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Correo electrónico:
revistafaccea@uniamazonia.edu.co

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Editor´s Note

Innovation, Sustainability and Strategic Management: Pillars for the MSMEs of the future

In a constantly evolving business environment, micro, small, and medium-sized enterprises (MSMEs) face challenges that require innovative solutions and strategic approaches to ensure their sustainability and competitiveness. This new issue of our journal focuses on key themes that set the tone for the development and resilience of MSMEs in the 21st century.

Topics such as electronic invoicing, beyond being a technological tool, have become a bridge toward formalization, efficiency, and transparency in microenterprises. In this edition, we explore how this practice can not only optimize administrative processes but also open doors to new markets by complying with increasingly globalized regulations.

On the other hand, the analysis of productive process systems provides optimal tools for business operations. This allows MSMEs to visualize relevant technologies for integrating agile processes to enhance productivity. Methodologies and case studies are also addressed, demonstrating that innovation is not exclusive to large corporations.

Similarly, studied topics such as the value chain, a central concept in strategic management, are revealed as indispensable tools for identifying improvement opportunities, creating competitive advantages, and maximizing the impact of MSMEs in their ecosystem. This approach not only improves financial results but also fosters collaboration and sustainable growth.

Finally, we recognize the growing importance of sustainability in business management. In this context, the European Sustainability Reporting Standards (ESRS) emerge as a crucial framework for companies, regardless of size, to align their operations with environmental, social, and governance (ESG) demands. In this issue,

we analyze how these standards can become a competitive advantage for MSMEs, promoting transparency and reinforcing stakeholder trust—defined as individuals or organizations involved in a project, organization, or action whose actions can affect the functioning of the enterprise or project.

For the above reasons, we invite our readers to immerse themselves in this compendium of ideas, research, and reflections aimed at empowering MSMEs to face today's challenges with tomorrow's tools. We are convinced that each article offers a unique approach to building more sustainable, efficient, and connected businesses.

We thank the authors and contributors for enriching this space with their knowledge and experiences, and our readers for being active participants in this conversation. The future of MSMEs is written with innovation, sustainability, and strategic management.

Welcome to this new issue!

Maria Yenny Fajardo
Editor-in.Chief of FACCEA Journal
Public Accountant, Mg. in Sustainable Development and the Environment

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Artículos de investigación científica y tecnológica
Scientific and technological research articles

DISEÑO DE LA CADENA DE VALOR EN LA PRODUCCIÓN DE RESINA DE PINO

DESIGN OF THE VALUE CHAIN IN THE PRODUCTION OF PINE RESIN

DAIRON ROJAS HERNÁNDEZ[1]
https://orcid.org/0000-0003-1443-6318

ESTELA GERTRUDIS ESPINOSA MARTÍNEZ[2]
https://orcid.org/0000-0003-2813-1785

LEO ALEJANDRO ACOSTA RODRÍGUEZ[3]
https://orcid.org/0000-0001-5128-2667

ARÍSTIDES PELEGRÍN MESA[4]
https://orcid.org/0000-0001-8723-9046

[1]*Máster en Finanzas por La Universidad de La Habana, estudiante de doctorado en ciencias contables y financiera de la Universidad de La Habana. Profesor auxiliar de tiempo completo en la Facultad de Ciencias Económicas, Universidad de Pinar del Río, Cuba,*
E *dairon920328@gmail.com*

[2]*Licenciada en Matemática por la Universidad de La Habana, Doctora en Ciencias Económicas por la Universidad de La Habana. Profesora Titular de la Facultad de Contabilidad y Finanzas de la Universidad de La Habana,*
E *estelaespinosa975@gmail.com*

[3]*Licenciado en Contabilidad y Finanzas por la Universidad de Pinar del Río (UPR), Cuba. Máster en Administración de Empresas Agropecuarias por la (UPR) Profesor de tiempo completo en la Facultad de Ciencias Económicas, Universidad de Pinar del Río, Cuba,*
E *leoalejandroacosta1@gmail.com*

[4]*Licenciado en Economía por la Universidad de Minsk, Bielorrusia. Doctor en Ciencias Contables y Financieras por la Universidad de la Habana, Cuba. Participa en el Proyecto de Investigación: La sustentabilidad en las organizaciones: Un enfoque global. Profesor de la Universidad de Guadalajara, México.*
E *pelegrin65@yahoo.es*

RESUMEN

El modelo económico cubano llevada consigo la reestructuración de las relaciones empresariales para su inserción en el mercado. Se ejecuta un estudio de abordajes teóricos afines con la aproximación de los ciclos productivos, cadenas productivas y cadena de valor industrial. Teniendo como objetivo diseñar un procedimiento para esbozar la cadena de valor de la resina de pino en la empresa Agroforestal de Pinar del Río, mediante una metodología cualitativa y cuantitativa donde se realiza un análisis de los métodos a utilizar para recopilar la in-

PALABRAS CLAVE

Cadena De Valor, Competitividad, Encadenamientos, Resina De Pino

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formación y procesar los resultados. Como resultados se obtienen el diseño de la cadena de valor de la resina y actividades generadoras de costo y valor, para en un futuro calcular las utilidades. Los hallazgos de la investigación permiten una mejor comprensión del fenómeno abordado, para posicionar el producto ante la competencia, direccionar estratégicamente los recursos materiales y financieros.

ABSTRACT

The Cuban economic model brought with it the restructuring of business relations for its insertion into the market. A study of theoretical approaches related to production cycles, production chains, and the industrial value chain is carried out. The objective is to design a procedure to outline the value chain of pine resin in the Agroforestal company of Pinar del Río, using a qualitative and quantitative methodology that analyzes the methods for collecting information and processing results. The outcomes include the design of the resin value chain and activities that generate cost and value, enabling future profit calculations. The research findings provide a better understanding of the phenomenon, allowing the product to be positioned competitively and material and financial resources to be strategically directed.

KEYWORDS

Value Chain, Competitiveness, Linkages, Pine Resin

INTRODUCTION

The extraction of pine resin has an extensive market due to its countless uses, being produced and traded internationally. As noted by Faldt (2000), in Asia, resin tapping is practiced by small family groups or individuals, who employ a system for its extraction based on cutting a V-shaped groove without chemical stimulants, descending to reach the secondary xylem.

For Belgacem and Gandini (2008), once the turpentine was separated, it was used as a sealant and waterproofing agent, the primary application of this resource for shipbuilding and maintenance between the 19th and 20th centuries in Spain.

In Mexico, the resin industry began to develop in the early 20th century, driven by Spanish and North American entrepreneurs. The global resin industry was going through a rough patch, and Mexico was a convenient location for new rosin production, becoming a tradable raw material. The expansion of resin production was carried out by the Mexican Forest Service. The company's main objective was the survival of woodlands through the principles of a new science in Mexico: forestry. The first organizer of this initiative was Miguel Ángel de Quevedo (1862–1946) (Urquiza, 2018).

In Cuba, research in this sector began in 1980, leading to the implementation of techniques for extracting resin from standing pine trees. By 1989, specific progress had been made in the sector. In 1990, production was affected by the "Special Period." A slight recovery was attempted in 1994. The imbalance was caused by several factors: lack of raw materials, insufficient incentives to retain labor, and disorganization (Amoedo, 2008).

In the current context of the international economy, the value chain is timely as a tool for designing and implementing industrial strategies in a saturated market with firm changes and increasingly rigorous consumer demands. The chain focuses on creating value for customers by strengthening internal activities or capabilities, which allows for the formation of a competitive advantage (Rojas *et al.*, 2021).

The value chain fosters internal cooperation and coordination of activities derived from its functions, enhancing production and technological development capabilities.

The motivation for this research stems from the insufficient use of the value chain as an analytical tool, which prevents the Agroforestal company of Pinar del Río from identifying the activities and processes that transform and add value for future profit calculations and proper accounting management, aiming to achieve competitive results.

Given the above, the problem is framed by the question: How can the value chain in pine resin production be designed for the Agroforestal company to facilitate decision-making and achieve competitiveness? The general objective of the research is to present the design of the value chain in pine resin production for the Agroforestal company of Pinar del Río.

THEORETICAL AND CONCEPTUAL BACKGROUND

Conceptualization of productive linkages

AAlbert Otto Hirschman suggests that "there are two types of linkages: backward and forward. [...] Backward linkages occur when any non-primary economic activity induces attempts to supply the necessary inputs for that activity through domestic production" (Hirschman, 1964:106).

A linkage is understood as a long-term relationship established between business units to obtain joint benefits (Peña, 2005).

The linkage approach is one of the most methodologically prioritized requirements for analyzing the variables that form a system of relationships, both internal and external (Anaya, 2015).

Nova *et al.* (2020) outline the concept of linkage as a long-term relationship created between business units to achieve mutual gains and maintain the resulting econo-

mic and social benefits.

Productive linkages strengthen the economy by accelerating collaboration among producers, intermediaries, transporters, employees, and entrepreneurs, creating articulation at each stage (Mera *et al.*, 2021).

Pérez and Vega (2021) argue that linkages should focus on the economic, social, and environmental benefits derived rather than on the linkages themselves.

The value chain as an analysis tool

Porter's model (1985) posits that competitive advantage is driven by industry organization and is influenced by its structure. From this perspective, the environment largely determines competitive advantage and performance, as all activities must control costs that influence the creation of an advantage.

Porter (1998) mentions that each process within the organization must have a long-term competitive advantage, either through differentiation or cost leadership. Therefore, it is crucial to analyze each link individually so managers can study them separately to make informed decisions. Thus, an effective management team is essential to add value through a flow methodology or a goal-oriented management approach.

The characteristics of the value chain are categorized by the number of involved representatives, the actors governing it, its territorial significance, and the product's investment value, as noted by Oddone and Padilla (2018).

Springer (2018) states that the value chain is defined as a socio-economic system containing all entities that serve a particular market. These entities establish the value chain through frequent trade, acquiring and transferring effects and goods, exchanging information, and achieving simultaneous benefits.

According to Guzmán and Chire (2019), the value chain identifies competitors' sources through a process to generate embedded value, based on cost- and va-

lue-creating activities that allow any company to act on elements requiring reinforcement.

The value chain is a theoretical model describing the dynamics of an entity to create value for the end customer and the company itself (Riquelme, 2020).

It is a tool for intrinsic analysis to learn about the main actions carried out by a company and identify which links generate value or competitive advantage in the final product. In 1985, Professor Porter at Harvard University theoretically designed the concepts of the value chain to achieve favorable market evaluation, distinguishing two types of activities: primary and support. Each generates a cost and value on the final product, called margin (Fernández, 2021).

Vecino Guerra *et al.* (2022) confirm that the amount of value created in the chain links allows the study of value creation traceability, identifying value sources and addressing continuous improvement conditions while comparing periodically with value generated in other value chains of the same product.

The productive chain as the basis of the value chain

Studies of local productive chains, productive succession, the level of perfection, and the formalization of operations have gained significant academic attention in recent years. The fundamental and habitual definition of the value chain refers to a theoretical model detailing the activities a structure must develop within its productive process (Peñaherrera, 2018).

The productive chain spans from the origin and cause of raw material production to final use. Some actors are clearly involved in manufacturing, innovation, and product commercialization, while others provide goods and services required in this process (Nova *et al.*, 2018).

Productive chains have not only a productive but also a social basis, recognizing the reasonable development of groups. They require collective contributions from their members to develop general interests that motivate the strengthening of all

chain links (Vargas *et al.*, 2019).

Industrial value chain

Porter established a model as a system that generates value for a company, which he called the value chain (Figure 1). The activities of suppliers, distribution channel members, and customers are included. He mentions that the value chain focuses on the goal and vision designed by companies, as a process involving multiple small processes from different areas forming a global system, where organizational resources intervene. Costs are determined based on all activities performed along the value chain, consequently linking to organizational profit (Porter, 1985). Porter (1986) states that value is a notion determined based on the benefits received by the customer, minus the perceived costs when acquiring or using certain products or services. In academia, the value chain becomes a tool for internal analysis of a company's essential activities, helping to identify which activities enable value creation and, therefore, potential competitive advantages in a product (Vázquez *et al.*, 2021).

The value chain describes the range of activities required to bring a product or service from conception to delivery to final consumers and its disposal after use (Kaplinsky & Morris, 2000 and Kaplinsky & Morris, 2016). Similarly, it details how producers, processors, buyers, sellers, and consumers, separated in time and space, gradually add value to products as they move from one link to another (Hartwich & Kormawa, 2009).

Porter (2015) asserts: "The organization of manufacturing shapes the value chain and reflects competencies" (p. 144).

Value-added chains within an organization's boundaries have been widely discussed in the discipline of industrial economics at the micro level (Armaghan & Emrah, 2022). Porter (1980 and 1985) made a significant contribution by developing a value chain model for companies and discussing their competitive advantages. The industry value chain perspective analyzes the supply flow along the product value chain and sheds light on a company's characteristics at different stages. It exp-

lains company behavior in terms of strategic choices, particularly regarding process-product and how they respond to market forces, customers, and other parts of the value chain (Armaghan & Emrah, 2022).

The links of the value chain are divided into primary and support activities. According to Porter (1985), the primary activities are:

Inbound Logistics: Involves relationships with suppliers and includes all activities necessary to receive, store, and distribute inputs.

- Operations: All activities required to transform inputs into outputs.
- Outbound Logistics: Includes all activities necessary to collect, store, and distribute the output.
- Marketing and Sales: Activities inform buyers about products and services, induce them to purchase, and facilitate their purchase.
- Service: Includes all activities necessary to maintain the product functioning effectively for sale and delivery.

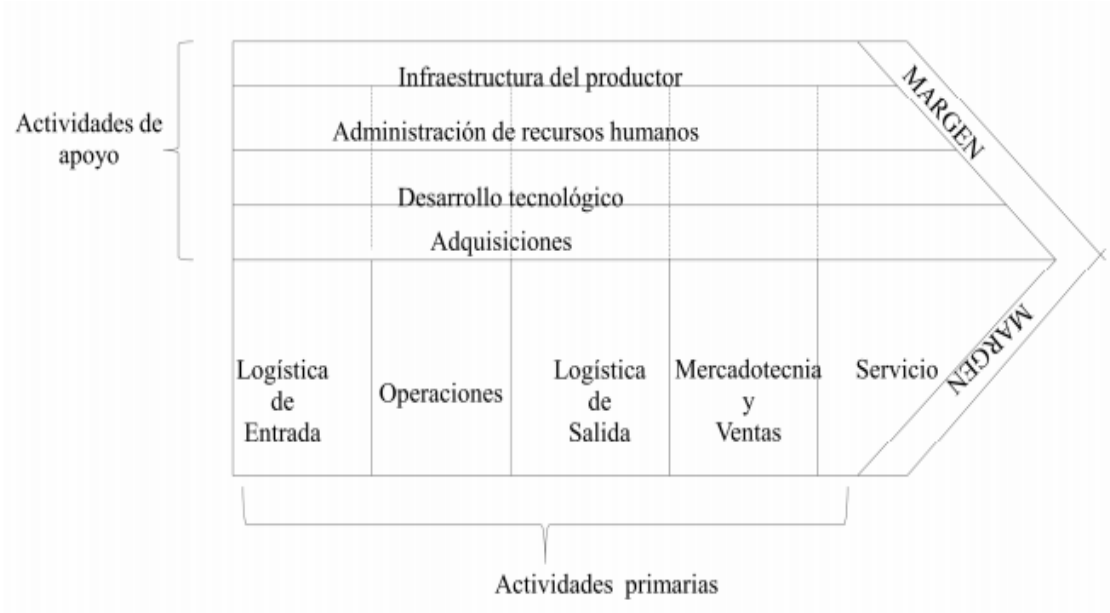
Similarly, Porter (1985) indicates that support activities are:

- Procurement: The acquisition of inputs or resources for the company.
- Human Resource Management: Consists of all activities involved in recruitment, hiring, training, development, and compensation.
- Technological Development: Refers to equipment, hardware, software, procedures, and technical knowledge influencing the company's transformation of inputs into outputs.
- Producer infrastructure: Addresses the company's needs and connects its va-

rious parts, consisting of functions or departments such as accounting, legal, finance, planning, public affairs, government relations, quality assurance, and general management.

Figure 1

The generic value chain



Source: (Porter, 2006).

Kaleka and Morgan (2017) affirm that the concept of the industrial value chain has gained prominence in issues of productive capability. Thus, one of the main challenges organizations face today is how to maintain superior competencies and, additionally, the ability to be creative and transformative.

Simatupang, Piboonrungroj, and Williams (2017) present a conceptual model consisting of four steps: value discovery, value design, value delivery, and value capture.

Rojas *et al.* (2023a) state that the industrial value chain enables the management

of activities and processes linked to business activity for the creation of a competitive product and/or service in the market.

METHODOLOGY

The research had a qualitative and quantitative character, with the Agroforestal company of Pinar del Río as the study object. The methods employed were as follows:

According to Hernández *et al.* (n.d.), the following theoretical methods were used to develop the theoretical framework:

- Historical (trend-based) and logical: To analyze the improvement, refinement, and attributes of the value chain and the study regarding the variety of judgments related to other forms, knowledge, and methods for its implementation.
- Analysis and synthesis: Used in the critical evaluation of the theoretical and contextual framework related to the value chain, based on profit calculation to manage the company's model and expansion regarding other reasoning for its development.
- Systemic-Structural: To base the proposal of the procedure for outlining the value chain in the decision-making process by the company, enabling effective execution of its tasks and the validity of its results.
- Modeling: For the design of the procedure related to the value chain to achieve the objectives.

For data collection, the following empirical methods were used:
Document Analysis: Used to adjust and catalog the selected bibliographic material pertaining to the value chain, to study these ideas in Cuba and internationally, for diagnosing the research object.

Surveys: To identify whether the components of the procedure related to the value chain design are considered in the process of acquiring efficiency by the entity's managers.

A population of 115 people was established. To achieve this intention, the arguments presented by Calero (1976) were used. Unrestricted random sampling (URS) was employed, with a 95% confidence level, a proportion of 0.50 (allowing the largest sample size), and a sampling error of 0.05. The result indicated that 65 production workers and 30 administrative workers should be surveyed, totaling 95 workers as the sample. In Cuba, there are ten Agroforestal companies, one of which is in Pinar del Río, an organization dedicated to economic activities to meet the market demand for forest products while ensuring the continuity of the commercial structure and its investments. The study lasted two years, involving fieldwork and necessary information gathering.

Based on Rojas *et al.* (2022a) and Rojas *et al.* (2022d), the following steps were followed in preparing the examination results:

1. Topic search.
2. Literature review.
3. Problem outline.
4. Objective specification.
5. Justification and establishment.
6. Theoretical framework outline.
7. Methodology analysis.
8. Research methods and materials.
9. Data collection.
10. Results study.
11. Conclusions.

RESULTS

Through the previously analyzed works, as shown in Figure 2, the proposed procedure for designing the value chain in pine resin production is presented.

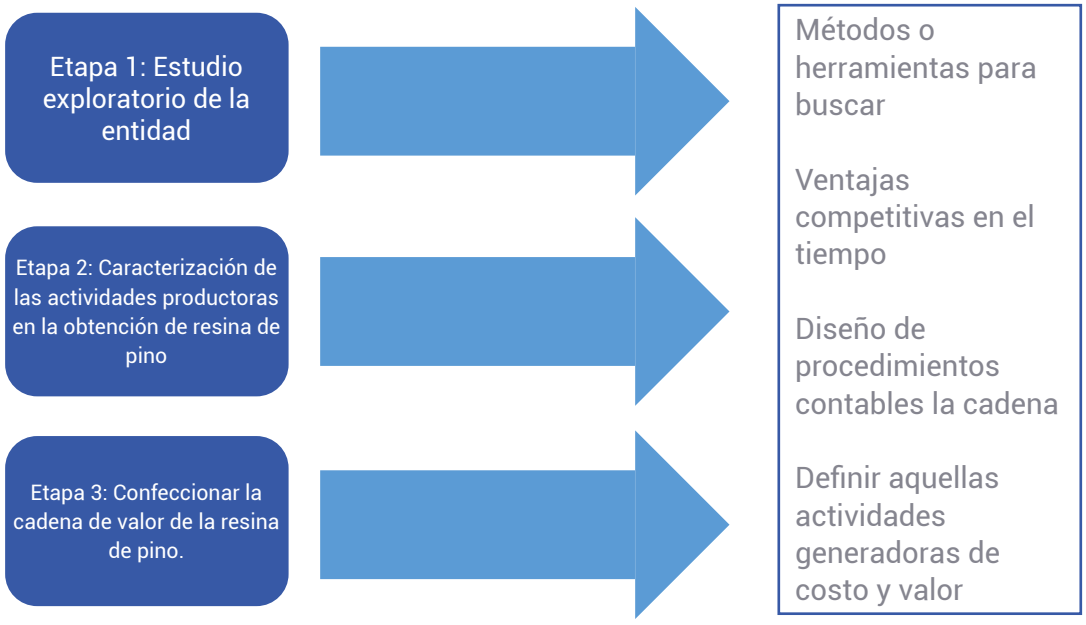
The proposal is structured in three stages:

- Stage 1: Exploratory study of the entity.
- Stage 2: Characterization of productive activities in pine resin extraction.
- Stage 3: Preparation of the pine resin value chain.

Each stage is specified by: methods or tools to seek competitive advantages over time, design of accounting procedures for the chain, defining cost- and value-generating activities, and calculating profits.

Figure 2

Procedure for designing the value chain in pine resin production.



Source: Own elaboration, based on Rojas *et al.* (2021).

Stage 1: exploratory study of the entity

This stage involves the necessary selection of all company inquiries to understand its operations.

Company characterization

The Agroforestal company of Pinar del Río was created on December 15, 1976, through Resolution 9/76, establishing that the Ministry of Economy and Planning, with its legal address at Km. 3 ½ Luis Lazo Road, Pinar del Río. The defined mission is: The production of seeds of all forest and fruit species, the reforestation of deforested areas and natural regeneration of all forest formations and categories, as well as their silvicultural management, protection against pests, diseases, and fires.

Market analysis of the Agroforestal Company, Pinar Del Río, in pine resin production

Cuban non-timber forest products show a trend toward increased production of their derivatives (pine resin, rosin, turpentine, and gum spirits) with high catalogs and quality measures, obtained from their ecologically sustainable derivatives and components. The focus is on progress and design in the market of the Cuban National Forest Industry and its byproducts. The importance of developing new synthesized procedures, catalytic and ordered methods, as well as the evaluation of biological and pharmacological properties of new products created from resin and rosin of Cuban pine species is emphasized.

The Agroforestal company of Pinar del Río has national market clients, including:

⇒ The National Match Company: purchases the byproduct turpentine, with an annual quantity of 20 tons for match production.

⇒ LABIOFAM Company: purchases rosin and turpentine, with annual quantities of 5 and 6 tons, respectively, for pharmaceutical product production.

⇒ Petroleum Laboratory Company: purchases rosin in quantities of 10 tons for chemical fuel treatment and turpentine in smaller quantities of 5 tons, used as a fuel solvent.

