Also, it was discussed whether the manufacturing or service process and environmental practices are related to decision-making support.

As shown in Fig. 9, approximately 64% of MSMEs do not have an environmental and business management system or tool, but a total of 36% of MSMEs apply a system. MSMEs that have implemented any system generally operate with large companies that require their suppliers to apply an environmental management system. However, the few types of environmental agreements between industries with MSMEs are

related to lower production or service costs than with any environmental concern.

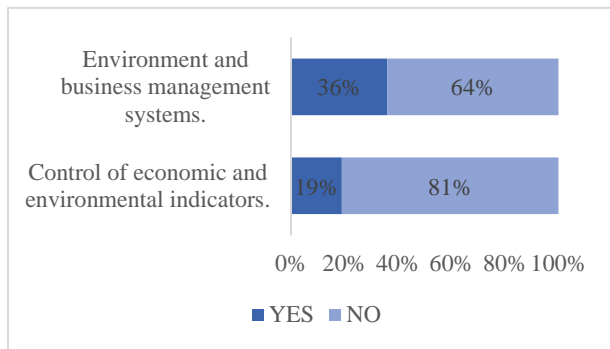


Fig. 9. Environmental and business management system in MSMEs.

Surprisingly, 81% of the MSMEs surveyed admit that they do not control their environmental and economic indicators (see Fig. 9). Only 19% admit that they control their indicators. Consequently, most of these companies do not allow them to demonstrate continuous improvement over time.

On the other hand, a total of 42% MSMEs consider the environmental practices in their decision-making process (see Fig.10). However, in practice, when the enterprises affirm to be sensitive to environmental issues, their concern does not focus on environmental preservation and protection but on avoiding negative effects on their product or service. MSMEs tend to prevent damaging their product image and sales, or financial penalties, but they do not tend to promote a sustainable vision.

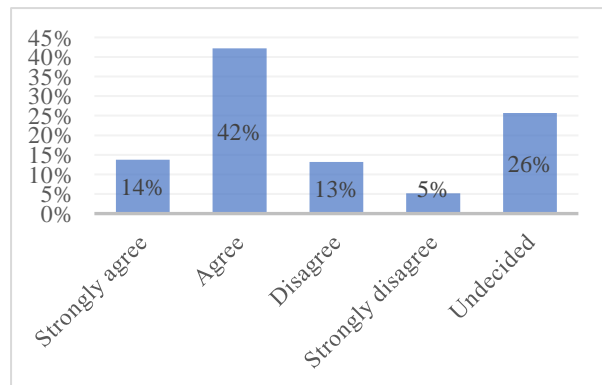


Fig. 10. The environmental practices in the decision-making process.

C. Analysis of barriers to adopting sustainability practices and strategies.

The principal reasons for companies evaluated not investing in sustainability are discussed in this section. The study highlights some potential barriers or constraints affecting the

willingness of companies to engage in sustainability practices. The results are shown in Table 6.

TABLE 6
Main barriers to adopting sustainability practices.

Barriers	% Of sample
Lack of collaborating partners	63%
Budget restrictions	59%
Lack of customer interest in the environment	57%
Difficulties in obtaining subsidies for environmental improvement	52%
The commitment of the organization's leaders	49%
Lack of clean technology	46%
Too much competition in the market	46%
Lack of qualified employees	44%
Lack of organizational strategies	32%

Overview, a total of 63% of MSMEs claim that lack of collaborating partners cited as the main potential barrier to adopting sustainability practices. Budget restrictions or cost is another barrier; in this case, the value of the investment is a generic concern. Companies will invest if there are positive returns, and the cost of investment is not too high. Manufacturers and trade services express concern that sustainability practices will require monetary funds to implement changes.

Lack of customer interest in the environment is also a significant barrier to the uptake of sustainability practices. It may be interesting to observe that in this case, the environmental situation is less influential in buying a product or taking a service. The cost and quality of the product or service are still relevant to customers.

VI. CONCLUSIONS

The present paper is focused on designing a comprehensive sustainability model for MSMEs by analyzing elements and factors identified in the literature. Besides, the proposed model was evaluated in Colombian SMEs. The results show that companies do not have a strategic system that allows them to guide them toward meeting economic, environmental, and social objectives. This study highlights that the lack of cooperation between companies is one of the main barriers that does not allow them to advance in sustainable markets.

The ISM-S is composed of different concepts which can be used to contribute to the knowledge and understanding of the adoption of Management systems for sustainable decision-making, sustainable tools and practices, social responsibility and knowledge management, and Technological and analytical information convergence. Likewise, the ISM-S includes three specific elements: Analysis of factors and components,

maturity level classification, and simulation for decision-making.

In addition, it has been achieved based on quantitative research wherein a survey was designed to collect information from the SMEs involved in this study. In applying this survey, it was observed that the sector's participation rate was 100% of the selected sample in various economic sectors in Colombia. Therefore, this quantitative study is uniquely positioned in the literature, considering the few existing works that comprehensively evaluate the factors exposed in the ISM-S across economic sectors and regions. In future research, it will provide analysis of the proposed factors of environmental knowledge, sustainable practices, and environmental management how to influence or affect sustainable development in SMEs. Additionally, appropriate a sustainable maturity model shows how capable enterprises are of achieving continuous improvement.

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