The international market defined by the Agroforestal company includes:

⇒ Mexican company DEVOX: purchases turpentine and rosin in quantities exceeding 20 tons for paint production and use as solvents in the industry.

⇒ UNILEVER S.A.: purchases turpentine and rosin in quantities exceeding 10 tons for paint, varnish, mixture, and waterproofing production.

General characterization of suppliers and regulators of the Agroforestal Company, Pinar del Río

Suppliers of raw materials for pine resin production:

⇒ CONSTRUIMPORT: an importing company that sells common resources to the company (files, machetes, clothing, and chainsaws).

⇒ MAQUIMPORT: a Cuban importing company allowing the import of specialized resources (blades, pickaxes).

⇒ CUPET: a Cuban fuel marketing company supplying Agroforestal with petroleum, gasoline, lubricants, and liquefied petroleum gas.

⇒ DIVEP: A Cuban marketing company dedicated to selling hammers, plates, and gloves to Agroforestal.

⇒ Union of military companies: dedicated to selling plastic resin cubes to the entity.

Regulators of the Agroforestal company:

⇒ State Forest Service: a regulatory entity of the Cuban state responsible for controlling all forestry activities of the company, ensuring no indiscriminate or illegal logging occurs. They also monitor silvicultural management of plantations, verifying this activity is performed in all forests.

⇒ Forest Rangers Corps: Authorized to ensure environmental protection, applying corresponding measures in compliance with forestry law. In case of non-compliance by the entity, they are authorized by Forestry Law No. 85 of 1998 to impose personal fines up to 8,000 Cuban pesos (CUP).

⇒ Ministry of Science, Technology, and Environment: Conducts state environmental inspections of the company, characterized as a substantially protective, control, inspection, and surveillance activity of compliance with current legal skills and norms in the country regarding environmental protection and sustainable use of natural resources.

⇒ Ministry of Agriculture: Controls and directs state policy through soil use and conservation; ownership and enjoyment of agricultural and forest land; and plant health.

⇒ Ministry of Economy and Planning: Establishes cooperation and coordination relationships at the territorial level to achieve the most rational use of available resources, greater productive economic efficiency, and corresponding assurance of compliance.

⇒ Ministry of Finance and Prices: Establishes and ensures the application of Financial, Tax, and Price Policies of the state, monitoring international market price behavior for exports and imports, proposing corresponding measures.

⇒ Flora and Fauna Company: Regulates reforestation and deforestation activities carried out by Agroforestal, ensuring the care of animal and plant life inhabiting the forests.

Stage 2: Characterization of productive activities in pine resin extraction

An outline of the main activities for pine resin production is made, through specialist knowledge.

Stage 3: Design the pine resin value chain

The study of how to design the proposed value chain is carried out, along with the selection of all study material.

Using methods for data collection (document analysis and observation), a diagnosis was made based on activities and processes for pine resin extraction, referencing studies by authors such as López (2016); Rojas (2017); Domínguez *et al.* (2017); Rojas *et al.* (2021); Rojas *et al.* (2022b); Rojas *et al.* (2022c); and Rojas *et al.* (2023b), to create a series of steps for designing the value chain of the product under study.

Main problems diagnosed with the pine resin value chain as support in accounting management for profit calculation in the Agroforestal Company of Pinar del Río:

1. Monthly analysis of raw material consumption and materials destined for the production area is not conducted.
2. Activities in the value chain are not classified as cost-generating or value-generating.
3. Productive processes are incompletely defined, preventing their identification in the chain links.
4. The company has defined its suppliers, clients, and regulators but does not view them as chain actors for each activity.
5. There is no certified economic-financial projection to achieve expected efficiency.
6. The company lacks automotive parks for transporting pine resin to the industrial production area.
7. There is no culture for applying financial ratios to measure efficiency and deci-

sion-making.
8. Insufficiencies in the use and application of the Management Project in productive decision-making.
9. Deficiencies in project development as a tool for investment execution.
10. Company managers lack knowledge for designing competitive sources to position the product in national and international markets.

During the diagnosis, it was verified that the company is in a revival process; it was detected that it does not have the pine resin value chain, identifying the main problems in the productive process and its production flows.

DISCUSSION

This section proposes a series of steps based on expert authors to design the pine resin value chain. Once the design is considered, surveys are applied to workers involved in production and administration to identify cost- and value-generating activities, enabling competitive advantages.

Steps to propose the pine resin value chain for the Agroforestal Company of Pinar del Río:

Step 1: Establish the Work Team for the Task

A discussion of the entity's organizational structure was held to create the work team, based on each worker's experience in the forestry sector. The following structure was formed: General Director; Accounting-Financial Director; Productive Director of Technique and Development; and Principal Specialist of Silviculture and Management.

Step 2: Work plan preparation

Each activity to be fulfilled by each team member is announced. The inputs and assurances available to carry out the task are disclosed.

This step pursues two results proposed by the author: mapping productive activities related to pine resin production and designing the pine resin value chain.

Step 3: Design of educational activities to train on the value chain tool

The author proceeds to develop workshops and seminars to induce learning among forestry sector workers on the value chain as a way to manage company strategy and accounting results. Integrating the experiences of both employees and the author aims to link the chain with the product: pine resin, theoretically and practically.

Step 4: Map each key or fundamental process of the pine resin productive chain

A study is made of activities performed within the company to meticulously identify strategic, key, and support processes. This enables a critical analysis of the mission, the social objective defined by the entity, and activities related to pine resin production, specified by specialists linked to production. The above is based on the theoretical-methodological materials addressed in Chapter 1 and the concretization of educational activities in Step 3.

Step 5: Design each input of the pine resin value chain

All inputs related to product development are designed: pine resin, previously determined in the diagnosis, to select each element entering the link: inbound logistics located in primary activities and the link: procurement in support activities, intermediating throughout the value creation process.

Defined inputs for the value chain:

- Raw materials and supplies: Fuel and Lubricants.
- Work tools: Transport (Trucks); Machete; Gloves; Debarker; Hammer; Plate; Bucket.
- Human resources: workers related to resin production.
- Financial resources: bank loans and credits, transfers, feasibility studies.

- Informational resources: advisory for product extraction, product positioning for sale.

Step 6: Design the main links related to the pine resin value chain

The links related to the operations component of the value chain are designed, previously determined in the inputs. The main links are: brigade creation and extraction area definition. Meanwhile, resin collection, loading and unloading, chemical resin processing, and packaging are operational processes determined in external logistics in the generic value chain.

Step 7: Design the support links of the pine resin value chain.

Support links are outlined, harmonizing with support activities in the value chain, considering the company's technical infrastructure, accounting-financial management, planning and treasury, as well as human resources, procurement, and commercialization.

Step 8: Establish the outputs of the pine resin value chain.

A study is conducted to identify activities forming part of the outbound logistics link: resin loading and unloading, chemical resin processing, and packaging. Global outputs include those expressed in monetary values (net profit and added value), obtained by the difference between generated value and incurred cost throughout the value chain, and, on the other hand, satisfied customers. This step concludes pine resin production until each derivative (rosin and turpentine) is delivered to its clients.

Step 9: Select each client of the pine resin value chain

Clients related to product acquisition and directly linked to its value chain are identified, nourished by the previous step.

Main client: DEVOX S.A.
Other clients: UNILEVER, LABIOFAM, and the National Match Company.

Step 10: Design the pine resin value chain

This step carries out the representative design of the pine resin value chain, completing each analyzed process step, as shown in Figure 3.

Figure 3:
Pine resin value chain..

Source: Own elaboration, based on Porter (2006); López (2016); Rojas *et al.* (2021); and Rojas *et al.* (2023b).

To execute the identification of cost- and value-generating activities, a survey (Annex 1) was applied to 65 workers linked to pine resin production, yielding the following results:

- 35 surveyed workers stated that the brigade creation activity is a cost-generating activity, representing 22%.
- 41 surveyed workers established that the extraction area definition activity is a cost- and value-generating activity, equating to 12%.
- 51 surveyed workers established that the collection activity is cost-generating, equating to 14%.
- 37 surveyed workers responded that the resin loading and unloading activity is a cost-generating activity.
- 65 surveyed workers established that the chemical resin processing activity is cost- and value-generating, representing 23%.
- 60 workers defined that the packaging activity generates cost and value.

Once the survey results from production area workers were processed, the authors applied a survey to administrative area workers (30 in sample) to identify support activities generating value and cost. The results were as follows:

- 26 workers stated that the infrastructure link generates cost and value.
- 15 workers stated that the human resources link generates cost and value.
- 18 workers stated that the procurement link generates cost and value.
- 23 workers stated that the procurement link generates cost and value.

Table 1 summarizes the primary and support activities generating cost and value in the pine resin value chain.

Table 1.
Primary and support activities generating cost and value in the pine resin value chain

Actividades de la cadena de valor **Actividades Primarias**	Generadoras de costos	Generadoras de valor
Creación de la brigada	X	
Definición del área de extracción	X	X
Acopio	X	
Cargue y descargue de la resina de pino	X	
Procesamiento químico de la resina de pino	X	X
Embalaje	X	X
Actividades de Apoyo		
Infraestructura	X	X
Recursos Humanos	X	X
Aprovisionamiento	X	X
Comercialización	X	X

Source: Own elaboration according to Rojas *et al.,* (2023a)

CONCLUSIONS

Using the value chain as a technique to establish cost- and value-creating activities allows for greater competitive advantage against competitors, determining strategies to carry out the business. Pine resin production is a fundamental branch for foreign currency inflows to the country, revealing no production linkages enabling industrial value generation to implant product competition in the market.

The diagnosis of the Agroforestal company recognized the economic-financial management model, which impedes correct process design and identification of activities present in the value chain. It demonstrates that the company does not invest in the value chain as a tool for strategy development and analysis of internal company activities to establish decision-making.

The proposed procedure contributes to identifying value- and cost-generating ac-

tivities to determine future company profits generated by pine resin production and achieve sustainable accounting and financial management over time.

For better performance of the primary and support activities of the studied value chain, a series of strategic recommendations on control and improvement are integrated, as shown below:

- Study activities generating value and costs throughout the productive cycle of the chain.
- Establish business strategies for better internal coordination of company areas.
- Delve into financial analyses for correct profit planning.

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Artículos de investigación científica y tecnológica
Scientific and technological research articles

FACTURACIÓN ELECTRÓNICA EN MICROEMPRESAS DE LA COMUNA DOS DE NEIVA: PERSPECTIVAS

ELECTRONIC INVOICING IN MICROENTERPRISES OF COMMUNE TWO OF NEIVA: PERSPECTIVES

LUZ MERY CELIS MURCIA[1]
https://orcid.org/0000-0003-3595-5096

CARLOS EDWAR VARGAS ÑUSTES[2]
https://orcid.org/0009-0001-7461-8570

[1]*Contadora Publica, Magister en Dirección y Gestión Financiera, Profesor asistente I Corporación Universitaria Minuto de Dios – UNIMINUTO*
E *luz.celis@uniminuto.edu.co*

[2]*Estudiante Contaduría Pública, Corporación Universitaria Minuto de Dios – UNIMINUTO*
E *carlos.vargas-n@uniminuto.edu.co*

DAYANA ESTEFANY CELIS TORRES[3]
https://orcid.org/0009-0002-7100-3164

WILLIAM VALENCIA RIVERA[4]
https://orcid.org/0000-0002-5642-7236

[3]*Estudiante Contaduría Pública*
Corporación Universitaria Minuto de Dios – UNIMINUTO
E *dayana.celis-t@uniminuto.edu.co*

[4]*Contador Publico*
Magister en Dirección y Gestión Financiera, Profesor I
Corporación Universitaria Minuto de Dios – UNIMINUTO
E *william.valencia.r@uniminuto.edu.co*

RESUMEN

Este estudio analiza la implementación de la facturación electrónica entre microempresarios de la comuna dos de Neiva, Huila, desde una perspectiva cuantitativa descriptiva. Se examina el conocimiento de los microempresarios sobre este sistema y se evalúan sus percepciones acerca de las ventajas y desventajas de su uso. Los resultados indican un bajo nivel de adaptación al sistema digital, con solo un 23% de los microempresarios incorporando esta tecnología, frente a un 77% que no lo ha hecho. La investigación identifica la necesidad de incre-

PALABRAS CLAVE

Facturación digital, microempresarios, tecnología comercial, implementación de sistemas, adopción tecnológica.

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mentar la educación y el apoyo para superar las barreras de inoperatividad y el temor hacia la tecnología digital. Además, se destacan beneficios significativos como la optimización de procesos contables y la reducción del uso de papel, contribuyendo a la sostenibilidad ambiental. Este trabajo subraya la importancia de la adaptación tecnológica para mejorar la eficiencia y la competitividad en el sector microempresarial.

ABSTRACT

This study analyzes the implementation of electronic billing among micro-entrepreneurs in commune two of Neiva, Huila, from a descriptive quantitative perspective. It examines the micro-entrepreneurs' knowledge of this system and evaluates their perceptions of the advantages and disadvantages of its use. The results indicate a low level of adaptation to the digital system, with only 23% of micro-entrepreneurs incorporating this technology, compared to 77% who have not. The research identifies the need to increase education and support to overcome barriers such as operational inefficiencies and fear towards digital technology. Additionally, significant benefits, such as the optimization of accounting processes and reduced paper use, contributing to environmental sustainability, are highlighted. This work underscores the importance of technological adaptation to improve efficiency and competitiveness in the micro-enterprise sector.

KEYWORDS

Digital invoicing, Micro-entrepreneurs, Commercial Technology, System Implementation, Technological Adoption

INTRODUCTION

The implementation of electronic invoicing in microenterprises has become a critical focus for improving operational efficiency and complying with current fiscal regulations. This study centers on the adoption of this technology among micro-entrepreneurs in Commune Two of Neiva, Huila, a region where the local economy relies on small businesses that often face significant challenges in adopting new technologies.

The importance of this research lies in its ability to identify barriers and facilitators in the adoption of electronic invoicing. Given the growing governmental push toward the digitalization of financial processes, understanding these elements is crucial for designing effective interventions that can increase technological adoption and, consequently, improve transparency and resource management efficiency (Dolça, 2019).

Recent studies indicate that electronic invoicing not only optimizes accounting management and reduces operational costs but also enhances tax compliance and lowers carbon footprints by reducing paper use (El-Manaseer et al., 2023); Hernández Aros *et al.*, 2018). However, in contexts like Neiva, resistance to change and lack of resources may pose significant obstacles.

Within this framework, references such as the National Tax and Customs Directorate (DIAN) and recent Colombian legislation on electronic invoicing provide a fundamental regulatory context for the study. Additionally, research by Kehler *et al*. (2020) and De Arco Fandiño (2020) on the implementation of electronic invoicing in other Colombian contexts offers a relevant comparative parallel for understanding potential outcomes and adaptations in Neiva (Carrascal Velásquez *et al.*, 2020), thereby contributing to effective tax collection.

The primary objective of this research is to analyze the perspective of micro-entrepreneurs in Commune Two of Neiva regarding the implementation of electronic invoicing in their commercial operations. The hypothesis posits that adequate education and technical support can significantly increase the adoption of this technology.

The research question guiding this study is: How do educational and technical support factors influence the adoption of electronic invoicing by micro-entrepreneurs in commune two of Neiva?

Esta introducción prepara el escenario para una investigación detallada que no solo busca responder a preguntas académicas, sino también ofrecer soluciones prácticas que puedan beneficiar a la comunidad empresarial local en Neiva, contribuyendo así a su desarrollo económico y sostenibilidad ambiental.

THEORETICAL FRAMEWORK

An electronic invoice is defined as a digital document that validates commercial transactions, ensuring compliance with all legal and fiscal requirements to be considered equivalent to paper invoices (Márquez Olier, 2020). This digital document contains identical information to its physical counterpart, including key details such as seller and buyer identification, a detailed description of the products or services provided, the total amount due, and applicable taxes, enabling an effective transition from paper-based to digital processes (Roncallo, 2019).

The electronic invoicing process relies on advanced technologies for the creation and management of digital documents, using formats such as XML — UBL 2.1, which allow for digital signatures and secure transmission via web services (Noguni and Romero, 2019; García *et al.*, 2021). Additional tools such as QR codes and CUDE (Unique Electronic Document Code) are implemented to enhance traceability and facilitate access to invoice information, thereby reinforcing transaction security and transparency (Serrano Aragón, 2023; Mejía, 2023).

The electronic invoicing system includes specialized software for generating electronic documents, document exchange platforms, and electronic certificates to validate digital signatures, ensuring the authenticity and legality of each transaction (Castro & Custodio, 2023; Rivas & Castillo, 2020). These components are integrated to automate and optimize the entire invoice lifecycle, from creation to final archiving, and are connected to ERP and accounting systems to increase operational efficiency

(Pimenta and Seco, 2019; Segura Clavijo, 2020).

The implementation of electronic invoicing brings numerous benefits, such as reduced operational costs, fewer manual errors, and increased administrative efficiency (Krieger *et al.*, 2023). This technology also helps decrease tax evasion and enhances transparency in commercial operations (Castillo Espitia, 2021). In places like Neiva, the system has proven particularly advantageous for micro-entrepreneurs, improving their administrative management and tax compliance through digital tools (Mausa *et al.*, 2023).

In Colombia, electronic invoices are recognized as negotiable instruments under certain legal conditions, providing additional probative value in commercial transactions (Congress of the Republic of Colombia, 1971). This recognition strengthens the legal validity of electronic invoices and facilitates their use within the country's commercial and legal framework (Ramírez Álvarez *et al.*, 2022).

Globally, electronic invoicing has evolved significantly since its introduction, adapting to technological advancements and international regulatory changes (Aguilar Castro, 2020). Colombia was a pioneer in the region by legally adopting electronic invoicing in the mid-1990s, demonstrating a firm commitment to administrative and fiscal modernization (Schwab, 2016; Urbano and Ledezma, 2020). In other countries, the implementation of this system has been promoted by government entities as an effective method to improve fiscal efficiency and combat tax evasion. For example, the European Union mandated the adoption of electronic invoicing in public procurement through Directive 2014/55/EU, aiming to optimize efficiency and transparency in public fund management (Pachón Torres, 2023).

The future of electronic invoicing appears promising, with trends toward greater integration with other digital platforms and broader global adoption, contributing to a more efficient and sustainable commercial environment (Tosca Magaña *et al.*, 2021; Ianenko *et al.*, 2019). In nations such as Brazil, Chile, Mexico, and Argentina, electronic invoicing systems have been fully integrated with national tax systems, enabling real-time monitoring of commercial transactions and more effective tax col-

lection (Rodríguez y Troncoso, 2023).

METHODOLOGY

The research was based on a positivist approach, describing and quantifying the perception and adaptation of electronic invoicing among micro-entrepreneurs in Commune Two of Neiva, using quantitative methods to collect and analyze objective data (Hernández and Mendoza, 2020). The study included micro-entrepreneurs registered with the Neiva Chamber of Commerce who were actively operating during the study period, excluding those unregistered or not engaged in commercial activities during the study.

A non-experimental, cross-sectional, and descriptive design was employed, focusing on micro-entrepreneurs in Commune Two of Neiva (Hernández and Mendoza, 2020). A sample of 119 micro-entrepreneurs was selected using non-probabilistic convenience sampling. Data were collected through structured surveys including closed and open-ended questions. Surveys were distributed and collected via digital platforms and, when necessary, on paper to ensure accessibility for all participants.

The survey was validated by electronic invoicing experts and pilot-tested to ensure reliability and validity in measuring perceptions and knowledge about electronic invoicing. Informed consent was obtained from all participants, ensuring confidentiality and anonymity of the collected data.

Data were statistically analyzed using SPSS. Descriptive analysis of variables was performed, and correlations between perceptions of electronic invoicing and demographic variables were explored. The methodological design aligned with the research objectives, enabling an effective evaluation of the impact of electronic invoicing among micro-entrepreneurs in Commune Two of Neiva. The study successfully identified both the level of knowledge and attitudes toward the adoption of this system.

RESULTS

The study's results reflect a clear interrelation between the stated objectives, the theoretical framework, and the findings. The initial hypothesis, that adequate education and technical support would significantly increase the adoption of electronic invoicing among micro-entrepreneurs in Commune Two of Neiva, was confirmed by the data.

As detailed in Table 1, 81% of micro-entrepreneurs demonstrated a high level of knowledge about electronic invoicing. This finding aligns with previous studies emphasizing knowledge as a precursor to technological adoption (Márquez Olier, 2020; Kehler *et al.*, 2020). Among respondents, those with greater knowledge of electronic invoicing showed a higher willingness to incorporate this technology into their commercial processes. In fact, 24% of micro-entrepreneurs who fully adopted the system highlighted the relevance of technical support and education received, validating the proposed hypothesi.

Table 1.
Frequency of results

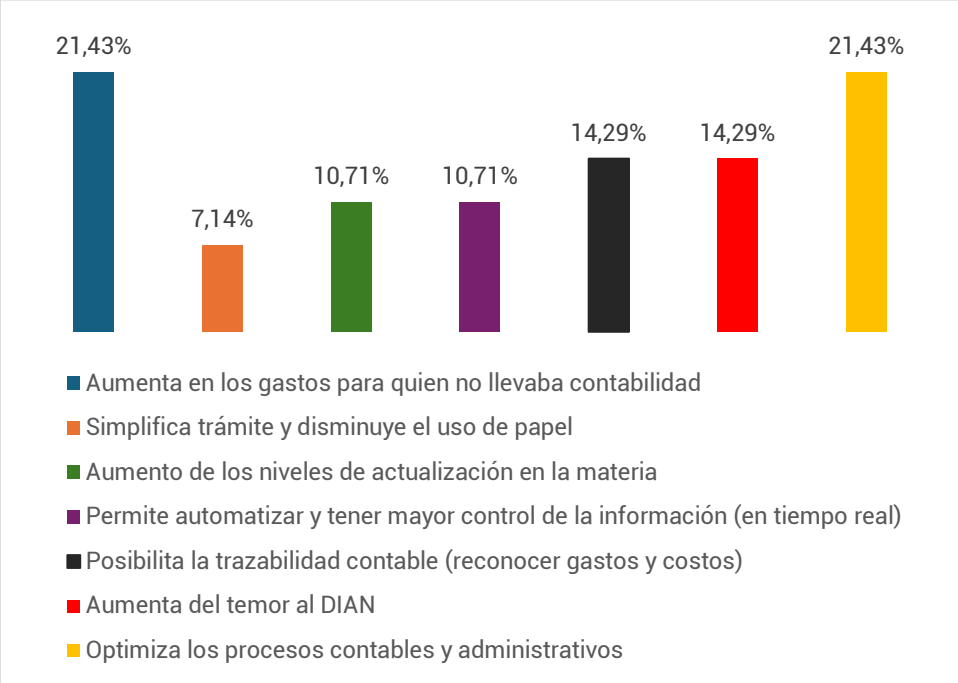
Pregunta / Variable	Respuesta	Frecuencia	Porcentaje
Sector económico	Agropecuario	1	1%
	Comercial	95	81%
	Servicio	23	19%
Número empleados vinculados	1-3 empleados	103	87%
	4-6 empleados	10	8%
	7-9 empleados	2	2%
	Más de 10 empleados	4	3%

Pregunta / Variable	Respuesta	Frecuencia	Porcentaje
Promedio ingresos mensuales	3-8 Millones de pesos colombianos	97	82%
	9-14 Millones de pesos colombianos	9	8%
	15-20 Millones de pesos colombianos	3	3%
	21 Millones de pesos en adelante	10	8%
Conocimiento sobre la factura electrónica	No	23	19%
	Sí	96	81%
Elaboración factura electrónica	No	91	76%
	Sí	28	24%
Factores que influyen en la implementación del sistema de facturación electrónica	Aumenta en los gastos para quien no llevaba contabilidad	6	21%
	Optimiza los procesos contables y administrativos	5	17%
	La DIAN los obliga	4	14%
	Aumenta los gastos por aumento de los costos operacionales	4	14%
	Exigencia de clientes	4	14%
	La implementación del sistema contable	3	10%
	No hay factores	2	7%
	No sabe, no responde	1	3%

Note: Frequency table of results, information based on survey data

The organized results indicate that the implementation of electronic invoicing is perceived not only as a tool for modernization and efficiency improvement but also as a mechanism essential for complying with fiscal regulations and enhancing financial management (see Annex Figure 1).

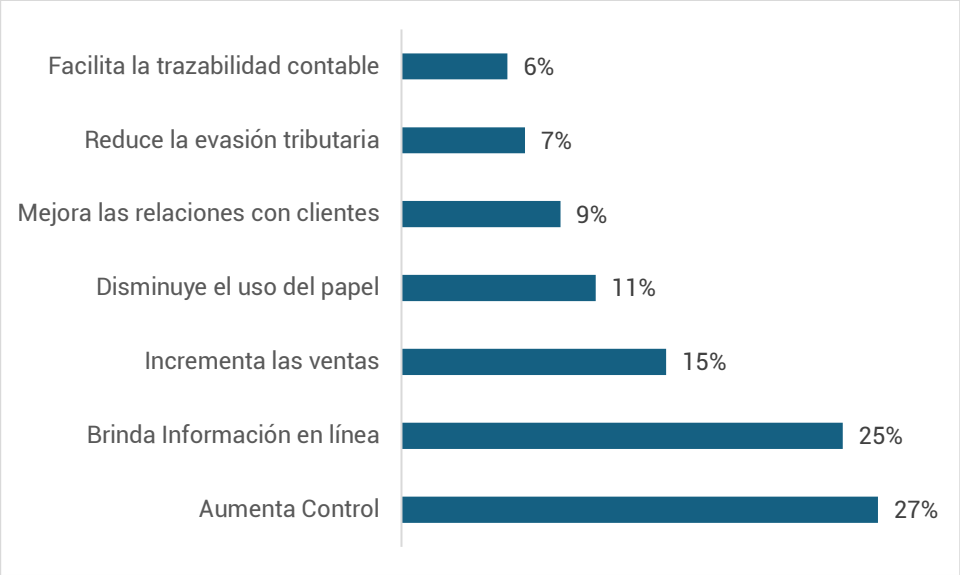
Figure 1.
Factors influencing the implementation of electronic invoicing



Note: Own elaboration based on data collected from micro-entrepreneurs in Commune Two of Neiva.

The results show that micro-entrepreneurs perceive electronic invoicing as beneficial, particularly in optimizing accounting processes and reducing operational costs. These perceptions align with the theoretical framework, which identifies electronic invoicing as a mechanism to improve administrative efficiency and reduce tax evasion (Krieger *et al.*, 2023; Rivas and Castillo, 2020). However, significant barriers were also identified, such as increased operational costs for those who previously did not use digital accounting. This reinforces studies highlighting resistance to change and initial implementation costs as major obstacles to adopting new technologies (Boness de Vasconcellos, 2021). (See Annex Figures 2 and 3).

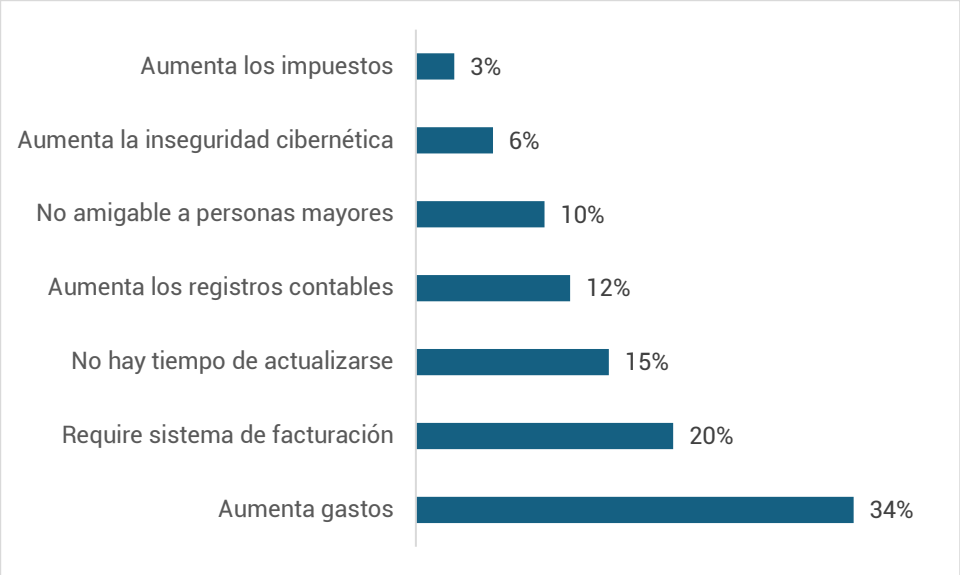
Figure 2.
Advantages of implementing electronic invoicing



Note: Own elaboration based on data collected from micro-entrepreneurs in Commune Two of Neiva.

Correlation analysis showed that the availability of education and technical support significantly impacts the adoption of electronic invoicing. Micro-entrepreneurs who received training or had access to technical support exhibited significantly higher adoption rates. This finding supports the hypothesis and aligns with prior research emphasizing the importance of educational interventions to facilitate the transition to advanced digital systems (Hernández Aros *et al.*, 2018; El-Manaseer *et al.*, 2023).

Figure 3.
Disadvantages of implementing electronic invoicing



In conclusion, the results confirm the hypothesis proposed and underscore the need to strengthen education and technical support programs in the region. The integration of theory with the findings highlights the relevance of knowledge and technical assistance as key factors for the successful adoption of electronic invoicing, which, in turn, contributes to the modernization and efficiency of the microenterprise sector in Neiva.

DISCUSSION

A direct correspondence was found between the theory of Kehler *et al.* (2020) and the study's data, which show that electronic invoicing would entail greater internal accounting and financial control for each commercial establishment.

Additionally, Hernández Aros *et al.* (2020) suggest that implementing electronic invoicing marks a shift from traditional commerce, presenting challenges and opportunities such as accounting organization, income and expense control, and market

adaptation.

The move toward digitalization has also led to greater business innovation, with measures to safeguard information and improve processes (Boness de Vasconcellos, 2021; Roncallo, 2019).

The implementation of electronic invoicing streamlines commercial activities, automating processes and increasing micro-entrepreneurs' confidence for future partnerships (Pimenta and Seco, 2019; Segura Clavijo, 2020). This streamlining helps reduce administrative costs, thanks to electronic signatures and swift verification by the DIAN (Rivas and Castillo, 2019; Castro and Custodio, 2023). Including buyer data allows for greater control over economic transactions and improves managerial decision-making (Márquez Olier, 2020).

Finally, adaptation to the digital world contributes to reducing carbon footprints and preserving the environment, aligning with environmental sustainability policies (Tosca Magaña *et al.*, 2021).

CONCLUSIONS

The central result of the study shows that the adoption of electronic invoicing among micro-entrepreneurs in Commune Two of Neiva is directly influenced by their level of knowledge about this technology. This observation addresses the primary research objective, which sought to analyze how knowledge of electronic invoicing affects its adoption among these micro-entrepreneurs.

The novel contribution of this study is the detailed correlation between specific knowledge of electronic invoicing and adoption rates in a geographically and economically defined context. This approach provides a deeper understanding of local barriers and facilitators, an aspect underexplored in prior research, which typically adopts broader perspectives.

A notable limitation of this study is its focus on a specific commune in Neiva, which

may not be representative of other regions with different economic and cultural characteristics. Additionally, the research relied on self-reports, which may be subject to respondent bias.

The implications of this study are significant for policymakers and educators, who can use these findings to design more effective educational and support interventions addressing the areas of ignorance identified among micro-entrepreneurs.

Future research should expand this study to include multiple communes and regions to compare and generalize results. It would also be beneficial to explore the effects of specific educational interventions on knowledge and adoption of electronic invoicing.

This study opens the door to new research questions about how specific cultural and economic factors within similar communities influence the adoption of new technologies. Future research could explore the relationship between general financial education and the adoption of electronic invoicing technologies.

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Artículos de investigación científica y tecnológica
Scientific and technological research articles

ANÁLISIS DEL COMPORTAMIENTO ECONÓMICO Y DESAFÍOS DEL SECTOR PANELERO EN LA REGIÓN DEL CATATUMBO

ANALYSIS OF THE ECONOMIC PERFORMANCE AND CHALLENGES OF THE PANELA SECTOR IN THE CATATUMBO REGION

GILBERTO MIRANDA ANGARITA[1]
https://orcid.org/0000-0002-2577-6185

JOHANA ASTRID FUENTES ARÉVALO[2]
https://orcid.org/0000-0001-9876-6773

JOHANN FERNANDO HOYOS PATIÑO[3]
https://orcid.org/0000-0002-0377-4664

[1]*Docente Coordinador Administrativo, FESC-Ocaña*
E *gmiranda0388@gmail.com*

[2]*Docente Catedrática, FESC-Ocaña*
E *ja_fuentes@fesc.edu.co*

[3]*Docente planta UFPSO y catedrático FESC*
E *jfhoyosp@ufpso.edu.co*

BLANCA LILIANA VELÁSQUEZ CARRASCAL[4]
https://orcid.org/0000-0001-7718-853X

KARLA GABRIELA NIÑO CLARO[5]
https://orcid.org/0000-0001-6088-8118

[4]*Decana Facultad Ciencias Económicas, Administrativas y Contables, UniLibre-Cucuta*
E *Blanca.Velasquez@unilibre.edu.co*

[5]*SENADO DE LA REPUBLICA*
E *trinida877@gmail.com*

RESUMEN

El artículo explora el comportamiento económico y los desafíos del sector panelero en la región del Catatumbo, Colombia, destacando su relevancia como motor de desarrollo rural. Mediante una revisión bibliográfica sistemática, se analizan las características productivas del sector, incluyendo la prevalencia de técnicas tradicionales y las limitaciones que enfrentan los productores para competir en mercados nacionales e internacionales. El estudio identifica oportunidades de expansión, como la creciente demanda de productos orgánicos, y propone

PALABRAS CLAVE

Panela, Catatumbo, desarrollo rural, modernización tecnológica, competitividad.

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estrategias para fortalecer el sector, incluyendo modernización tecnológica creación de una marca colectiva que diferencie la panela del Catatumbo. Además, se discuten las implicaciones de las políticas públicas y el papel de la asociatividad en la sostenibilidad del sector. El artículo concluye que, a pesar de los desafíos, el sector panelero del Catatumbo tiene un potencial significativo para contribuir al desarrollo económico regional.

ABSTRACT

This article explores the economic performance and challenges of the panela sector in the Catatumbo region of Colombia, highlighting its relevance as an engine of rural development. Through a systematic literature review, it analyzes the productive characteristics of the sector, including the prevalence of traditional techniques and the constraints faced by producers to compete in national and international markets. The study identifies opportunities for expansion, such as the growing demand for organic products, and proposes strategies to strengthen the sector, including technological modernization and the creation of a collective brand that differentiates panela from Catatumbo. It also discusses the implications of public policies and the role of associativity in the sustainability of the sector. The article concludes that, despite the challenges, the Catatumbo panela sector has significant potential to contribute to regional economic development.

KEYWORDS

Panela, Catatumbo, rural development, technological modernization, competitiveness.

INTRODUCTION

Colombia stands out as one of the world's leading producers of panela, ranking second after India. Panela, an unrefined whole cane sugar obtained from the juice of sugarcane (*Saccharum officinarum L.*), is a staple in the Colombian diet and represents a significant source of income for thousands of rural families (Buitrago Ardila, 2019). In the Catatumbo region, panela production is not only an economically relevant activity but also a deeply rooted cultural tradition.

Rural agricultural industries in Latin America and the Caribbean are notable for their production of panela, a food product made from sugarcane juice (*Saccharum officinarum*). Global production is estimated at nearly 13 million tons per year, distinguishing it from brown and white sugar due to its chemical composition, which includes not only sucrose but also fructose, glucose, minerals, vitamins, and protein compounds (FAO, 2019).

In Latin America, panela holds great importance in countries such as Colombia, Brazil, Ecuador, Peru, and Venezuela. In these nations, its production is an essential agricultural activity, particularly in rural and mountainous areas, where peasant families combine sugarcane cultivation with livestock farming and other agricultural activities. This production model allows for the utilization of family labor and the optimization of local resources (Pérez Lobo & Rojas Contreras, 2020).

Colombia ranks as the world's second-largest producer of panela, behind India, with substantial production that meets both domestic and international demand. Colombian panela exports have found buyers in Europe, North America, and other regions where the demand for natural and organic products is growing (Rodríguez *et al.*, 2020; Cadavid, 2007). However, panela production faces challenges related to competitiveness and the modernization of production techniques.

In India, panela production, known as Jaggery, is a significant industry that employs millions of people and contributes substantially to the rural economy. It is produced using traditional methods, and its consumption is deeply rooted in Indian

culture and cuisine (FAO, 2019).

Brazil is also a notable producer of panela, locally referred to as Rapadura. Rapadura production is concentrated in rural areas, where traditional methods of sugarcane juice extraction and concentration are employed. Rapadura is widely used in Brazilian cuisine and is valued for its nutritional properties and distinctive flavor (Obando, 2010).

The production and international commercialization of panela face several challenges, including quality standardization, adaptation to international regulations, and competition with other sweeteners. However, the growing demand for natural and organic products presents significant opportunities to expand the panela market and improve the incomes of rural producers.

General market of Panela.

Panela has played a significant role in both local and global economies, driving growth in rural and urban communities. In terms of global production, India leads with 86% of the world's panela output, followed by Colombia, which holds second place with 13.9% of global production (García, Rivera & Rivera, 2019). Other producing countries include China, Pakistan, and several Latin American nations such as Peru, Brazil, and Mexico, though their production levels are significantly lower, accounting for no more than 0.01% of global output.

In Colombia, panela represents the second most important rural agribusiness, after coffee, generating over 285,000 direct jobs and approximately 570,000 indirect jobs. Sugarcane for panela production is cultivated in 27 departments, involving more than 170 municipalities that depend directly on this economic activity (Ministry of Agriculture and Rural Development, 2015). This production is essential for the rural economy, contributing significantly to the country's agricultural Gross Domestic Product (GDP).

Panela production in Colombia not only meets domestic demand but has also been

oriented toward exports, particularly to markets that value organic and natural products. This trend is supported by government policies that incentivize the formalization and export of panela, thereby improving market opportunities for local producers (La Opinión, 2019).

In terms of competition, Colombian panela faces significant challenges due to competition from other producing countries such as Brazil and Mexico, which are also developing their panela markets. Nevertheless, the quality and nutritional properties of Colombian panela provide a competitive advantage, especially in markets seeking healthy and sustainable products.

In recent years, the Colombian economy has shown signs of slowdown, influenced by external volatility and a decline in domestic demand. Despite this, GDP growth of 1.5% is projected for 2024, driven by private consumption and fixed investment (de Política Monetaria & de Modelos, 2024). This broader economic context directly impacts the panela sector, which must adapt to changing market conditions to maintain its competitiveness and sustainability (Ballesteros Escobar & Palacio Archer, 2021).

Panela consumption in Colombia has steadily increased, driven by its nutritional value and role as a traditional food. This growth in domestic demand, coupled with government policies promoting product formalization and export, creates a favorable environment for the development of the panela sector (Restrepo & Flórez, 2017). It is essential to adopt modernization and marketing strategies that facilitate the exploitation of these opportunities and strengthen the sector's competitiveness at both national and international levels.

At the local level, the municipality of Convención stands out as an important panela production center, though processing methods date back more than 30 years, resulting in low productivity and resource waste (López Sánchez et al., 2019). Modernizing these techniques and improving infrastructure are crucial to enhancing product efficiency and quality, as well as complying with current health and environmental standards.

The general objective of this article is to analyze the economic performance and challenges of the panela sector in the Catatumbo region of Colombia, identifying development opportunities and strategies for strengthening the sector to contribute to sustainable rural development. The specific objectives include characterizing the predominant production techniques in the sector, highlighting limitations and opportunities for technological modernization; evaluating the impact of public policies and associativity on the sustainability and competitiveness of the panela sector in the region; and proposing strategies for quality standardization and the creation of a collective brand to differentiate panela from Catatumbo, enhancing its competitiveness in external markets.

METHODOLOGY

This study is based on a systematic literature review to analyze the economic performance and challenges of the panela sector in the Catatumbo region, Colombia (Barrientos-Monsalve, Sotelo-Barrios & Hoyos-Patiño, 2023). The methodology was designed to ensure a comprehensive collection and rigorous analysis of existing literature, providing a solid foundation for developing strategies to strengthen the panela sector in this region.

An exhaustive search of the literature was conducted in academic databases such as Scopus, Web of Science, Google Scholar, AGRIS, and CAB Abstracts. Keywords included combinations of terms such as “panela production,” “rural development Catatumbo," “Colombian panela economy," and “agricultural competitiveness" (Barrientos Monsalve, Velásquez-Carrascal, & Hoyos-Patiño, 2021).

Inclusion Criteria:

- Publications in Spanish and English, published between 2010 and 2023.
- Studies related to panela production, rural development in Catatumbo, or economic analyses of the agricultural sector in Colombia.
- Peer-reviewed articles, government reports, and relevant research theses on the panela sector.

Exclusion Criteria:

Studies not specifically focused on the Colombian context or lacking empirical data or relevant analyses for panela production in Catatumbo were excluded.

The study selection process was conducted in two stages. First, the titles and abstracts of identified studies were reviewed for a preliminary selection based on relevance to the article's central theme. Subsequently, preselected studies were read in full to assess their relevance and quality. Only those meeting the established criteria were included in the review. Reference management software, Zotero, was used to organize studies and avoid duplicates (Barrientos Monsalve et al., 2021).

Relevant data were extracted from each study, including study objectives, context, methodology, key findings, and recommendations. This information was organized into thematic matrices to facilitate analysis. A critical analysis of the studies allowed for the identification of strengths and weaknesses in methodological approaches and the evaluation of gaps in the existing literature. Subsequently, the information was synthesized around key themes such as the productive characteristics of the panela sector, economic challenges, market opportunities, and development strategies.

To ensure the validity of the results, source triangulation was employed by comparing findings from different studies and contrasting quantitative and qualitative data. Additionally, the article's methodology and results underwent a peer-review process, where field experts provided feedback to enhance the quality of the work (Dulcey Nieves & Coronel Montaguth, 2014; Barrientos Monsalve et al., 2021).

RESULTS AND DISCUSSION

This section presents a detailed analysis of the literature used in this study, aiming to evaluate the diversity and relevance of the consulted sources. The analysis focuses on two key aspects: the temporal distribution of publications and the typology

of cited sources. The first table examines the relationship of publications by year, identifying trends in academic and documentary production related to the panela sector in Colombia (Table 1). The second table classifies references by type, distinguishing between theses, academic articles, government documents, and organizational reports, providing a comprehensive view of the information bases used in this work (Table 2). These analyses are fundamental for understanding the rigor and breadth of the theoretical framework supporting the research.

The graph shows an increasing trend in academic and report production related to the panela sector from 2007 to 2024, with a notable rise starting in 2019. Peaks in 2020 (15.2%) and 2022 (17.4%) stand out as years of intense research activity, suggesting heightened interest in the topic during these periods. This increase may be linked to recent developments in agroindustrial technologies, government policies focused on the sector, and increased funding for research in this area. The continuity in publication numbers through 2024 reflects the enduring relevance of the topic, indicating that the panela sector remains a crucial field of interest for academia and public policy in Colombia.

Table 1.

Relationship of publications by year. Own elaboration.

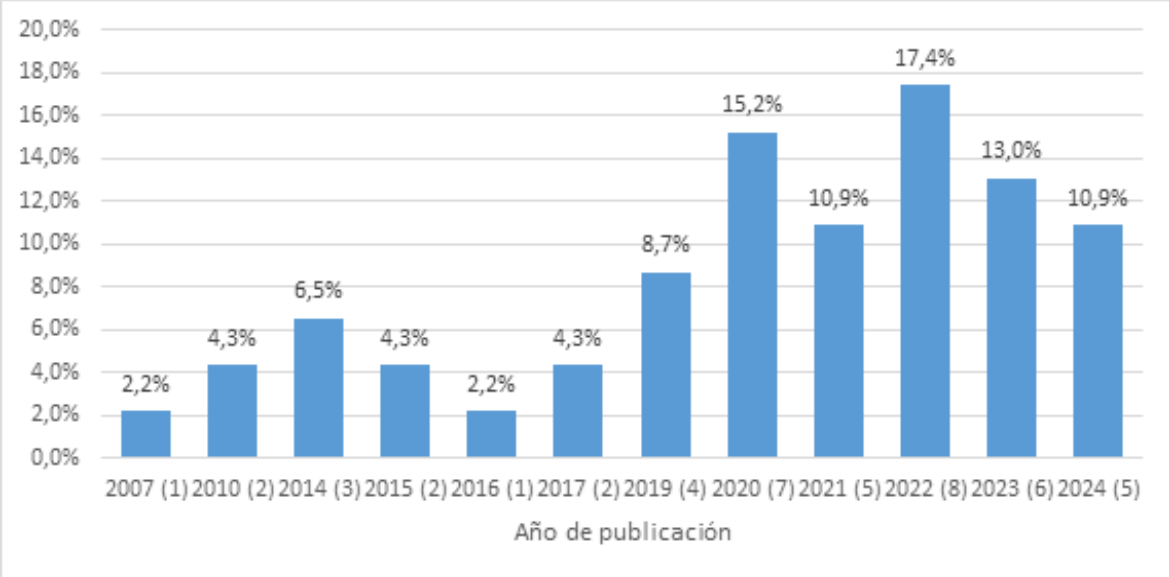
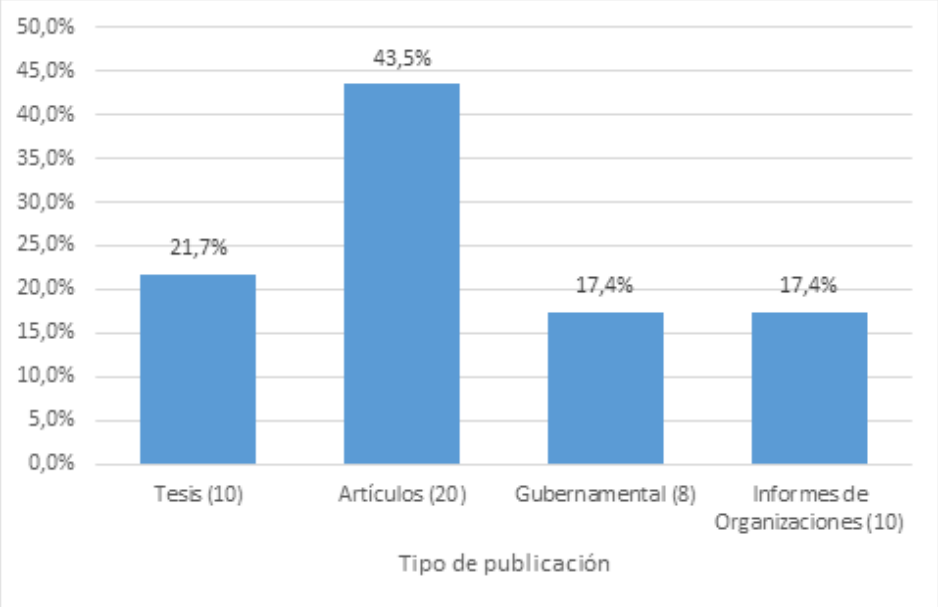


Table 2.

Type of publication analyzed. Own elaboration



The graph shows the distribution of publication types used in the article, highlighting that the majority are academic articles, representing 43.5% of the total. Theses also have a significant presence, constituting 21.7% of the references, reflecting a solid base of academic research in the area. Government sources and organizational reports each account for 17.4% of the total, underscoring the importance of these sources for contextualizing the panela sector within public policies and development initiatives. This distribution demonstrates a balanced approach in the use of diverse information sources, combining academic research with official documents and sectoral studies to provide a comprehensive analysis.

Context of the Panela sector in Catatumbo

The panela sector in the Catatumbo region, particularly in municipalities such as Convención, has become a cornerstone of the local economy. This crop not only represents a significant source of income for thousands of families but also serves as an engine for rural development in a region historically affected by armed

conflict. Panela production, a derivative of sugarcane, has emerged as a viable and sustainable economic alternative to less legal activities, such as coca cultivation (Dulcey Nieves & Coronel Montaguth, 2014; Minagricultura, 2017).

In this regard, the panela agroindustry in Catatumbo has demonstrated notable resilience and adaptability, enabling local producers to not only meet domestic demand but also explore international markets. This sector is considered the primary generator of employment in municipalities like Convención, where more than 350 families depend directly on panela production (Bastos et al., 2019). Associativity, promoted through cooperatives such as COOINCAPRO, is key to improving production and commercial conditions for panela producers, facilitating access to technical assistance and the adoption of better agricultural practices (Bastos Osorio *et al.*, 2020).

Challenges and opportunities in panela production

Despite significant progress, the panela sector in Catatumbo faces several challenges that limit its growth potential. One of the most critical issues is the lack of standardization in production processes and the absence of quality certifications, which hinders penetration into more demanding international markets (Fedepanela, 2009; Bastos Osorio *et al.*, 2020). The trapiches, the basic infrastructure for transforming sugarcane into panela, mostly operate at less than 70% of their installed capacity, indicating considerable room for improvement in terms of efficiency and productivity (Minagricultura, 2016).

Additionally, the volatility of panela prices, influenced by factors such as oversupply and competition with imported products from Venezuela, has negatively affected the profitability of small producers (Minagricultura, 2017). However, significant opportunities exist for sector development, particularly if a distinctive brand for Catatumbo panela can be established in national and international markets. The growing global demand for organic and natural products presents a window of opportunity to position Catatumbo panela as a premium product, provided the necessary quality standards are met (Bastos Osorio *et al.*, 2020).

Strategies for strengthening the sector

To strengthen the panela sector in Catatumbo, it is essential to implement a series of strategies addressing both production challenges and commercial opportunities. First, the standardization of production processes should be promoted through training and technical assistance, ensuring producers comply with quality regulations required by international markets (Dulcey Nieves & Coronel Montagu-th, 2014). Likewise, fostering associativity among producers is crucial to facilitate access to resources and participation in more competitive markets.

Regarding commercialization, the development of a collective brand representing Catatumbo panela could be a decisive step to improve its market positioning. This brand should be backed by quality certifications ensuring the product's authenticity and nutritional value. Finally, public policies must support the modernization of production infrastructure, incentivizing investment in technology to enhance efficiency and reduce production costs (Minagricultura, 2017).

The success of these strategies will largely depend on collaboration among the various stakeholders involved, including producers, cooperatives, local governments, and international organizations. Only through coordinated efforts can current obstacles be overcome, and the agroindustrial potential of panela in Catatumbo fully realized.

History of the panela sector at the local level

In the Catatumbo region, panela production is an economically and culturally significant activity (Toro, 2022). Since colonial times, this region has developed a strong tradition in panela production, characterized by artisanal techniques and extensive family involvement. The municipalities of San Calixto, Teorema, and Convención stand out as the main sugarcane production centers for panela, driving the local economy and generating employment for a large number of rural families (Manosalva, 2022).

At the local level, panela production in Ocaña has evolved significantly, though it still faces major challenges related to the modernization of techniques and production infrastructure. According to Barbosa Sandoval (2015), the infrastructure used for panela production in the region is outdated and obsolete, resulting in low productivity and high levels of resource waste. This scenario underscores the urgent need to modernize processes and improve technological conditions to enhance product efficiency and quality.

Initially, panela produced in the region was distributed through intermediaries in the province of Ocaña and also marketed on the Atlantic coast, this distribution, while effective, limited local producers' opportunities to access broader and more competitive markets (Pérez Lobo & Rojas Contreras, 2020). Currently, the growing interest in organic and natural products presents an opportunity for Ocaña panela producers to position themselves in national and international markets, capitalizing on the trend toward healthier food consumption.

The most direct competition for Catatumbo panela producers comes from regions such as Boyacá and Santander, where high-quality panelas with lower chemical content are produced, making them attractive in demanding markets (Mogrovejo Andrade *et al.*, 2022). However, Catatumbo panela has the potential to compete favorably if improvements in production processes are implemented and sustainable practices are adopted to highlight its nutritional and natural value (Hoyos-Patiño, Velásquez & Hernández Villamizar, 2020). The history of the panela sector in the region reflects a combination of tradition and challenges, with clear potential for growth and sustainable development through modernization and effective marketing strategies.

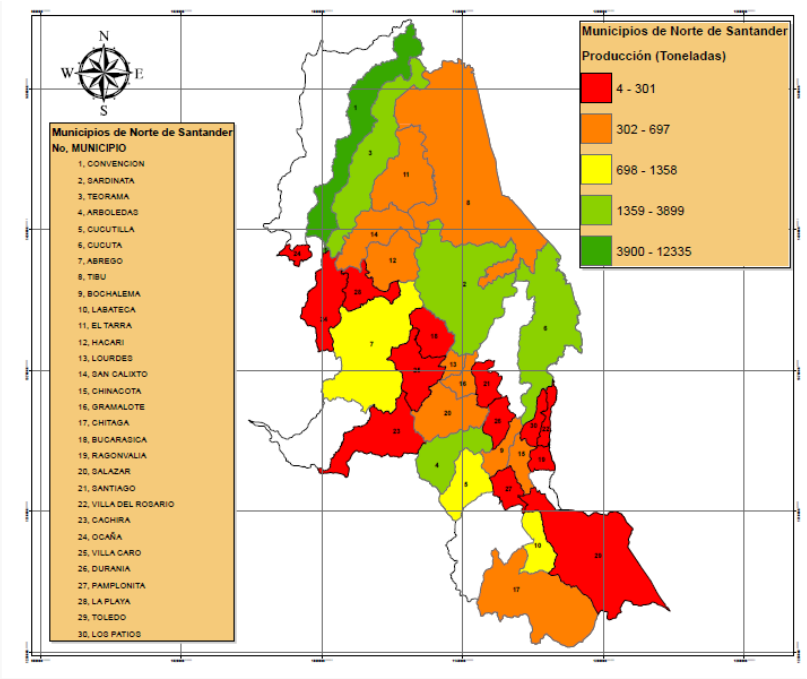
Productive characteristics of the panela sector in Catatumbo

The panela sector in the Catatumbo region, particularly in municipalities like Convención, has evolved considerably in recent decades, becoming a key component of the local economy. This sector is characterized by the artisanal and semi-industrial production of panela, a sugarcane-derived product cultivated on more than 2,500 hectares of land (Dulcey Nieves & Coronel Montaguth, 2014). Panela production in

this region is led by small and medium producers (Figure 1), grouped into cooperatives such as COOINCAPRO, which facilitate commercialization and access to technical services for farmers (Bastos Osorio, Mogrovejo Andrade, & García Torres, 2020).

Figure 1: PANELA PRODUCTION IN NORTE DE SANTANDER – 2018 (Tons)

Figure 1.
Map of panela production by municipalities in Norte de Santander (2018). Adapted from the National Federation of Panela Producers, Panela Information System (S.I.P.A), 2018.



The presented map illustrates the distribution of panela production in the municipalities of Norte de Santander during 2018. Production is concentrated primarily in the municipalities of Convención, Sardinata, and Teorama, which lead in volume with over 3,900 tons annually. These municipalities benefit from better agroecological conditions and access to infrastructure, driving their productivity. In contrast,

municipalities such as Bucarasica and Chitagá show significantly lower production due to infrastructure and technological limitations. This disparity highlights the need for strategies promoting modernization and strengthening productive capacity in less developed areas, fostering equitable growth of the panela sector across the region.

One of the distinctive characteristics of the panela sector in Catatumbo is its high reliance on traditional cultivation and processing techniques, which, while ensuring artisanal product quality, limit mass production capacity and competitiveness in international markets (Minagricultura, 2017). Most trapiches operate at less than 70% of their installed capacity, suggesting considerable room to increase efficiency and production (Bastos *et al.*, 2019). This aspect is critical, as growing demand in external markets requires consistent volumes and standardized quality, two areas where the Catatumbo panela sector must improve substantially.

Sugarcane cultivation in the region benefits from unique agroecological conditions, such as fertile soils and a favorable climate, yielding over 7 tons per hectare, slightly above the departmental average but below the national yield (Dulcey Nieves & Coronel Montaguth, 2014). However, the sector faces significant challenges, including competition with illicit crops and the lack of technological renewal in trapiches, affecting both productivity and business sustainability.

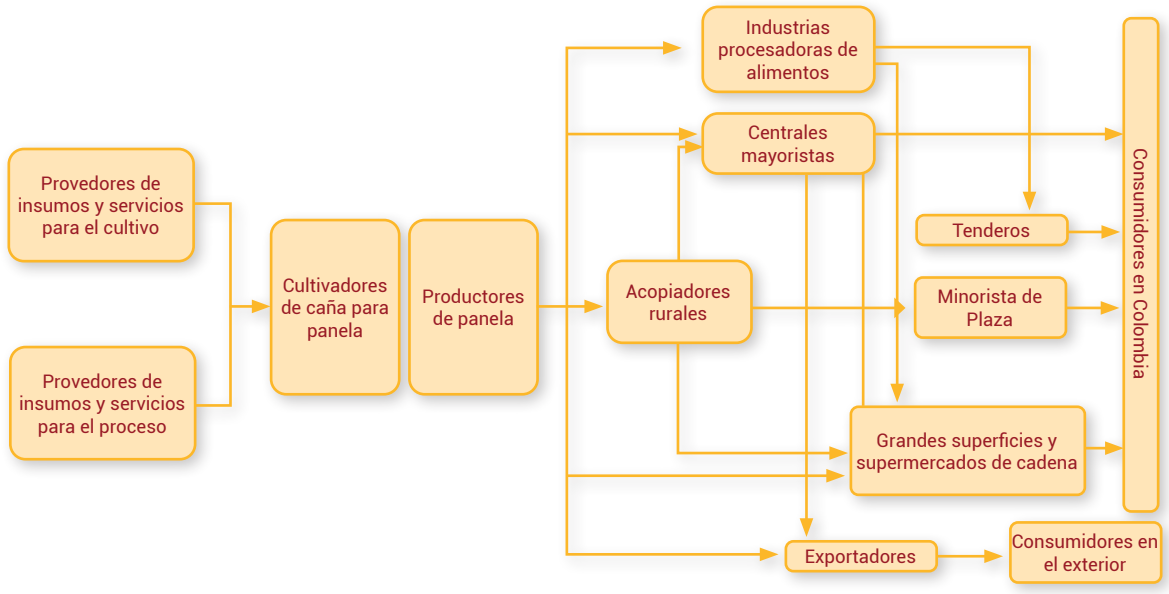
The panela market in Catatumbo has traditionally focused on domestic consumption, with minimal participation in exports. This is partly due to the lack of standardization and certifications, which are essential requirements for competing in international markets (Bastos Osorio et al., 2020). Nevertheless, with the growing global demand for natural and organic products, the Catatumbo panela sector has a unique opportunity to expand and position its product in market niches that value authenticity and artisanal quality.

Structure of the panela value chain

The diagram highlights the interconnections among the different actors in the production process, from input and service providers to end consumers, both at national and international level. The value chain begins with sugarcane growers and panela producers, who are fundamental in transforming the crop into the final product. Next, rural collectors and other intermediaries facilitate the transit of panela

through various commercial channels, including wholesale centers, shopkeepers, supermarkets, and exporters. This structure underscores the complexity and importance of coordination among all actors to ensure panela reaches consumers in optimal condition and with the added value each stage of the process provides (Figure 2).

Figure 2.
Structure of the panela value chain.



Source: *FEDEPANELA (2019).*

The panela value chain in Colombia consists of several interrelated actors who play key roles in the production, transformation, commercialization, and distribution of the product. According to Serna Rincón & Chaparro Rojas (2020), these actors are:

1. Input and service suppliers: ECompanies and personnel dedicated to the production and supply of agricultural inputs such as seeds, fertilizers, pesticides, and irrigation equipment. Also included are providers of machinery and equipment for sugarcane milling and processing.

2. Sugarcane producers: Farmers who cultivate sugarcane using traditional or modern techniques. These producers are responsible for harvesting and transporting sugarcane to trapiches for processing.
3. Trapiches: Establishments where sugarcane is milled, extracted, evaporated, and concentrated to produce panela. Trapiches can be small, medium, or large, varying in terms of technology and efficiency.
4. Distributors and marketers: Companies and cooperatives responsible for distributing and selling panela in local markets. These entities play a crucial role in connecting producers with final consumers.
5. Consumers: The final market includes both domestic and international consumers who value panela for its nutritional properties and use in a variety of food products.

This organization of the value chain emphasizes the relevance of each stage in the production and commercialization of panela, highlighting the need for coordination and cooperation among diverse actors to enhance the sector's competitiveness and sustainability.

Benefits granted to panela producers

En Colombia, los productores de panela han recibido diversos incentivos y apoyos para fortalecer su actividad productiva y mejorar su competitividad. Estos beneficios se han implementado a través de políticas gubernamentales y programas específicos diseñados para atender las necesidades del sector panelero.

Fiscal incentives and assistance programs: The Panela Law (Congreso de Colombia, 2019), enacted before the COVID-19 pandemic, establishes fiscal incentives and technical assistance programs to expand the demand for panela and its derivatives. This law seeks to diversify panela production and commercialization, promoting innovation in the sector. Small and medium producers can benefit from these incentives, which include the possibility of producing alcohols for human consumption, thereby diversifying income opportunities (Olvera Garcia & Quintana

Macias, 2021).

Export support: Panela production is promoted through various initiatives. For example, the importance of complying with quality and safety standards and understanding consumer preferences in international markets has been emphasized. The National Federation of Panela Producers (Fedepanela) and companies like BLACKMILL have worked together to strengthen the presence of Colombian panela in markets such as the United States, Europe, and Asia, promoting its unique quality and flavor (Cidecolombia, 2023).

Events and fairs: Events like EXPOPANELA 2023 provide a platform for panela producers to showcase their advancements and products at national and international level. This event, organized by FEDEPANELA, allows producers, marketers, and public and private entities to gather, exchange experiences, learn about new technologies, and explore commercial opportunities. EXPOPANELA highlights the importance of panela in the Colombian economy and its potential to contribute to the country's sustainable development (Expopanela, 2023).

Modernization and training programs: The FAO and other international organizations have supported projects to modernize the panela sector, such as the Agro-Food Supply System of Antioquia (SABA). These programs aim to strengthen agricultural chains and expand commercialization channels. The FAO has promoted the participation of Colombian panela in global initiatives, highlighting its unique qualities and special characteristics that can contribute to more efficient and sustainable agri-food systems (Correa, 2021).

Tax incentives for the acquisition, marketing, and export of panela

In Colombia, panela producers have received various fiscal incentives and tax benefits designed to support the acquisition, marketing, and export of this product. These measures aim to improve the competitiveness of the panela sector and promote its growth in both domestic and international markets.

Exemptions and tax deductions: The Colombian government has implemented a series of tax exemptions and deductions for panela producers. Among the most notable benefits is a ten-year income tax exemption for producers dedicated to panela production, provided they meet certain requirements established by current regulations (Soto, 2022). Additionally, discounts on value-added tax (VAT) are provided for the purchase of inputs and machinery necessary for panela production, facilitating the modernization of production techniques and infrastructure improvements.

Export incentives: The Panela Promotion Fund (El Fondo de Fomento Panelero) is a key tool for boosting panela exports. This fund provides resources to support producers in promoting and commercializing panela in international markets. Producers who meet adequate labeling and traceability requirements can access these funds, enabling them to improve product presentation and comply with quality and safety standards demanded by international markets (Cidecolombia, 2023).

Support and technical assistance programs: In addition to fiscal incentives, the government and international organizations have developed support and technical assistance programs for panela producers. For example, the FAO has collaborated with local entities to offer training and technical assistance in modernizing production processes, promoting sustainable and efficient practices that enhance product quality and reduce production costs (Correa, 2021).

Panela Law: Law 2005 of 2019, also known as the Panela Law, establishes a series of guidelines to encourage innovation and growth in the panela sector. This law includes incentives for producing alcohols from panela, opening new market opportunities for small and medium producers. Additionally, the law promotes national consumption campaigns and supports the formalization of producers, facilitating their access to government benefits and support programs(Congreso de Colombia, 2019).

Plans and programs to formalize technology

In Colombia, the modernization and technification of the panela sector have been promoted through a series of projects and strategic alliances. AGROSAVIA has led initiatives including self-propelled monocable transport systems, production of selected sugarcane seeds, and hybrid evaporation models for panela production (AGROSAVIA, 2024). These technologies aim to improve the energy and environmental efficiency of panela furnaces, optimize the management of binding species used in sugarcane juice clarification, and provide more sustainable and profitable methods for producers (Gómez Espinosa, 2022).

Additionally, FEDEPANELA has established alliances with entities such as Husqvarna to facilitate access to machinery and equipment at competitive rates, benefiting small and medium panela producers. These alliances seek to optimize production times and costs, thereby improving sector profitability (Casanova Ortiz, 2022). Technification also includes training and update sessions that enable producers to learn about and adopt new technologies, strengthening the productive chain and contributing to the sector's sustainable development (Rodríguez, *et al.* (2020).

Institutional acquisition of panela

The institutional acquisition of panela is promoted through programs that incentivize the consumption of local products in public entities. These programs ensure that panela is included in the offerings of government cafeterias and restaurants, as well as in food supply contracts for these institutions. This approach not only guarantees a stable market for local producers but also fosters the consumption of natural and organic products, strengthening the rural economy (Casanova Ortiz, 2022).

Furthermore, institutional support extends through policies promoting panela purchases in educational institutions and hospitals, creating a steady and significant demand for producers. These programs contribute to the economic sustainability of the panela sector and ensure that the benefits of local production are widely

distributed, improving the quality of life in rural communities (Cidecolombia, 2023).

Gains for peasants, artisans, and entrepreneurs

Support programs for peasants, artisans, and entrepreneurs in the panela sector include fiscal incentives and facilities for business formalization. The Panela Law offers benefits such as a ten-year income tax exemption and access to credit at preferential rates. These incentives are designed to enhance the economic viability of small and medium panela enterprises, facilitating their growth and sustainable development (Soto, 2022; Velásquez-Carrascal *et al.*, 2020).

Additionally, the formalization of producers enables them to access broader markets and obtain better prices for their products. The creation of associations and cooperatives is also promoted as a strategy to strengthen producers' bargaining power and improve their access to resources and services. These initiatives not only increase producers' incomes but also contribute to social cohesion and the economic development of rural communities (Olvera Garcia & Quintana Macias, 2021).

Government and municipal support

The Colombian government, through the Ministry of Agriculture and Rural Development and other entities, has implemented technical and financial assistance programs for panela producers. These supports include subsidies for the purchase of inputs and machinery, as well as training in good agricultural practices and sustainable management. Local governments also play a crucial role by promoting producer formalization and supporting the creation of associations and cooperatives (Polo-Murcia *et al.*, 2022).

Additionally, municipalities have developed specific programs to improve production infrastructure, such as the construction of collection and processing centers. These local efforts are complemented by national programs aimed at enhancing the competitiveness of the panela sector, ensuring small producers can access markets under favorable and sustainable conditions (Rodríguez *et al.*, 2020).

Stimulus for panela-related tourism

Rural tourism related to panela production is incentivized through the creation of tourist routes and immersive experiences. Programs like "La Ruta de la Panela" (The Panela Route) allow tourists to visit trapiches and participate in the panela production process. This type of tourism not only generates additional income for producers but also promotes the region's cultural and gastronomic heritage, attracting national and international visitors (Polo-Murcia *et al.*, 2022).

These tourism initiatives include the promotion of panela-related events and festivals, where tourists can learn about the history and culture of panela production. Additionally, rural accommodations offering authentic countryside experiences have been developed, contributing to the economic and sustainable development of rural communities (Hoyos-Patiño, Hernández-Villamizar & Velásquez-Carrascal, 2019).

Strategy for better development of the panela sector

To improve the development of the panela sector, strategies focused on technological modernization, producer formalization, and market expansion have been implemented. The adoption of advanced technologies and training in sustainable practices are fundamental to increasing productivity and panela quality. These strategies include the implementation of new production methods and the promotion of more efficient and eco-friendly inputs (Gómez Espinosa, 2022; Velásquez Carrascal, B. L., *et al.*, 2020).

Furthermore, promoting panela consumption at national and international levels, along with the creation of new derived products, is key to diversifying the market and ensuring sector sustainability. Marketing campaigns and commercial alliances aim to position Colombian panela in international markets, highlighting its nutritional properties and natural origin, which can open new business opportunities and improve producer incomes (Cidecolombia, 2023).

Economic value for peasant families

Panela production constitutes one of the primary sources of income for thousands of peasant families in Colombia. This sector generates direct and indirect employment, providing economic stability and improving the quality of life in rural areas. Support policies and rural development programs have been crucial to strengthening this economic activity, ensuring benefits reach the most needy communities (Soto, 2022; Moreno & García, 2020).

Additionally, the formalization and technification of the panela sector have enabled small producers to increase their incomes and access more competitive markets. Government support and international cooperation initiatives have facilitated the adoption of new technologies and sustainable practices, improving production efficiency and profitability, directly benefiting peasant families (Gómez Espinosa, 2022).

Potential of AI in Sugarcane Production

Artificial intelligence (AI) is revolutionizing sugarcane production, offering significant improvements in efficiency, sustainability, and profitability for this agricultural sector (Patiño, Carrascal, Bautista & Díaz, 2023). One of the most notable applications of AI is in yield and sugar content prediction using deep learning models. These models utilize vast amounts of data, including meteorological information, remote sensor data, agronomic attributes, and historical records, to provide accurate and detailed predictions that enable producers to make informed decisions and optimize their operations. For instance, GAMAYA has developed AI models that can predict sugarcane yield and sugar content with up to 98% accuracy, leading to significant improvements in plantation management and productivity (GAMAYA, 2024).

In addition to yield prediction, AI is being used to monitor and assess sugarcane crop health. Projects such as those developed by CSIRO and the University of Wollongong in partnership with Vietnamese tech company VIGREEN have implemen-

ted AI-driven aerial monitoring systems that detect plant health issues, such as nutritional stress, water stress, and foliar diseases. These systems enable farmers to receive real-time data via mobile applications, facilitating quick and effective decision-making to protect their crops and ensure productivity (Pachón & Fernández, 2024). The integration of AI and automation in harvesting and crop management allows farmers to optimize their operations, improving efficiency and reducing operational costs. This is achieved through the use of drones and sensors that collect precise data on crop and soil conditions, enabling timely and accurate adjustments to agricultural practices.

The application of AI in sugarcane production is also driving environmental sustainability. AI technologies enable more precise resource management, such as efficient water and fertilizer use, reducing the environmental impact of agricultural production. Additionally, AI is being used to analyze soil organic content and verify carbon removal programs, contributing to the fight against climate change. These innovations not only enhance producer profitability but also promote more sustainable and responsible agricultural practices (GAMAYA, 2024).

Below, as presented in Table 3, is a synthesis of the main contributions derived from the results of this study. This table summarizes the key aspects identified in the analysis of the panela sector in Catatumbo, highlighting technological limitations, the impact of public policies and associativity, proposed strategies to improve competitiveness in external markets, and the importance of a comprehensive vision of sustainable rural development. These contributions provide a solid foundation for formulating specific recommendations and guide future interventions in the sector, aiming to promote its long-term growth and sustainability.

Table 3.
Contributions derived from the research results.

Aportación	Descripción	Impacto Esperado	Recomendaciones
Diagnóstico de las Limitaciones y Potencialidades Tecnológicas	Se realizó un diagnóstico detallado de las técnicas productivas utilizadas en el sector panelero del Catatumbo, identificando tanto las limitaciones tecnológicas actuales como las potencialidades para su modernización.	Mejorar la eficiencia productiva en un 20% mediante la adopción de tecnologías modernas.	Invertir en capacitación y acceso a tecnologías avanzadas.
Impacto de las Políticas Públicas y la Asociatividad en el Sector	Los resultados revelan que las políticas públicas implementadas han tenido un impacto desigual en el sector panelero. Se observa que la asociatividad juega un papel crucial en fortalecer las capacidades de los productores y en mejorar el acceso a mercados.	Incrementar la competitividad del sector panelero en un 15% a través de políticas más inclusivas.	Promover políticas que fortalezcan la asociatividad en la región.
Propuesta de Estrategias para la Competitividad en Mercados Externos	Formulación de estrategias dirigidas a la estandarización de la calidad y la creación de una marca colectiva para la panela del Catatumbo, con el fin de mejorar su competitividad en mercados nacionales e internacionales.	Aumentar las exportaciones de panela en un 10% dentro de los próximos cinco años.	Realizar estudios de mercado para la creación de una marca colectiva.
Visión Integral de Desarrollo Rural Sostenible	El artículo aporta una visión integral del desarrollo rural sostenible en el contexto del sector panelero, considerando los impactos productivos, económicos, sociales y ambientales.	Desarrollar un modelo de producción panelera sostenible en la región.	Fomentar incentivos para la adopción de prácticas sostenibles.

Source: *Own elaboration.*

CONCLUSIONS

The analysis of the economic performance and challenges of the panela sector in the Catatumbo region reveals a series of key conclusions essential for understanding the sector's current dynamics and future development opportunities.

Regarding the need for technological modernization, it was identified that the predominant production techniques in the region are largely traditional, limiting the sector's competitiveness at national and international levels. Technological modernization is crucial to improving productive efficiency and ensuring the sector's long-term sustainability.

Concerning the impact of Public Policies and Associativity, it is evident that the public policies implemented to date have had a significant but uneven impact on sector development. Associativity emerges as a determining factor in strengthening the capacities of small and medium producers, improving their market access and enabling better adaptation to global market demands.

Regarding opportunities in external markets, the growing global demand for organic and natural products presents a unique opportunity for the Catatumbo panela sector. However, to fully capitalize on this opportunity, the creation of a collective brand differentiating Catatumbo panela for its quality and authenticity is essential, facilitating its positioning in international markets.

Regarding the comprehensive vision of sustainable rural development, the study underscores the importance of adopting an integrated approach to rural development that considers not only economic aspects but also social and environmental impacts. Developing a sustainable production model is essential to ensuring balanced growth of the panela sector, contributing to the well-being of local communities and environmental preservation

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Scientific review articles

ANÁLISIS CONCEPTUAL DE LA CONTABILIDAD FINANCIERA A TRAVÉS DE LAS PUBLICACIONES DE LA REVISTA LIBRE EMPRESA (2008-2022)

CONCEPTUAL ANALYSIS OF FINANCIAL ACCOUNTING THROUGH THE PUBLICATIONS OF THE JOURNAL LIBRE EMPRESA (2008-2022)

VIVIANA MENJURA DÁVILA[1]

https://orcid.org/0009-0000-7889-5842

[1]*Administradora financiera de la Universidad del Quindío. Integrante de la Escuela de Formación e Investigación Contable en el programa de Contaduría Pública de la Universidad del Quindío en categoría Estudiante investigador principal. Integrante semilleros de investigación de la Red de Investigación en Ciencias Económicas, Administrativas y Contables REDI-CEAC*

E *vmenjurad@uqvirtual.edu.co*

RESUMEN

La investigación tuvo como objetivo analizar las teorías, conceptos y procedimientos en contabilidad financiera expuestos por los autores en los artículos de la revista libre empresa, entendiendo esta rama como aquella que se encarga de resumir, examinar e informar las transacciones financieras del ente económico. Se utilizó el método de estudio bibliométrico con enfoque cualitativo, de tipo teórico descriptivo y explicativo. La investigación reveló que la contabilidad financiera desempeña un papel crucial en la transparencia, la rentabilidad, la planificación económica y el valor económico agregado, pero también presenta limitaciones y desafíos que deben ser complementados con otros sistemas de información organizacional. La mejora de estándares y prácticas contables es fundamental para maximizar los beneficios, a través del

PALABRAS CLAVE

Contabilidad financiera, Paradigma de utilidad, Valor económico agregado, indicadores financieros, teoría de la agencia

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cálculo de la situación, rendimiento y flujos financieros de las organizaciones, esta contabilidad busca satisfacer las necesidades de información de los usuarios externos conocidos como principales en la Teoría de la Agencia.

ABSTRACT

The research aimed to analyze the theories, concepts, and procedures in financial accounting presented by authors in the articles of the journal Libre Empresa, understanding this branch as the one responsible for summarizing, examining, and reporting the financial transactions of an economic entity. A bibliometric study method with a qualitative approach was used, adopting a descriptive and explanatory theoretical framework. The research revealed that financial accounting plays a crucial role in transparency, profitability, economic planning, and added economic value. However, it also presents limitations and challenges that must be complemented by other organizational information systems. The improvement of accounting standards and practices is essential to maximize benefits, as financial accounting seeks to calculate the financial situation, performance, and flows of organizations to satisfy the information needs of external users, known as principals in Agency Theory.

KEYWORDS

Financial accounting; Utility Paradigm; economic value added; financial indicators; agency theory

INTRODUCTION

Financial accounting is a branch of accounting knowledge recognized and used by various social groups. By studying the theoretical and conceptual developments of this field, this research is based on publications in the Revista Libre Empresa from the Universidad Libre de Colombia. Accounting acknowledges the possibility of preparing and presenting information in multiple dimensions, with financial statements representing the most advanced stage in conceptual foundations, regulation, procedures, and practical implementation.

This article was developed using a bibliometric study methodology to assess the development and impacts of financial accounting. Central topics include the definition of accounting, conceptual foundations, agency theory, the utility paradigm of information, financial accounting regulation, and users and their information needs. External accounting is a fundamental discipline in the business and economic field, supported by a theoretical foundation.

The theory and regulation of financial accounting are part of a broader accounting science with a wider scope. Each dimension of accounting requires the development of specific conceptual frameworks and procedural structures, which must be articulated within a single, general, and versatile theory. Financial accounting establishes its object of study in the universe of financial wealth, targeting providers of risk capital as its primary users.

METHODOLOGY

EThe article presents the results of a documentary and bibliometric analysis of financial accounting publications in the journal Libre Empresa of the Universidad Libre de Pereira up to the first semester of 2024. The research is documentary in nature, employing qualitative, theoretical, descriptive, and explanatory analysis. It focuses on the approaches, terms, proposals, and paradigmatic perspectives identified in publications since 2008. The study analyzes areas of controversy, limitations, challenges, and the importance of financial accounting in terms of transparency, profitability, and economic planning, as well as its impact on meeting the

information needs of external users.

RESULTS AND DISCUSSION

Identification of bibliographic sources for analysis

Table No 1.
Identification of Financial Accounting Articles Published in journal Libre Empresa

N° de identificación del artículo	Nº de identificación de la Revista (tabla 1)	# de Revista		Título de los artículos de contabilidad financiera C.F. publicados en la Revista Libre Empresa Universidad libre de Cali
		Vol	Num	
1	5	7	1	Estrategias financieras de capital de trabajo en empresas farmacéuticas (Sánchez Roys & Rangel López, 2010)
2	6	7	2	Además de indicadores financieros ¿qué otras técnicas se pueden utilizar en el análisis contable? Nuevas tendencias internacionales (Ramirez Echeverry et al., 2010)
3	7	8	1	Fuentes de financiamiento microempresarial. Análisis en las comunas 4, 5, 6,7 Y 8 de Cali 2009-2010 (César, 2011)
4	8	8	2	Documento de discusión: acercamiento a unos códigos elaborados para abordar la contabilidad financiera (Otálora & Sánchez Cabrera, 2011)
5	8	8	2	Evaluación del impacto de la certificación BASC en la liquidez y rentabilidad en las empresas de Cali – Colombia (Herrera & Morelos Gómez, 2011)

6	11	10	1	Efecto financiero de las diferencias de tasa de cambio, de acuerdo con los estándares internacionales de contabilidad (Solarte, 2013)
7	15	12	1	Determinantes del acceso al crédito: Evidencia a nivel de la firma en Bolivia (Peñaloza, 2015)
8	16	12	1	Efecto de diferentes mecanismos de financiación en la productividad. Enfoque Financiero tipo Cobb-Douglas, 2009-2014 (Mejía, 2015)
9	16	12	2	Tecnología en Finanzas y Sistemas Contables: Objeto, Método y Pedagogía (Trujillo-Peralta, 2015)
10	17	13	1	Bonos de carbono: un instrumento en el sistema financiero internacional (Cruz, 2016)
11	19	14	1	Análisis comparativo de la inversión-financiación de la innovación entre sectores manufacturero y de servicios en Colombia (Zuluaga & Rivera Godoy, 2017)
12	19	14	1	Financiación de innovación tecnológica en mercados de capitales globales. 2009-2016 (Mejía, 2017)
13	19	14	1	Factores que inciden en la toma de decisiones financieras de las pymes del sector construcción, Popayán, 2016 (Rangel et al., 2017)
14	23	16	1	Desempeño financiero de Tecnoquímicas y Genfar (2013-2017) (Godoy & Vallecilla Moreno, 2019)
15	25	17	1	La gran empresa de bebidas no alcohólicas en Colombia: rendimiento y EVA (Godoy, 2020)
16	28	18	2	Reflexiones acerca del retorno financiero, social y ambiental del sector cultivo del café en Colombia (Rendón et al., 2021)

17	29	19	1	Rentabilidad y valor económico agregado del sector de elaboración de productos de café en Colombia (Godoy & Villota Ortega, 2022)
18	29	19	1	Conocimiento financiero y su relación con la sostenibilidad microempresarial: Un estudio de caso (Hernández et al., 2022)

Source: Own elaboration.

Table No 2.

Percentage of Financial Accounting Articles Published in journal Libre Empresa.

Nº identificación de la revista	Nº de revista		Año de publicación	Nº total de artículos de la revista	Nº de artículos de C.F	% de artículos de C.F
	Vol.	Nº				
1	5	1	2008	7	0	0,00%
2	5	2	2008	6	0	0,00%
3	6	1	2009	7	0	0,00%
4	6	2	2009	8	0	0,00%
5	7	1	2010	8	1	12,50%
6	7	2	2010	8	1	12,50%
7	8	1	2011	7	1	14,29%
8	8	2	2011	7	2	28,57%
9	9	1	2012	8	0	0,00%
10	9	2	2012	11	0	0,00%
11	10	1	2013	8	1	12,50%
12	10	2	2013	8	0	0,00%
13	11	1	2014	10	0	0,00%
14	11	2	2014	9	0	0,00%
15	12	1	2015	11	1	9,09%
16	12	2	2015	10	2	20,00%
17	13	1	2016	9	1	11,11%
18	13	2	2016	9	0	0,00%
19	14	1	2017	11	3	27,27%

20	14	2	2017	12	0	0,00%
21	15	1	2018	10	0	0,00%
22	15	2	2018	10	0	0,00%
23	16	1	2019	7	1	14,29%
24	16	2	2019	10	0	0,00%
25	17	1	2020	8	1	12,50%
26	17	2	2020	7	0	0,00%
27	18	1	2021	8	0	0,00%
28	18	2	2021	7	1	14,29%
29	19	1	2022	8	2	25,00%
				249	18	7,23%

Source: Own elaboration.

Conceptual aspects of financial accounting

The financial accounting articles published in journal Libre Empresa allow for the identification of the following concepts associated with the study topic:

- Financial Management: Understood as “a form of applied economics aimed at maximizing a company's wealth through the acquisition of financial resources via capital contributions or credit, their proper management and application, and the efficient administration of working capital, investments, and results to facilitate sound short- and long-term decision-making"(Sánchez Roys & Rangel López, 2010, p. 57).
- Working Capital: Defined as “the excess of current assets over current liabilities. This means that working capital is the portion of current assets financed by long-term creditors and shareholders, or equivalently, not financed by short-term creditors” R. Kennedy (1999) citado por(Sánchez Roys & Rangel López, 2010, p. 56).
- Budgetary Control: “Should be understood as the set of procedures and resources that, used skillfully, serve the science of management to plan, coordinate, and control all company functions and operations through budgets to achieve maximum efficiency with minimal effort"(Ramirez Echeverry et al., 2010, p. 34).
- Quantifiable: “Indicator to measure impacts on organizations, measures varia-

bles that have previously been operationalized with valid and reliable metrics. These should also consider non-quantifiable categories or qualities that can be described and integrated into analyses and diagnostics"(Rendón Montoya *et al.,* 2021, p. 22)

- Effectiveness in achieving accounting profits from financial contributions by investors or owners: "Measured by return on assets (ROA) and return on equity (ROE). ROA incorporates operating profit generated by assets (operating profit / assets), while ROE reflects net profit attributable to equity (net profit / equity)" (Rendón Montoya *et al.*, 2021, p. 11)
- Company structure: Understood as "assets represent investments; liabilities and equity represent financing (i.e., the cash flow required to support investments). From an economic-financial perspective, liabilities are the origin or source of resources used by the company to finance asset investments. Liabilities (obligations) may be subdivided into two groups: equity, which constitute the company's net equity and are made up of capital contributions by the owners" (Efecto financiero de las diferencias de tasa de cambio, de acuerdo con los estándares internacionales de contabilidad, 2013, p. 74).
- Financial Market Structure: "Includes the capital market, which encompasses the non-intermediated market comprising the stock exchange and over-the-counter markets"(Cruz Díaz, 2016, p. 14).
- Ease of reading and interpretation: "Indicator to measure impacts on organizations should be as simple as possible, ensuring the information can be easily accessed and interpreted, clarity for decision-making by stakeholders. or this reason, they should be constructed with the participation of all stakeholders, as mentioned above. In this case, it is necessary to review literature and successful experiences that can serve as models to be adapted or followed, selecting a set of qualitative and quantitative indicators that serve the fulfillment of the community's vision" (Figueroa, 2016) citado por (Rendón Montoya *et al.*, 2021, p. 22).
- Financial purpose of organizations: "To maximize profits while creating value for all stakeholders, reflected in social and environmental impact of the organization" (Rendón Montoya et al., 2021, p. 16)
- Growth Indicators: "Measure the company's progress in assets, sales, and net

profit. Asset turnover measures efficiency in asset utilization to generate sales, i.e., it measures efficiency in the use of assets, in other words, it measures the effectiveness in controlling costs and expenses" (Desempeño financiero de Tecnoquímicas y Genfar (2013-É 2019, p. 12).

- Effectiveness Indicators: Measure "profits received by investors and owners for deployed capital" (La gran empresa de bebidas no alcohólicas en Colombia: rendimiento y EVA, 2020, p. 13).
- Financial Indicators: "Numerical results derived from relating two figures or accounts from the Balance Sheet and/or Income Statement" (Herrera Fontalvo & Morelos Gómez, 2011, p. 124)
- ROA and ROE Indicators: "Measure the benefits received by the company and its owners from investments, determining organizational effectiveness in generating profits for its investors and owners. Under the DuPont system, ROA is the product of asset turnover and operating profit margin, while expanded DuPont system defines ROE as the product of asset turnover, net profit margin, and financial leverage" (Ross, Westerfield & Jordan, 2018, pp. 67-69; Rivera, 2004, pp. 38, 52) cited by (Desempeño financiero de Tecnoquímicas y Genfar (2013-É 2019, p. 12)
- Capital market: "Forms part of the financial market, serving as the mechanism through which medium- and long-term financial assets are traded in an economy, i. e., savings-derived resources to the demanders of such resources: companies and governments"(Cruz Díaz, 2016, p. 17)
- Securities market: "Mobilizes medium- and long-term resources from savers or investors to the productive sector through the issuance, underwriting, intermediation, and trading of securities via public offerings"(Cruz Díaz, 2016, p. 19)
- Financial market: "Composed of a set of markets where, either virtually or physically, transactions occur for the placement and acquisition of resources - that is, exchanges of financial instruments (affected by supply and demand). It facilitates price determination, enables financial asset transactions, allows capital increases or reductions, permits risk transfers through derivatives markets, and enhances international trade via foreign exchange markets"(Cruz Díaz, 2016, p. 15).
- German financial structure model: "Finances technological innovation through

bank credit, which is granted to secure, low-risk projects backed by real guarantees, typically real estate mortgages or through the bank's acquisition of the innovating company" (Efecto de diferentes mecanismos de financiación en la productividad. Enfoque financiero tipo Cobb-Douglas, È 2015, p. 66).

- Anglo-Saxon financial structure model: "Promotes technology development financing through equity issuance and bond funding. These provide the necessary capital for technological research, which often entails multi-year development and consequently carries high risk" (Efecto de diferentes mecanismos de financiación en la productividad. Enfoque financiero tipo Cobb-Douglas,È 2015, p. 66).
- Relevance: "An indicator for measuring impacts on organizations based on the needs of information users such as stakeholders, as well as policies and contextual applicability" (Rendón Montoya *et al.*, 2021, p. 22)
- Precision: "Indicator for measuring impacts on organizations, built on robust and validated theoretical foundations, ensuring they withstand validity and reliability analyses. They must enable problem identification and monitoring of proposed solution programs" (Rendón Montoya *et al.*, 2021, p. 22)
- Budget: "Understood as a specific plan with financial implications, constituting a control mechanism that includes estimated operational programs for future periods. It establishes actionable plans to coordinate activities and influence maximization of company profits" (Ramirez Echeverry et al., 2010, p. 34).
- Return on Assets (ROA): "Indicates an organization's capacity to generate profit from asset utilization. This size-independent metric indicates operational and financial performance" (Rendón Montoya *et al.*, 2021, p. 16)
- Social Return on Investment (SROI): "A methodology providing principles to measure non-financial variables such as economic, social, and environmental value, typically excluded from traditional accounting. SROI quantifies and evaluates impacts on stakeholder groups" (ECODES, s.f.) cited by (Rendón Montoya *et al.*, 2021, p. 19)
- Asset turnover: Estimates "the efficiency with which a company utilizes its resources, particularly operational assets, based on the speed of recovery of the money invested in each of them" (Anaya, 2018, p. 223) cited by (La gran empresa de bebidas no alcohólicas en Colombia: rendimiento y EVA, 2020, p. 13).

- Economic Value Added (EVA): "Measures, in absolute terms, an organization's performance in value creation"(Rendón Montoya et al., 2021, pp. 16-17).
- Economic Value Added (EVA): "Considered as residual profit derived by subtracting from after-tax operating profit is considered a charge for the use of capital" (Stewart, 2000, p. 164) citado por (DesempeñofinancierodeTecnoquímicasyGenfar(2013-É 2019, p. 12)

Definition of accounting and financial accounting

Accounting is a science whose object of study is wealth, comprising various branches and dimensions depending on its field of application or aspect of study. From an applied perspective, "accounting is 'an information system that aids decision-making while simultaneously serving as a control instrument" (Porporato, 2008, p. 76). "Understand accounting as information system enabling control, decision-making, and encompassing social notions such as wealth, resources, property, and benefit" (Otálora Rodríguez & Sánchez Cabrera, 2011, p. 15).

Financial accounting evolves in complexity due to its environment, shaped by commerce, technological changes, economics, and organizational management transformations, which introduce new production, marketing, and consumption methods, create relationships between people and constantly change reality . (Arquero, 2001) cited by (Otálora Rodríguez & Sánchez Cabrera, 2011, p. 15).

Accounting is characterized as a technique, technology, or science, particularly in Financial and Accounting Systems Technology, operating through computerized systems in organizational management (Trujillo-Peralta, 2015, pp. 165-166).

Accounting and Accountancy are disciplines within accounting, aimed at achieving generic goals through a complex framework incorporating multiple factors:

- "Organized information, applied via scientific models ensuring coherence and verifiability or falsifiability of data to guarantee reliability".

- "Principles, definitions, rules, techniques, and computerized tools for data collection and knowledge production about organizational transactions".

- "Produced knowledge that can be analyzed, interpreted, and substantiated through human sciences frameworks".

- "Epistemologically, the object of study of [accountancy[1]] accounting remains under discussion; and can be thought of by the technologist in order to improve and modernize it".

- "It produces and understands its objects of interdisciplinary analysis, with objects that are susceptible to innovation" (Trujillo-Peralta, 2015, p. 166)

The Accounting and Financial Management process exemplifies accounting knowledge transmission, facilitating planning, business decisions, and control (Trujillo-Peralta, 2015, p. 166)

The final stage of the accounting process is "presentation", synthesizing and representing financial positions and operational results through financial statements, reports, and disclosures (SENA, 2013) cited by (Trujillo-Peralta, 2015, p. 167)

Financial management encompasses processes for fund administration and efficient organization's resource use, including acquisition, maintenance, and deployment of financial assets per approved budgets. Accounting knowledge is vital for identifying, resolving, and proposing cognitive and operational solutions, based on accounting, including multiple linkages between theories, concepts, and practices. (Trujillo-Peralta, 2015, p. 167 - 168)

A holistic accounting perspective integrates accounting theory and epistemology as the discipline's conceptual foundation. This involves recognizing accounting as a scientific discipline distinct from the social practice of accountancy. It also includes an understanding regulatory model influencing the accounting profession and

1 Public accounting is a profession, in this sense, when the object of study is proposed, it is more pertinent to predicate it on the knowledge that in this case corresponds to accounting, regardless of the location given in the field of knowledge.

its interactions with organizations and society in general. Accounting education is deepened in terms of interpretation and application of national and international regulatory schemes. It analyzes the different regulatory models, the institutions and organizations issuing standards, their contexts of origin, trends and their application in specific situations (Trujillo-Peralta, 2015, p. 168).

Accounting evaluates organizations' economic and administrative conditions, emphasizing cost management as a key factors in business competitiveness. Integrated technology affects product quality and pricing standards (Trujillo-Peralta, 2015, p. 168), this process is guided by management accounting.

Financial information enables planning, evaluation, monitoring, and analysis of efficient resource acquisition and utilization. This information is aligned with organizational objectives and policies defined by the appropriate organizational authorities. The reality of a company is reflected in its financial statements, where the impact of organizational decisions is evidenced. It is essential to analyze financial information in relation to the environment, the sector, and the organization's objectives, in order to make informed decisions. (Trujillo-Peralta, 2015, p. 168).

Disclosed information must aid users making the appropriate decisions. Indicators, analyzed via time-series and cross-sectional enhance this process. In this analysis, the size of the companies is considered, and is usually improved when compared to the average or the leading company in the sector. . (Rendón Montoya et al., 2021, pp. 15-16)

Principal-agent relationships

In organizations, agency relationships exist between risk capital providers (principals) and administrators (agents). Agents such as managers, possess full information, while principals rely on financial statements and managerial reports. Audits address this information asymmetry.

“Financial accounting, as information for external users, serves a threefold purpose: to support decision-making, provide evaluation and control tools, and report to investors" (current and potential) (Zimmerman, 1995; Salas, 2004) cited by (Otálora

Rodríguez & Sánchez Cabrera, 2011). "In this regard, developments in positive accounting, accounting is presented as the fundamental mechanism for monitoring contractual compliance among different organizational agents, incorporating insights from agency theory and firm theory" (Sunder, 2005) cited by (Otálora Rodríguez & Sánchez Cabrera, 2011, p. 18).

Agency theory focuses on principals and agents, while accounting not only enforces contracts compliance but also evaluates their impact on other stakeholders, thereby expanding accountants' scope of action. (Otálora Rodríguez & Sánchez Cabrera, 2011, p. 19).

"There is no doubt that profitability for company owners and investors drives innovative enterprises" (Mejía Gómez, 2017, p. 59). "However, these investors require guarantees protecting their invested resources, which explains why financial accounting primarily focuses on these information users who provide resources to the organization through external financing activities (defined as all funding sources excluding equity" (Zuluaga Barona & Rivera Godoy, 2017, p. 25)

Regarding financial statement users' information needs, it is highlighted that these reports are generated annually according to current regulations. Managers utilize this information to monitor sales, inventories, budgets, and financing. Contrary to Calderón's (2011) position, evidence shows that SME managers not only consult financial statements tax payment periods (Rangel Acosta *et al.*, 2017, p. 160). These perspectives present two views of financial information use: one limited to external users, and another recognizing its administrative decision-making value.

The organization's financial purpose is profit maximization, but is crucial to add value for all stakeholders, considering social and environmental impacts alongside economic benefits (Rendón Montoya et al., 2021, p. 16). The evolution toward broader organizational reporting has given rise to tools such as sustainability reports, integrated reporting, and sustainability accounting standards. These initiatives aim to provide comprehensive organizational performance assessments incorporating financial, social, and environmental dimensions. Developing institu-

tional sustainability performance indicators requires stakeholder participation and consensus. This holistic approach is essential for promoting responsible business practices and contributing to global sustainable development (Rendón Montoya *et al.*, 2021, p. 20).

Paradigm of the usefulness of information for decision making

Paradigm of the usefulness of information for decision making is a theory that emphasizes the value of information in providing useful elements for users. "Users make decisions regarding matters such as":

- "Making decisions about which assets to acquire, how to finance them, and how to manage current resources" Besley and Brigman (2000) cited by (Sánchez Roys & Rangel López, 2010, pp. 54-55)
- "Establishing in advance how to acquire and determine capital, as well as allocating working capital and its derivatives" Koontz and Weinhch (2000) cited by (Sánchez Roys & Rangel López, 2010, p. 55).
- "Analyzing the organization's internal and external situation to achieve financial results" Thomson and Strickland (2001) cited by (Sánchez Roys & Rangel López, 2010, p. 55).
- "Achieving organizational objectives and pursuing the company's mission" Thomson and Strickland (2001) cited by (Sánchez Roys & Rangel López, 2010, p. 55).
- "Obtaining funds for financing and investment activities and managing working capital" (Sánchez Roys & Rangel López, 2010, p. 55)"For a company to carry out its production and distribution activities and achieve efficiency and quality in its products or services, it must always have financial resources available in certain amounts. This is why financial decisions must be made, among which are financing decisions" (Millán Solarte, 2011, p. 76)
- Financial decisions are fundamental for managing a company's resources and are divided into investments, financing, and dividends. These decisions are interconnected and can influence each other, making it important to consider these interactions when making financial decisions at both micro and macroeconomic levels (Rangel Acosta et al., 2017, p. 155).

- "Evaluating the financial and operational performance of any company, identifying areas for improvement and opportunities to achieve a better position"(Rangel Acosta *et al.,* 2017, p. 155).
- "Keeping up with taxes, managing financial statements, and generally maintaining accounting records as required by regulations"(Rangel Acosta *et al.*, 2017, p. 160)

Many authors question the usefulness of accounting information for financial decision-making, particularly criticizing common indicators for not considering risk, cost of capital, being short-term oriented, and being influenced by accounting policies. This debate has led to the creation of new value-based management (VBM) models to measure financial performance through the calculation of residual income. (Stern & Willette, 2014; Arnold & Lewis, 2019; Atrill, 2017; Salaga, Bartosova & Kicova, 2015) citados por (La gran empresa de bebidas no alcohólicas en Colombia: rendimiento y EVA, 2020, p. 14).

"Proponents of VBM argue that accounting data prepared according to generally accepted accounting principles (GAAP) are not designed to reflect value creation" (Martin & Petty, 2001, p. 62) cited by (La gran empresa de bebidas no alcohólicas en Colombia: rendimiento y EVA, 2020, p. 14). However, value creation can be determined from two perspectives: internal (measurable for all companies) and external (observable only for publicly traded companies). From the internal perspective, it can be calculated using the net present value technique (Milla, 2010) cited by (La gran empresa de bebidas no alcohólicas en Colombia: rendimiento y EVA, 2020, p. 14), knowing historical and projected information, or through adjusted accounting information to obtain residual income, as is the case with EVA, which stands out as one of the most well-known value-based management models " (Worthington & West, 2001) cited by (La gran empresa de bebidas no alcohólicas en Colombia: rendimiento y EVA, 2020, p. 14).

Financial accounting and regulation (accounting standards)

Financial accounting research is conducted with the aim of contributing to the regulation and issuance of accounting standards (Porporato, 2008, p. 77), as well as

to the interpretation of the resulting values, statements, and indicators. Standardization or normalization is not a neutral process; regulation in society can influence accounting through its control of wealth, information, and measurement, serving different objectives and purposes (Otálora Rodríguez & Sánchez Cabrera, 2011, p. 20).

Regulation extends beyond compliance with standards, encompassing the incorporation of codes that transform accountants into active constructors of historical regulation, contrasting with their previous role as mere executors (Otálora Rodríguez & Sánchez Cabrera, 2011, p. 21).

The preparation of financial reports under uniform criteria benefits both investors and international lenders. It reduces translation costs and uncertainty risks, thereby fostering investment and the global circulation of financial capital. (Rueda, 2004, p. 60) (Trujillo-Peralta, 2015, p. 175).

Financial legislation can either benefit or harm actors in the financial sector. Regulatory neutrality is difficult to achieve due to ideological and political biases. This depends on competition among financing mechanisms, capital accessibility and costs, and fiscal preferences (Mejía Gómez, 2017, p. 63).

In financial accounting, information users and their needs are crucial factors in the public accountability process. Managers utilize the information provided in financial statements for decision-making related to profitability and costs (Rangel Acosta *et al.*, 2017, p. 148)

"Investors focus on financial indicators, governments are interested in economic indicators, environmentalists concentrate on environmental impact indicators, and social leaders consider social indicators" (Fernández, Sotto, Vargas, 2020, Patró and Vargas, 2019) cited by (Rendón Montoya *et al.*, 2021, p. 15).

Users highly value ROI and ROE, as these summarize a company's performance. ROI measures efficiency in asset utilization to generate profits, while ROE focu-

ses on shareholder profitability. (Contreras, 2006) cited by (Rendón Montoya *et al.,* 2021, p. 15).

LFinancial users may face risks due to lack of access to reliable and timely information. Information asymmetry in banking negotiations can pose challenges for consumers. (Delvasto, 2011) cited by (Hernández Chunga *et al.*, 2022, p. 119). Financial accounting should seek mechanisms that enable different market stakeholders associated with the organization to access the entity's information on equal terms.

Financial education and financial inclusion are tools to reduce the effects of information asymmetry and vulnerability caused by informality. Financial education enables financial system users to make informed decisions, while financial inclusion provides transparent access to financial services in a transparent manner (Hernández Chunga *et al.*, 2022, p. 120).

Financial accounting from the information preparers' perspective

Financial accounting seeks to simplify socioeconomic reality through valuation and presentation to achieve comprehensive understanding and analysis, requiring constant adaptations to new demands and perspectives of the world (García Casella, 2002) citado por(Otálora Rodríguez & Sánchez Cabrera, 2011, p. 15).

The diversity of organizations impacts financial accounting, as it requires flexibility to adapt to different sectors, objectives, and cultures. The existence of “universal" accounting methods alone is insufficient " (Aktouf, 2001) cited by (Otálora Rodríguez & Sánchez Cabrera, 2011, p. 15).

“A course of action for addressing financial accounting is formulated, consisting of three basic thematic blocks: the accounting information system and its management, the abstraction of operations and their relationship with other disciplines, and intra- and extra-firm information relationships." The proposed framework encompasses fundamental levels of financial accounting, including accounting principles and concepts, information recognition, financial statement projection, and information analysis for decision-making and reporting. Meanwhile, accounting coordina-

tes information flows within organizations for analysis, design, and evaluation of organizational policies (Otálora Rodríguez & Sánchez Cabrera, 2011, p. 17).

The Accounting Information System (AIS) serves as a fundamental instrument for decision-making, whose effectiveness is directly proportional to its proper structuring. This requires the convergence of organizational environments and areas that, when interacting correctly, facilitate the coherent and useful functioning. (Gómez and Suárez, 2007) cited by (Otálora Rodríguez & Sánchez Cabrera, 2011, p. 17).

Two sets of accounting practices in multinational corporations are addressed. The first focuses on price variation accounting and exchange rate fluctuation accounting. The second refers the agreements required to consolidate financial information and determine profits in corporations that are part of a group. (Efecto financiero de las diferencias de tasa de cambio, de acuerdo con los estándares internacionales de contabilidad, 2013, p. 75)

In small businesses, financial management is often underestimated, which can lead to erroneous decisions. It is essential that owners and managers understand the importance of proper financial management and seek professional advice when necessary (Rangel Acosta et al., 2017, p. 149)

A company's financial performance can be evaluated and analyzed using accounting indicators that measure various financial activities, such as growth, efficiency, efficacy, and effectiveness(Rendón Montoya *et al.,* 2021, p. 11). A company's progress can be assessed by considering the growth of its assets, generated sales, and net profit obtained (Dumrauf, 2017) cited by (Rendón Montoya *et al.,* 2021, p. 11).

Accounting also enables understanding of "the efficiency with which a company utilizes its resources, particularly operational assets, based on the speed of recovering money invested in each of them" (Ortiz,Rivera) cited by (Rendón Montoya *et al.*, 2021, p. 11) [This is also estimated through turnover ratios of: portfolio, inventory, fixed assets, net operating assets, and total assets (Rivera, 2017) cited by (Rendón

Montoya *et al.*, 2021, p. 11)

Organizational decision-making requires tools to assist decision-makers, such as cost and expense control that affect company profitability, calculated through margins like gross profit, operating profit, and net profit (Rivera, 2017) cited by (Rendón Montoya *et al.*, 2021, p. 11)

The priority variables for achieving business success are: having adequate capital, maintaining good financial records and controls, conducting planning, and obtaining professional advice on how to manage the business (Baidoun *et al.*, 2018) cited by (Hernández Chunga et al., 2022, p. 119).

CONCLUSIONS

The conclusions of this research are not generalizable to financial accounting as a whole but are specifically related to the publications in journal Libre Empresa from Universidad Libre de Cali. These findings are based on the analyzed authors and contribute more to systematization than to formulation. The key elements identified in the document are as follows:

- Liquidity is a critical issue for organizations, as its scarcity can trigger financial problems by reducing income and complicating short-term cash acquisition. Avoiding low liquidity situations is essential to maintaining financial stability in commercial enterprises.
- Financial strategies are broad and comprehensive, encompassing plans and objectives aimed at fund acquisition, financing and investment activities, and working capital management.
- Analysts compare a company's financial ratios with those of similar companies and industry averages. In this context, international analysis techniques prove useful, as they facilitate such studies and present results accurately and timely.
- Financial information derived from accounting analysis using international techniques is valuable both for external investors and senior management. It enables effective and timely decision-making. A lack of financial education increases

vulnerability to fraud and imprudent investments, while financial education helps prevent economic losses.

- The primary objective of any entity should focus on improving return on equity (ROE), considered the ultimate indicator reflecting the results of successful business management. Companies can gain competitive advantages by aligning internal factors such as personnel organization, logistics, and technology. This strengthens their market position and ensures sustainable cash flows, aspects also relevant in accounting information.
- Globally, financial equity productivity is observed to be higher than debt productivity, suggesting the superiority of the Anglo-Saxon model over the German model. It is proposed to develop an economic policy aimed at creating a capital market, including tax incentives, legal process simplification, and appropriate training. It is noted that investing in capital instruments carries more risk than equity instruments, though both types of risks differ.
- Epistemological approaches in accounting propose various objects of study, such as equity, information, wealth, utility, order, finance, and control. The diversity of these objects does not indicate discrepancies but rather reflects the complexity of the real accounting system, where their close interrelationship must be considered without isolating or overspecializing their study.
- The regulatory development of financial accounting should be analyzed as an expression of the interests of specific sectors, recognizing that accounting extends beyond financial accounting and seeks to provide decision-useful information for dominant groups within the accounting regulatory framework.

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NEIS: NUEVOS REPORTES DE SOSTENIBILIDAD APLICABLES PARA EMPRESAS EN LA UE DESDE 2024

NEIS: NEW SUSTAINABILITY REPORTS APPLICABLE TO COMPANIES IN THE EU FROM 2024

ADRIANA FLÓREZ LAISECA[1]
https://orcid.org/0000-0003-1439-1236

EUTIMIO MEJÍA SOTO[2]
https://orcid.org/0000-0002-7162-9928

RUBÉN ANTONIO VÉLEZ RAMÍREZ[3]
https://orcid.org/0000-0001-5524-0640

[1]*Economista Universidad la Gran Colombia, Magister en Medio Ambiente y Desarrollo Sostenible. docente y directora del programa de economía de la Universidad del Quindío*
E *amflorez@uniquindio.edu.co*

[2]*Contador Público y docente de la Universidad del Quindío, Doctor en Desarrollo Sostenible de la Universidad de Manizales,*
E *eutimiomejia@uniquindio.edu.co*

[3]*Contador Público y docente de la Universidad del Quindío, Magister en Administración*
E *ravelez@uniquindio.edu.co*

RESUMEN

El artículo presenta un análisis introductorio de las Normas Europeas de Información sobre Sostenibilidad (NEIS), que entrarán en vigor en la Unión Europea para los estados financieros del 2024 en adelante. Las NEIS se caracterizan por su doble materialidad, que incluye materialidad financiera y materialidad de impacto, el alcance e información requerida en comparación con las Normas Internacionales de Información Financiera sobre Sostenibilidad (IFRS S).

El estudio es de tipo cualitativo, teórico, documental y

PALABRAS CLAVE

Gobernanza, reportes organizacionales, riesgos, sostenibilidad, sustentabilidad.

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explicativo. identificando lineamientos, particularmente la NEIS 1 “Requisitos generales", que son aspectos a divulgar sobre incidencias, riesgos y oportunidades relacionados con cuestiones ambientales, sociales y de gobernanza. Las NEIS representan un avance significativo de información sobre sostenibilidad en empresas; Al ser una norma transversal y transectorial, los elementos derivados de la misma, serán de aplicación y guía de interpretación para las demás normas emitidas. Su implementación permitirá a los inversores y otros interesados tomar decisiones más informadas sobre las empresas en las que invierten.

ABSTRACT

The article presents an introductory analysis of the European Sustainability Reporting Standards (ESRS), which will come into force in the European Union for financial statements from 2024 onwards. The ESRS are characterized by their double materiality, which includes financial materiality and impact materiality, the scope and required information compared to the International Financial Reporting Standards on Sustainability (IFRS S). The study is qualitative, theoretical, documentary, and explanatory nature. Identifying guidelines, particularly ESRS 1 “General Requirements," which are aspects to disclose on impacts, risks, and opportunities related to environmental, social, and governance issues. The ESRS represent a significant advance in sustainability reporting for companies; as a cross-cutting and cross-sectoral standard, the derived elements will be applicable and a guide for interpreting other issued standards. Their implementation will allow investors and other stakeholders to make more informed decisions about the companies in which they invest.

KEYWORDS

Environment, Governance, Organizational reports, Risks, Sustainability

INTRODUCTION

Since the early 1970s, institutional recognition of sustainability has emerged as a reaction to growing social awareness of the global crisis evidenced by biodiversity deterioration and multicultural degradation. Although sustainability has a history of over three hundred years (Escrivá, 2023, p. 22), lthe Stockholm Conference marks the officially recognized starting point for interpreting progress in building new relationships between the economy and nature (Naciones Unidas, 1972) (Bedoya Parra & Mejía Soto, 2023, p. 95). The 1970s are so significant for these topics that the birth of ecological economics is considered to date from the publication of The Entropy Law and the Economic Process (Georgescu-Roegen, 1996 [1971]).

It should be clarified that the terms "sustainability" and "sustentability" are different; the first is associated with financial, economic, organizational interests, of an economic-centric and anthropocentric nature; the second is associated with life defense, of a biocentric and ecocentric nature. The development and philosophy of the ESRS respond to sustainability interests, despite having a greater commitment to natural and social conditions than the IFRS S, which develop simple materiality with explicit interest only in financial matters.

Specifically, for the accounting field, the increasing social demand for greater organizational responsibility in environmental, social, and governance aspects has led to a rise in methodologies, frameworks, and standards for preparing and presenting non-financial organizational reports. In 1997, the Global Reporting Initiative GRI was created, promoting sustainability reports (GRI, 2023), at the beginning of the second decade of the 21st century, the International Integrated Reporting Council (IIRC) emerged (IIRC, 2014). In 2011, the Sustainability Accounting Standards Board (SASB) was founded, later issuing seventy-seven standards (SASB, 2023). In 2015, the seventeen Sustainable Development Goals (SDGs) were formulated (UN, 2015). In 2021, the International Sustainability Standards Board (ISSB) was created, and two years later, the first two IFRS S standards were issued (ISSB, 2023a, 2023b). Congruently, the European Union's response was the formulation in July 2023 of the twelve ESRS (European Commission, 2023a).

Under the advisory of the European Financial Reporting Advisory Group EFRAG, the European Union implemented the European Sustainability Reporting Standards ESRS, promulgated on July 31, 2023, and effective from January 1, 2024. The ESRS presents a chronological coincidence with the Financial Reporting Standards on Sustainability IFRS S issued by the International Sustainability Standar Board ISSB, where the first two standards were issued on June 26, 2023, and their entry into force corresponds to the same start date as the ESRS.

The European Sustainability Reporting Standards ESRS constitute a tool for entities to communicate with stakeholders regarding impacts, risks, and opportunities related to sustainability issues, i.e., reporting how the organization affects environmental and social conditions and how these aspects associated with sustainability impact the organization positively or negatively. This European regulation, parallel to the development of the International Financial Reporting Standards on Sustainability IFRS S approved in June 2023 and effective on the same date as their European counterparts, seeks to inform about risks and opportunities that sustainability issues represent for organizational finances, their scope, and more limited materiality compared to the ESRS, constituting one of the main differences between the mentioned standards.

The present introductory article highlights the importance that sustainability represents for bodies regulating organizational communication with different stakeholder groups. Financial and non-financial organizational reports reflect the categorization and stratification that the standardizer makes of the different actors converging as users of organizational information. While for some bodies, risk capital providers are the most important users, other regulatory proposals consider a much broader universe of important users. Underlying the spirit of the standards are currents of strong moral anchoring called sustainability and sustentability; the first prioritizes financial and organizational aspects, while for the second, interest in life and the protection of ecosystemic conditions that make it possible prevails. This last reflection is beyond the scope of this article, but readers are urged to approach it critically, understanding that regulation is not objective and is politically militant; standards are not innocuous or neutral.

METHODOLOGY

The research conducted is qualitative, theoretical, documentary, and explanatory in nature. Allowing through the systematic literature review technique to reference topics, laws, regulations, and relevant authors in the field of the standard, to propose the basic aspects of the ESRS related to the issue in question (Da Silva et al., 2020). As a result, through Aigneren, M.'s (2009) content analysis, the basic aspects of the European Sustainability Reporting Standard ESRS are identified, which, from a qualitative study, are synthesized and in some sections compared with the International Accounting Standards IAS, International Financial Reporting Standards IFRS, and International Financial Reporting Standards on Sustainability IFRS S. Thus understanding the scope, differences, and similarities between financial standards and the two main formats of organizational sustainability standards.

Results and analysis

a) Background of the European Sustainability Reporting Standards ESRS

Directive 2013/42 of the European Commission and the European Parliament states in Article 19 that "to the extent necessary for an understanding of the company's development, performance, or position, this analysis shall include both financial and, where appropriate, non-financial nature, relevant to the specific activity of the company, including information relating to environmental and personnel matters" (European Parliament and Council of the European Union, 2013, p. 19).

On December 11, 2019, the European Commission approved the European Green Deal (European Commission, 2019). The Deal responds to climate and environmental challenges, aiming to "transform the EU into a fair and prosperous society with a modern, resource-efficient, and competitive economy, where there are no net emissions of greenhouse gases by 2050 and economic growth is decoupled from resource use" (European Commission, 2019, p. 2)

The Deal assumes responsibility for issues such as natural capital, health, and well-being, concerning what it terms environmental risks and impacts. It asserts that "the human dimension must be prioritized" (European Commission, 2019, p.

2), reflecting a clear anthropocentric imperative. It also states that the situation "represents an opportunity to firmly place Europe on a new path of sustainable and inclusive growth" (p. 2), explicitly defending economic growth, that is, there is no halt or brake on the perpetual growth drive of traditional economics. The path remains continuous with consumption. Authors advocating for sustainable development argue that sustainability is a new stage of infinite economic growth, now recognizing the risks and opportunities in the economy-nature relationship and incorporating these aspects into financial calculations. In this sense, sustentability and sustainability development can be seen as antagonistic concepts (Bedoya Parra & Mejía Soto, 2023, p. 97; Bedoya Parra et al., 2023, p. 123).

The Green Deal aligns with the Sustainable Development Goals SDGs (UN, 2015, p. 16), which also constitute an apology for perpetual economic growth, not only through SDG 8 "Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all" but throughout its entire narrative. The European Union aims to achieve climate neutrality by 2050 (European Commission, 2019, p. 5), promote a circular economy (p. 8), ensure healthy and environmentally responsible food systems, and implement just transitions and sustainability-linked fiscal reforms (p. 20). The EU, which champions this sustainability model, Paradoxically advances in an international conflict where environmental and social impacts are not the primary focus of reporting, as propaganda obscures both the true causes and interests of the war, but also conceal the negative impact on nature.

Directive (EU) 2464 of 2022 specifies which companies must report sustainability, related information under the double materiality criterion, that is, disclosing how the company impacts the environmental and social landscape and how it is affected by sustainability issues (European Parliament and Council of the European Union, 2022, p. 19 bis) (European Commission, 2023b, p. Recital 1). This contrasts with the IFRS Sustainability Standards, which adopt a strictly financial materiality approach, requiring disclosure only of information that financially affects the organization. IFRS S1 states that "this [standard] requires an entity to disclose information about all sustainability-related risks and opportunities that could reasonably be expec-

ted to affect the entity's cash flows, access to finance, or cost of capital over the short, medium, or long term" (ISSB, 2023a, p. 3). Financial considerations are the sole concern of the IFRS S, the standards redaction of International Sustainability Standards Board ISSB leaves no doubt in stating that: "sustainability-related risks and opportunities that cannot reasonably be expected to affect the entity's prospects are outside the scope of this [standard]" (ISSB, 2023a, p. 6). In contrast, the European Sustainability Reporting Standards ESRS adopt a double materiality approach, requiring disclosure of how sustainability affects the organization and how the organization impacts environmental and social issues.

Commission Delegated Regulation (EU) 2023/2772 of July 31, 2023, approves the following twelve ESRS, categorized into cross-cutting, thematic (environmental, social, and governance), and sectoral standards (European Commission, 2023b, p. 5), as listed below:

Table 1.
European Sustainability Reporting Standards

NEIS	Nombre
1	Requisitos generales
2	Información general
E1	Cambio climático
E2	Contaminación
E3	Recursos hídricos y marinos
E4	Biodiversidad y ecosistemas
E5	Uso de los recursos y economía circular
S1	Personal propio
S2	Trabajadores de la cadena de valor
S3	Colectivos afectados
S4	Consumidores y usuarios finales
G1	Conducta empresarial

Source: Own elaboration.

Development of this article focuses primarily on ESRS 1 General Requirements, as it is a cross-cutting and cross-sectoral standard.

b) General requirements of the European sustainability reporting standards

The objective of the European Sustainability Reporting Standards ESRS is to specify the sustainability information that companies must disclose under EU regulations (European Commission, 2023b, p. 5). They specify the information companies must disclose about their material impacts, risks, and opportunities related to environmental, social, and governance issues (p. 2). The purpose of ESRS 1 is "to enable an understanding of the architecture of the ESRS, drafting conventions, and fundamental concepts used, as well as the general requirements for preparing and presenting sustainability information [in accordance with EU regulations]" (p. 5).

The ESRS establish the following information areas, which are also followed by the International Sustainability Standards Board ISSB standards.

Table 2
Information Areas

Gobernanza (GOV)
Estrategia (SBM)
Gestión de incidencias, riesgos y oportunidades (IRO)
Parámetros y metas (MT), los IFRS S utilizan el término métricas y objetivos

Source: (ISSB, 2023a, p. 25), (ISSB, 2023a, p. 25) (European Commission, 2023b, p. 12)

The structure of ESRS information areas was developed by the Task Force on Climate-Related Financial Disclosures (TCFD, 2017, pp. 26–29). The aforementioned connection between the ESRS, IFRS S, and TCFD criteria demonstrates the interrelation among various frameworks for organizational sustainability reporting.

a) Qualitative characteristics of information

ESRS 1 "General Requirements" stipulates that when presenting the Sustainability Statement, companies must apply the fundamental characteristics of information: relevance and faithful representation, as well as the enhancing qualitative characteristics of comparability, verifiability, and understandability (ESRS 1 in European Commission, 2023b, p. 19) (Appendix B, European Commission, 2023a). Appendix B of ESRS 1 defines these qualitative characteristics of the information, establishing the following: relevance (European Comission, 2023a, pp. QC 1-QC 4), faithful representation (pp. QC 5 - QC 9), comparability (pp. QC 10 - QC 12), verifiability (pp. QC 13 - QC 15), understandability (pp. QC 16 - QC 20). Comparative information is not required in the first year of preparing the Sustainability Statement (European Commission, 2023a, p. 136)

The Conceptual Framework for Financial Reporting by the International Accounting Standards Board IASB establishes relevance and faithful representation as fundamental qualitative characteristics (IASB, 2018b, p. 2.5) and comparability, verifiability, timeliness, and understandability as enhancing characteristics (IASB, 2018b, p. 2.23). The IFRS S state that the qualitative characteristics of sustainability-related financial information are the same as those for financial information, as outlined in Appendix D of IFRS S1 (ISSB, 2023b, p. D2).

Multidimensional accounting asserts that the basic requirements of information [termed not as characteristics] are faithful representation and transparency. It also defines auxiliary or complementary requirements for accounting: auditable, accessible, complete, comparable, comprehensible, reliable, consistent, clear, material, timely, accurate, predictable, regular, relevant, and verifiable (Montilla Galvis et al., 2023, pp. 42-49).

b) Double Materiality

Double materiality is a hallmark of the ESRS (European Commission, 2023a, p. 21) ldistinguishing them from the IFRS S, which focus solely on financial materiality. According to the European Sustainability Reporting Standards, materiality encompasses two fields (European Commission, 2023a, p. 37):

- Relative importance in terms of incidence (European Commission, 2023a, pp. 43-46)

- Relative financial importance (European Commission, 2023a, pp. 47-51)

Relative importance in terms of incidence aligns the guidance of the United Nations regarding the respect that companies must uphold for human rights, as well as with the OECD Guidelines for Multinational Enterprises (United Nations, 2011) (OECD, 2011) (European Commission, 2023a, p. 45).

The materiality concept in the ESRS is bidirectional. The International Financial Reporting Standards on Sustainability IFRS S is unidirectional and financially oriented, meaning that its sole focus is on the effect on financial performance. Impact materiality in the ESRS refers to positive or negative impacts on people and nature, with severity measured by "scale, scope, and irremediability character of incidence" (European Commission, 2023a, p. 45). "Materiality [is] the measure, against a comparison standard, of any item included in or omitted from accounting records or financial statements, or of any procedure or change therein which ostensibly may change affect such statements" (Cooper & Ijiri, 2005, p. 404) Materiality refers to accounting information whose inclusion or omission could influence the decisions of financial statement users.

"An entity shall disclose material information about sustainability-related risks and opportunities that could reasonably be expected to affect the entity's prospects. In the context of sustainability-related financial disclosures, information is material if omitting, misstating, or obscuring of such information would influence the decisions made by the primary users of general-purpose financial reports. These reports include financial statements and sustainability-related financial disclosures, which provide information about a specific reporting entity" (ISSB, 2023b, pp. 17–18). This wording reveals the ISSB's bias, where materiality exists only when there is a financial impact on the organization.

The drafting of the International Financial Reporting Standards is categorical, the

sole concern of the International Financial Reporting Standards Foundation IFRSF, through the International Sustainability Standards Board ISSB, is financial in nature, not the protection of the environment. From this perspective, the ISSB functions as an instrument or appendix of the International Accounting Standards Board IASB, a role that the ISSB itself appears to acknowledge when it states that "sustainability disclosure is an extension of the materiality scope used in the process of determining what information should be included in a company's financial statements" (European Commission, 2023a, p. 47). In essence, the term "sustainability" is misleading; it conveys a concern for the public interest, but fundamentally, it is oriented toward private financial interest.

The IASB's Conceptual Framework for financial information, with regard to materiality, states that "Information is material if omitting, misstating or obscuring it could reasonably be expected to influence decisions that the primary users of general purpose financial reports make on the basis of those reports, which provide financial information about a specific reporting entity. In other words, materiality is an entity-specific aspect of relevance based on the nature or magnitude, or both, of the items to which the information relates in the context of an individual entity's financial report. Consequently, the Board cannot specify a uniform quantitative threshold for materiality or predetermine what would be material in a particular situation" (IASB, 2018a, p. 2.11). Materiality within the IFRS Sustainability Standards (IFRS S) is assumed from the perspective of financial reporting standards, where users are identified based on the concept of representative or prototypical users who reflect a broader interest (Fowler Newton, 2008, p. 570).

In relation to the concept of double materiality, ESRS establish the existence of two categories of stakeholders. The first are the affected stakeholders, described as "individuals or groups whose interests are or could be affected, positively or negatively, by the undertaking's activities and its direct and indirect business relationships across its value chain" (European Commission, 2023a, p. 22). The second group comprises users of sustainability statements, which in practice corresponds to the primary users of financial information, in general namely, providers of risk capital.

The group of stakeholders defined by the ESRS represents a novelty and a departure from the international financial model [IASB]: it shifts the focus from the effects of sustainability on company financial interests to a concern for the impact that the organization generates on nature and its relationships. According to the International Accounting Standards Board IASB, the users of financial information are existing and potential investors, creditors, and lenders (IASB, 2018b, pp. 1.3, 1.10). These users, as established by the IASB, have been regarded by financial accounting theory as external users, referring to those who do not have access to full and direct information within the organization (Chaves *et al.*, 2006, p. 54).

The ESRS indicate that, in addition to traditional financial users, other users include "the company's business partners, trade unions and social partners, civil society and non-governmental organizations, governments, analysts, and academics" (European Commission, 2023a, p. 22b). Appendix A further clarifies that "the common categories of stakeholders are the following: employees and other workers, suppliers, consumers, clients, end-users, local communities and people in vulnerable situations, and public authorities, such as regulators, supervisors, and central banks" (European Commission, 2023a, p. AR6).

Ultimately, all impacts on nature whether in the short or long term, will have financial consequences. This is acknowledged by the Global Reporting Initiative GRI which states: "Even if they lack financial materiality at the time of reporting, most, if not all, impacts of an organization's activities and business relationships on the economy, environment, and people eventually become matters of financial materiality. Consequently, these impacts are also relevant to stakeholders concerned with financial performance and the organization's long-term success. Understanding these impacts is a necessary first step in identifying related matters of financial materiality for the organization" (GSSB, 2023, p. 12). In parallel, it should be noted that it is highly probable that all economic activities of the organization will necessarily have an impact on nature and society.

c) Procedural aspects of the ESRS

The preparation and presentation of sustainability information under the ESRS

must consider the following aspects:

- The sustainability statement must be issued with the same reporting dates as the financial statements of the organizations (European Commission, 2023a, p. 73). This criterion is consistent with accounting theory, which states that "financial statements are issued alongside annual reports or discussion and analysis memorandums prepared by the managers" (Fowler Newton, 2007, p. 439)
- Sustainability information must include links between retrospective and prospective information (European Commission, 2023a, p. 74). This criterion can be compared with the informational needs outlined by the multidimensional accounting research program, which are expressed in four goals pursued by the science of wealth valuation.

"Retrospective: Accountability for the organization's management of multidimensional wealth under its control.

Present: To spatially and temporally represent the qualitative and quantitative valuation of the existence and flow of multidimensional wealth controlled by the organization

Predictive: To spatially and temporally project possible and probable behaviors of the qualitative and quantitative valuation of the existence and circulation of multidimensional wealth controlled by the organization.

Prospective: To serve as a techno-scientific support for informed decision-making by information users, based on the general purpose of integral sustainability, through the identification of preferred qualitative and quantitative valuations of the existence and flow of multidimensional wealth" (Montilla Galvis et al., 2023).

- The ESRS define the short term as the period covered by the financial statements, the medium term as five years, and the long term as periods exceeding five years (Comisión Europea, 2023a, p. 77)
- The entity must present comparative information in its quantitative and monetary parameters, when necessary, comparative explanatory information should

also be provided (European Commission, 2023a, p. 83). Multidimensional accounting states that a requirement of accounting reports is that they be "Comparable: they must allow users to understand changes in wealth by analyzing differences and similarities in wealth management across multiple periods (horizontal), among various entities at the same time (vertical), or across multiple periods for multiple entities (transversal)" (Montilla Galvis *et al.*, 2023, p. 46).

- The sustainability statement must be presented in a format readable by both humans and machines (European Commission, 2023a, p. 111b). Taxonomy frameworks have advanced significantly, allowing standardized languages to present uniform information that can be interpreted using consistent reference criteria.
- The Sustainability Statement is structured into four sections: general information, environmental information, social information, and governance information (European Commission, 2023a, p. 115). This structure resembles with other initiatives such as sustainability which include four categories, universal, economic, social, and environmental, grouped into universal, sector-specific, and topic-specific standards (GSSB, 2023, pp. 3–4). The principles of the Global Compact are grouped into four areas: human rights, environment, labor standards, and anti-corruption (United Nations, 2000). The Sustainable Development Goals SDGs may also be categorized similarly (UN, 2015, p. 16)

Starting in 2025, empirical studies may be developed in order to know the concrete processes of forms and essence of preparing and presenting non-financial information in organizations, particularly in relation to sustainability. Research opportunities will expand as comparisons become possible between the European ESRS and the international IFRS S standards. These studies will be both theoretical and practical opportunities to advance critical judgments improve the integration of nature and society into organizational reporting.

CONCLUSIONS

The widely recognized environmental and ecological crisis has prompted theoretical and practical advancements across different fields of knowledge and professions to address this situation. Accounting has not remained isolated from this move-

ment toward sustainability, as non-financial organizational reporting formats have evolved over the past quarter-century. The focus on sustainable development does not necessarily reflect organizational interest in the protection of natural wealth or ecosystem conditions but rather responds to societal demands for socially and environmentally responsible behavior.

The European Union issued the European Sustainability Reporting Standards ESRS following a long process of drafting documents and regulatory provisions on environmental, social, and sustainability matters. However, this does not necessarily indicate a strong commitment by the EU to the protection of natural and social wealth. These seemingly laudable discourses may serve as propaganda to enhance organizational image, strengthen brands, and reduce partially or entirely social pressure for greater socio-environmental responsibility.

The ESRS embrace double materiality, distinguishing them from the International Financial Reporting Standards for Sustainability IFRS S, which focus solely on impact materiality. The concept of impact in the ESRS explicitly refers to both positive and negative aspects related to sustainability, thereby establishing double materiality and impact as significant advancements in European sustainability standards compared to their international counterparts.

The study of double materiality clarifies the distinction between sustainability and sustainable. While the former primarily relates to financial elements and economic impacts for providers of risk capital, the latter [i.e. sustainable] focuses on physical, biological, chemical, and ecosystemic relationships, this concern transcends financial interests and aims to contribute to the conservation, safeguarding, care, and protection of natural wealth, including stocks, flows, and biocultural relationships [biodiversity and multiculturalism].

The common requirements for both qualitative and quantitative information to be disseminated among the different methodologies, frameworks and standards on sustainability issues raise questions about the proliferation of platforms when a single format could simplify organizational efforts and enhance comparability. The

sustainability reports GRI, IIRC integrated reports, the Global Compact, the Sustainable Development Goals SDGs of United Nation, and the ESRS, among others, share convergent elements that could facilitate a unified global reporting standard.

An assessment and ideological orientation of different non-financial reporting methodologies is necessary to determine whether they align with sustainability or sustainable criterion, whether it is positive or normative approaches, whether it adopts an anthropocentrism approach, biocentrism, or ecocentrism, whether it reflects a vision of growth or degrowth, whether it is framed within development or post-development objectives, and whether it focuses on natural capital or financial capital, whether it corresponds to ecological economics or environmental economics, among other value judgments that organizations must confront within the framework of its actions, which are not neutral, but are marked by the political ascription of science, technology and regulation. The above statement is based on the assumption of the inescapable political and ideological commitment inherent in all human action.

Future assessments will determine whether the European Sustainability Reporting Standards ESRS, in theory and practice, contribute to improving socio-environmental wealth and practices or whether they simply join the list of methodologies designed to protect financial capital under the guise of sustainability. The sustainability statements for the 2024 period, to be published in 2025, will contribute to the study of this process.

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EVOLUCIÓN DE LA RELACIÓN ENTRE PSICOLOGÍA Y ECONOMÍA EN LA ÚLTIMA DÉCADA: UN ANÁLISIS TENDENCIAL Y BIBLIOMÉTRICO

EVOLUTION OF THE RELATIONSHIP BETWEEN PSYCHOLOGY AND ECONOMICS IN THE LAST DECADE: A TREND ANALYSIS AND BIBLIOMETRIC STUDY

MARENA DE LA C. HERNÁNDEZ LUGO[1]
https://orcid.org/0000-0001-9036-3953

DIEGO D. DÍAZ GUERRA[2]
https://orcid.org/0000-0001-5169-838X

ARIADNA GABRIELA MATOS MATOS[3]
https://orcid.org/0000-0003-3442-9801

[1]*Licenciada en Psicología. Departamento de Psicología, Universidad Central "Marta Abreu" de Las Villas, Cuba,*
E *marenahernandezlugo@gmail.com*

[2]*Licenciado en Psicología. Departamento de Psicología, Universidad Central "Marta Abreu" de Las Villas, Cuba.*
E *diegod.diazg@gmail.com*

[3]*Doctora en Psicología. Departamento de Psicología/Sociología. Universidad "Ignacio Agramonte" de Camagüey, Cuba.*
E *ariadnamatos09@gmail.com*

RESUMEN

Este artículo explora la evolución de la relación entre la psicología y la economía durante el período 2014-2024, emplea un análisis bibliométrico de la base de datos Scopus. Centrándose en cómo las interacciones y los fenómenos psicológicos afectan las decisiones económicas, el estudio utiliza el software VOSviewer para visualizar las tendencias y las redes de colaboración en el campo de la economía conductual. Se revela un creciente interés en cómo los factores emocionales, los sesgos cognitivos y las influencias sociales influyen en las decisiones

PALABRAS CLAVE

Economía Conductual, Psicología Económica, Análisis Bibliométrico, Scopus, Vosviewer.

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económicas. Este análisis no solo muestra la integración de conocimientos psicológicos en la teoría económica, sino que también subraya el impacto de estas investigaciones en el desarrollo de políticas públicas más eficaces. Al identificar las principales áreas de investigación y colaboración, se proporciona una visión comprensiva de la dinámica entre estas dos disciplinas, destaca la importancia de una aproximación interdisciplinaria para entender y mejorar la toma de decisiones económicas en un entorno global.

ABSTRACT

This article explores the evolution of the relationship between psychology and economics during the period 2014-2024, employing a bibliometric analysis of the Scopus database. Focusing on how psychological interactions and phenomena affect economic decisions, the study utilizes the VOSviewer software to visualize trends and collaboration networks in the field of behavioral economics. By analyzing the scientific literature, a growing interest is revealed in how emotional factors, cognitive biases, and social influences impact economic decisions. This analysis not only demonstrates the integration of psychological knowledge into economic theory but also underscores the impact of this research on the development of more effective public policies. By identifying key areas of research and collaboration, this article provides a comprehensive insight into the dynamics between these two disciplines, emphasizing the importance of an interdisciplinary approach to understanding and enhancing economic decision-making in a global context.

KEYWORDS

Behavioral Economics, Economic Psychology, Bibliometric Analysis, Scopus, VoSviewer.

INTRODUCTION

Over the past decade, the interaction between psychology and economics has emerged as a fertile field of research. This reflects how economic dynamics influence and are influenced by individual and collective psychological processes (Debortoli & Brignole, 2024; Ross, 2022).

This multidisciplinary approach reveals the intimate interconnection between the human mind and economic forces, highlighting how factors such as cognitive biases, emotions, and perceptions influence financial decisions, consumer preferences, and the formation of efficient markets. At the same time, it is increasingly recognized how economic conditions and financial policies impact mental health, emotional well-being, and social behavior (Ahmad & Oriani, 2022; Bartholomeyczik *et al.*, 2022; Higuera Carrillo, 2022).

The synergy between psychology and economics opens a vast field of possibilities for interdisciplinary research. This fertile ground not only broadens and enriches the theoretical understanding of both disciplines but also promotes an integrated approach to addressing the most complex socioeconomic challenges faced by contemporary society (Eslava-Zapata *et al.*, 2023; Sueyoshi & Wang, 2020; Voulvoulis & Burgman, 2019).

The study of behavioral economics, which lies at the intersection of psychology and economics, provides valuable insights into how people make decisions that do not always align with the rationality expectations of traditional economic theory. This approach reveals the importance of factors such as emotions, cognitive biases, and social influences, which affect economic decisions ranging from investment and savings to consumption and negotiation (Aoujil *et al.*, 2023; Arnott & Gao, 2019; Pérez Valdivia *et al.*, 2024; Winter, 2020).

Furthermore, the integration of psychological knowledge into economics not only enriches economic theory but also fosters the development of more effective public policies that account for the complexity of human behavior. In this context,

bibliometric analysis offers a powerful tool to examine how research in this field is advancing, which topics dominate the discussion, and how international collaborations influence the evolution of these disciplines (Cardeño-Portela *et al.*,2023; Lecouteux, 2023; Williamson, 2019).

This article explores the evolution of the relationship between these two disciplines from a bibliometric perspective, using the Scopus database to identify trends, patterns, and developments from 2014 to 2024. It seeks to map the structure of research in psychology and economics, identify key actors, collaboration networks, and emerging thematic areas. With this approach, the aim is to provide a comprehensive view of how contributions from these fields converge to form a body of knowledge that is fundamental for understanding and improving decision-making in a complex and globalized economic context.

METHODOLOGY

To conduct the bibliometric analysis, a rigorous methodological approach comprising multiple interconnected stages was implemented. In this process, the prestigious Scopus database, recognized for its extensive coverage and reliability in academia, was used, along with the specialized software VOSviewer for the visual representation of the collected data (Bretas & Alon, 2021; Gómez-Cano *et al.*, 2023; Ledesma & Malave-González, 2022).

Phase 1. Definition of search criteria and data collection

The process began with defining the search criteria to gather relevant articles. Keywords such as “Psychology,” “Economics,” and “Behavioral Economics” were selected to capture the interaction between these disciplines. A temporal range from 2014 to 2024 was established. The search was conducted in the title, abstract, and keywords of articles available in Scopus, ensuring that the documents were directly related to the study's topics of interest.

Phase 2. Data extraction and filtering

Once the data were collected, they were filtered to exclude documents that were not research articles, such as conference papers, book chapters, or reviews, focusing the analysis on published scientific articles. It was verified that the selected articles were written in English to maintain consistency in the analysis.

Phase 3. Bibliometric analysis with VOSviewer

With the filtered data, VOSviewer software was used to conduct bibliometric analysis. This software enabled the creation of co-citation and keyword co-occurrence maps to identify the most prominent trends and topics in the field of study. Parameters in VOSviewer were configured to analyze collaboration networks among authors, institutions, and countries, providing a graphical visualization of how collaborations and research topics are interconnected globally.

Phase 4. Interpretation and synthesis of results

The final phase involved interpreting the maps and data obtained from the bibliometric analysis. The most influential authors, most cited articles, and leading institutions contributing to research in this field were identified. Additionally, connections between different subfields within economic psychology were analyzed, and emerging areas and research trends were identified. This phase culminated in synthesizing the findings within a broader context to understand how the interaction between psychology and economics has evolved over the past decade.

This methodology provided a detailed and well-organized overview, allowing for an exploration of the complex dynamics and evolution of research in the fields of psychology and economics. By unraveling the intricacies of these interdisciplinary fields, critical areas and emerging trends were identified, highlighting nodal points that could be fundamental for guiding future research in these domains of knowledge (Eslava-Zapata *et al.*, 2023; Lomas *et al.*, 2020; Sánchez Catillo *et al.*, 2024).}

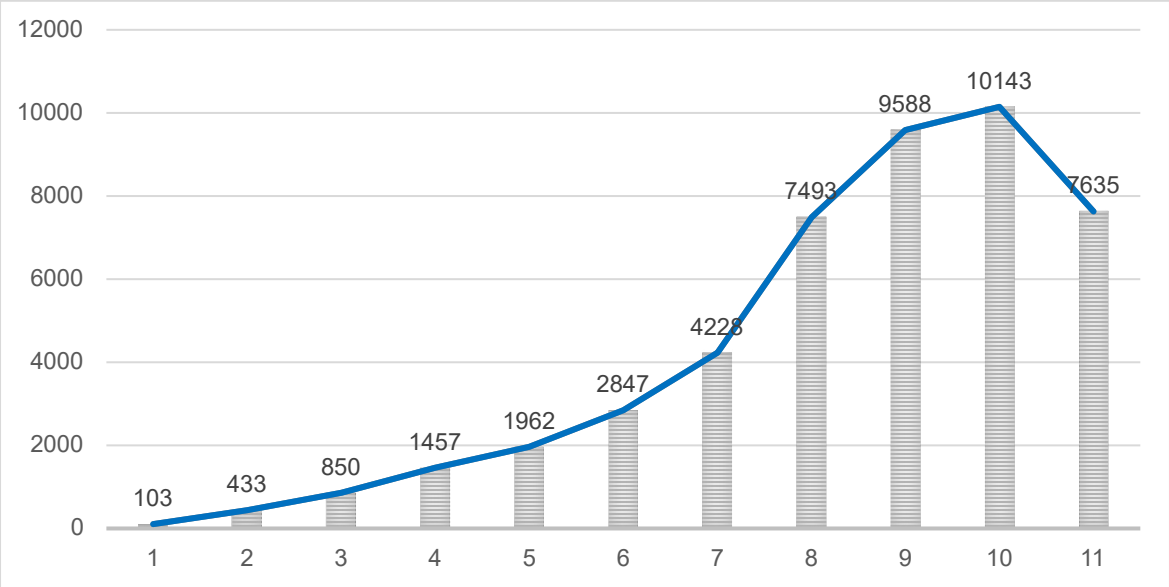
RESULTS

Bibliometric analysis

Over the past decade, the bibliometric analysis of the relationship between psychology and economics in the Scopus database revealed several key trends. The observed evolution in the relationship between these fields of study during the last decade is remarkable, with a significant increase in the number of articles published annually (see Figure 1). Starting modestly in 2014 with 103 articles, this field experienced exponential growth, peaking in 2023 with 10,143 articles and remaining robust in 2024 with 7,635 publications. This upward trend reflects growing interest and commitment from the academic community to explore the intersection between these two seemingly disparate fields (Wang *et al.*, 2022).

Figure 1

Documents published by year



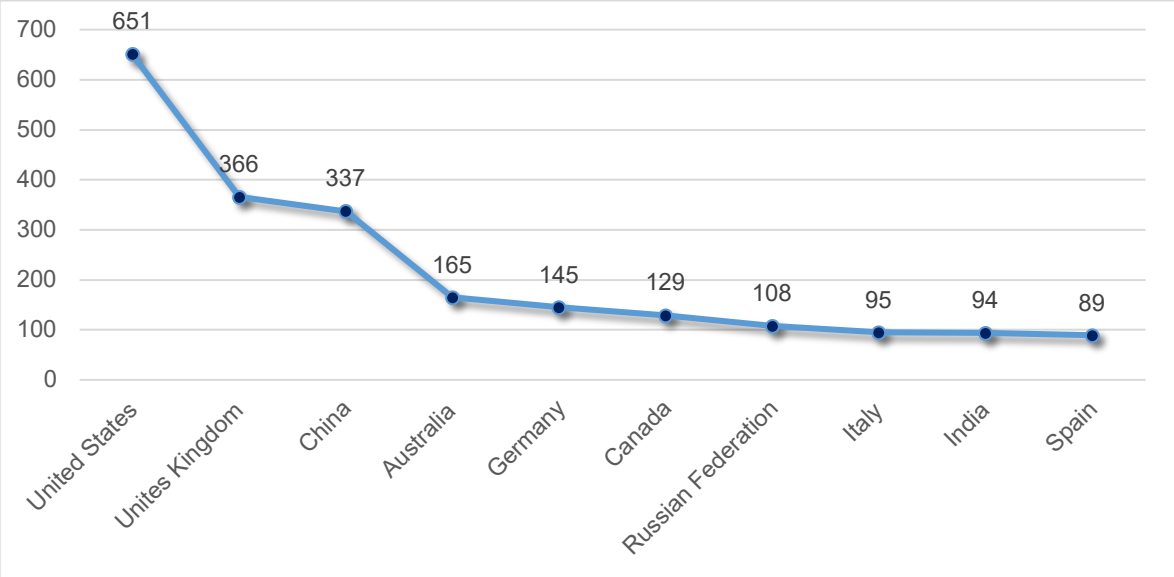
Note: The figure shows the number of documents published from 2014 to 2024 on the addressed topic.

Source. Own elaboration.

The countries most involved in this area of study, such as the United States, the United Kingdom, and China, indicate a global distribution of interest and research in this topic (see Figure 2). This geographical diversity highlights the international importance and relevance of the relationship between psychology and economics, as well as the need for diverse perspectives and approaches to fully understand its implications (Bullock, 2019).

Figure 2

Countries most involved in this field of study

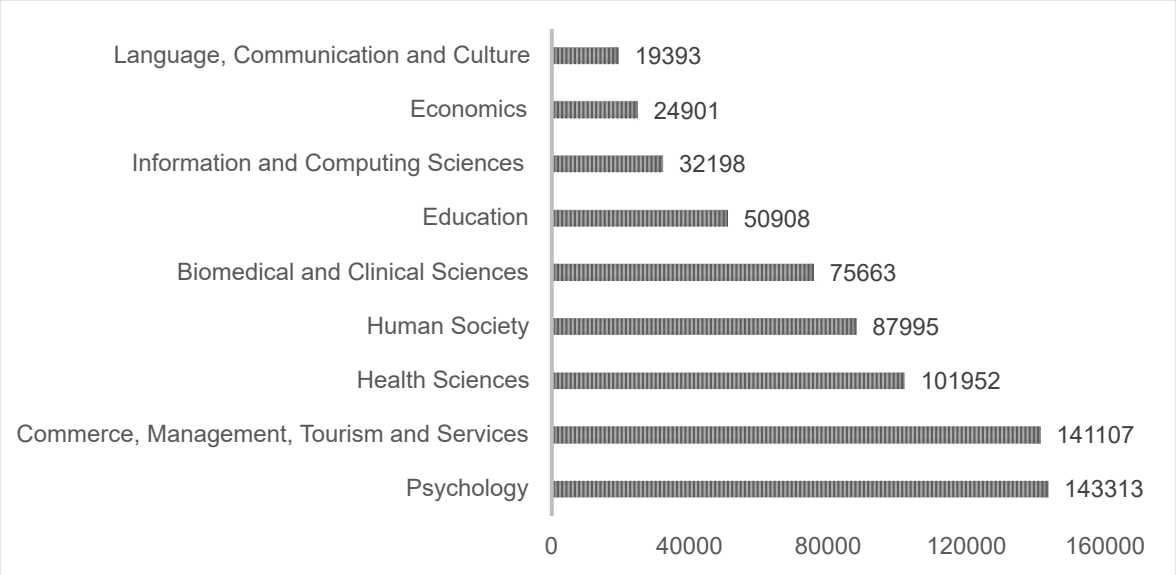


Note: The figure shows the number of publications in the countries most involved in the field of study.

Source: Own elaboration.

Regarding the most prominent research fields, which range from Psychology to Commerce, Management, Tourism and Services, Health Sciences, and Human Society, a wide array of disciplines involved in this interdisciplinary dialogue is evident (see Figure 3). This multifaceted approach underscores the complexity and interconnectedness of these fields, as well as the countless possibilities for collaborative research and the generation of innovative knowledge (Dalton *et al.*, 2021).

Figure 3
Most prominent research fields



Note: The figure indicates the number of publications in the most prominent research fields on the addressed topic.

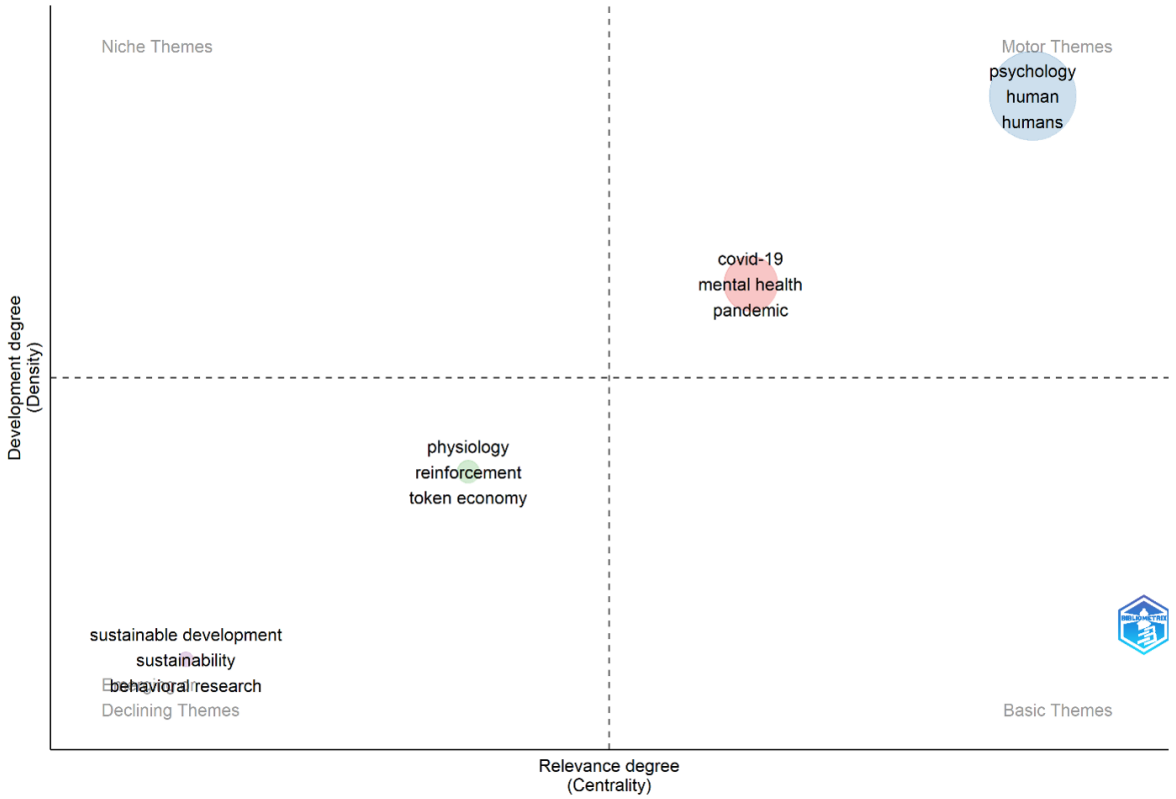
Source: Own elaboration.

The main trends identified, such as mental health, symbolic economics, sustainable development, and political economy, reflect critical and emerging areas of interest at the intersection of Psychology and Economics (see Figure 4). These topics suggest a focus on fundamental issues related to human well-being, social and economic impact, and the long-term sustainability of our societies and systems.

The predominant keywords, such as psychology, political economy, mental health, and economics, highlight the fundamental concepts guiding research in this field (see Figure 5). These core terms indicate key focus areas and common points of interest that unite researchers in their exploration of the complex interaction between the human mind and economic processes.

Figure 4

Thematic map of main research trends



Note: The figure shows the research trends identified during the study period through bibliometric analysis.

Source. Bibliometrix

Figure 5
Keyword co-occurrence

Note: The figure shows the predominant keywords in the reviewed articles during the study period
Source. VOSviewer.

As observed, the bibliometric analysis reveals a dynamic landscape in research on the relationship between Psychology and Economics, characterized by steady growth, global diversity, enriching interdisciplinarity, and a renewed focus on sustainability and digital innovation. These findings offer valuable insights for future research and collaborations, as well as for a deeper understanding of the challenges and opportunities inherent in this fascinating area of study.

Growth in innovation ecosystem research

In recent years, a significant increase has been observed in studies exploring the impact of innovation ecosystems on global economic and social progress. This research field continues to develop, with growth suggesting a fertile ground for visionary researchers seeking to delve into it (Domanski *et al.*, 2020; Hoyos Chavarro *et al.*, 2022; Konietzko *et al.,* 2020).

While Nordic countries and the United Kingdom stand out for their research activity in this area, the United States and China lead in terms of citations and impact. This growing interest reflects greater recognition of the complexity and dynamism inherent in interactions within innovation ecosystems, addressing a wide range of topics from digitalization to sustainable development (López-Rubio *et al.*, 2021; Sandnes, 2021; Zhang *et al.*, 2019).

This trend demonstrates an evolution in the perception of how innovation intertwines with crucial aspects such as environmental sustainability, social equity, and economic prosperity. Additionally, it underscores the importance of understanding and fostering these dynamic environments to drive global progress (Chege & Wang, 2020; Linares Giraldo *et al.*, 2023; Xiao & Su, 2022).

Interdisciplinarity and international collaboration

Research in this field highlights a marked interdisciplinary focus, merging elements of psychology with economic and management practices. This amalgamation of disciplines significantly enriches the analysis, allowing for a deeper and more holistic understanding of the phenomena studied. The synergy between psychology and economic and management approaches yields new perspectives on decision-making, consumer behavior, organizational efficiency, and other fundamental aspects influencing the business and economic world (McNeish & Kelley, 2019; Pouso *et al.*, 2020; Truc, 2021).

International collaboration emerged as a determining factor in this landscape, enhancing productivity, the impact of published research, and fostering diversity of approaches and richness of ideas. This emphasis on global networks highlights

the importance of connectivity and knowledge exchange in generating significant advances in fields that transcend traditional disciplinary boundaries (Aulawi, 2021; Dua *et al.*, 2022; Mogrovejo Andrade, 2022).

Focus on sustainability and digital innovation

With the growing focus on sustainability, research explores how innovation and digital transformation can support sustainable development goals. This includes studies on how technology can improve energy efficiency, food security, and mitigate the effects of climate change. These areas of study demonstrate how economic policies and strategies can benefit from a more human behavior psychology and social interactions-centered approach (Mondejar *et al.*, 2021; Sachs *et al.*, 2019; Singh *et al.*, 2022).

These trends underscore a significant evolution toward an increasingly sophisticated understanding of the intricate relationship between human behavior and economic systems. This emerging approach stimulates a stream of research that transcends national and disciplinary boundaries, advocating for a global and interdisciplinary perspective that encompasses multiple viewpoints and methodologies (Addessi *et al.*, 2019; Pérez-Guedes & Arufe-Padrón, 2023; Schill *et al.*, 2019).

By exploring this complex intersection between human behavior and economics, the need to adopt holistic approaches that consider both individual and systemic aspects is highlighted. This integrative perspective provides fertile ground for collaboration across different disciplines, fostering the emergence of new ideas and approaches that enrich the understanding of these complex phenomena in today's society (Arnaud *et al.*, 2021; Aksenov *et al.*, 2021; Whitman, 2021).

Trend analysis

Over the past decade, the relationship between psychology and economics has evolved significantly, highlighting several key trends and developments, such as the incorporation of psychology into behavioral economics and its practical application in marketing and finance. These advances open the door to deeper and more collaborative interdisciplinary research, enriching both theory and practice in both

disciplines (Dowling *et al.*, 2019; Horton, 2019; Vlaev *et al.*, 2019).

Behavioral economics delves into how psychological factors influence economic decisions. This discipline emphasizes that, unlike the classical assumption of rationality and utility maximization, individuals are frequently influenced by emotions, cognitive biases, and social contexts. Studies in this field explore intrinsic and extrinsic motivations, the effect of loss aversion, and how social norms affect economic decisions, suggesting that public policies can benefit from these insights to promote more desirable behaviors (Gómez Miranda, 2022; Phillips & Pohl, 2020; Sánchez-Castillo *et al.*, 2024; Valaskova *et al.*, 2019).

Economic psychology has found practical applications in areas such as marketing, where psychological principles are used to influence consumer purchasing decisions. Additionally, in the financial realm, it helps understand investor behaviors and how these affect markets, revealing how mass psychology can influence phenomena such as speculative bubbles or financial panics (Naseem *et al.*, 2021; Sussman *et al.*, 2023).

Beyond psychology, the relationship between economics and sociology is also gaining relevance. It is observed how economic and social behaviors are intertwined and how understanding these links can enhance our comprehension of well-being and human decision-making. The integration of these disciplines underscores the importance of considering social and cultural factors in economic analysis (Akhtar, F., & Das, 2020; Paule-Vianez *et al.*, 2020; Raut, 2020).

Prospect theory, which highlights how people value changes in wealth states and handle probabilities in situations of gains and losses, critiques the classical economic view that assumes rational and utility-maximizing decisions. This drives a reexamination of many economic principles in light of psychological findings (Lipman & Attema, 2019; Maialeh, 2019; Wang et al., 2020).

The ethical dimensions of economic behavior are receiving more attention, exploring how dishonesty and corruption can be understood and mitigated through

economic psychology. This leads to growing interest in how psychological factors, such as social norms and self-control, play a crucial role in economic decisions and their underlying ethics (Anguera-Torrell, 2020; Ivașcu *et al.*, 2022; Speer *et al.*, 2020).

These trends underscore an increasingly deep integration between psychology and economics, allowing for a more nuanced understanding of how humans make decisions in an economic context. This ongoing evolution promises to drive innovative discoveries and fresh perspectives in the landscape of psychological and economic research in the years to come.

DISCUSSION

The intersection between psychology and economics, particularly highlighted in the realm of behavioral economics, underscores the importance of integrating economic fundamentals into the academic training of future psychologists. This interdisciplinary approach not only enriches the understanding of human behavior in economic contexts but also expands the tools and methods psychologists can employ to address complex problems (Anglada-Tort *et al.*, 2022; Pérez Gamboa *et al.*, 2019; Roman-Acosta *et al.*, 2023).

First, teaching economics in psychology programs enables students to better understand how economic decisions affect emotional and psychological well-being. Concepts such as opportunity cost, incentives, and markets are not only relevant in business or finance but also apply to personal and social decision-making. For example, prospect theory illuminates how people value losses and gains, which can be crucial for understanding behaviors ranging from financial investments to lifestyle choices (Baranov *et al.*, 2020; Hua & Liu, 2021; Schröder & Freedman, 2019).

Furthermore, training in economics helps future psychologists design better interventions and public policies. Understanding economic principles can facilitate the design of programs that motivate desired behaviors, such as incentive schemes to improve public health or penalty systems to deter harmful behaviors. Econo-

mic psychology provides a framework for evaluating the effectiveness of these interventions, considering both rational and emotional factors in decision-making (Feldman *et al.*, 2020; Miles & Fassinger, 2021; Rodríguez-Torres *et al.*, 2022).

Lastly, economics training prepares psychologists to contribute to broader areas such as policy development, urban planning, and product and service design. These roles require an understanding of how economic structures and policies influence human behavior on a large scale (Nayyar & Malhotra, 2023; Sima *et al.*, 2020).

Incorporating economics into the training of psychologists not only broadens their perspective and skill set but also better equips them to face the challenges of the modern world, where economics and psychology are increasingly intertwined. This interdisciplinary approach promotes a more holistic understanding of human behavior, essential for designing effective and sustainable solutions to complex problems.

CONCLUSIONS

The research revealed significant growth in the integration of psychology into the study of economics, particularly in behavioral economics, from 2014 to 2024. The bibliometric analysis showed that publications in this field have increased notably, reflecting growing interest from the scientific community in exploring how economics and psychology intertwine and affect human behavior..

It was observed that institutions in countries with advanced economies, primarily in Europe and North America, dominate research in this field. This underscores the importance of fostering greater international collaboration and the inclusion of researchers from diverse regions of the world to enrich perspectives and approaches in the study of behavioral economics.

The study emphasized the relevance of incorporating economic education into psychology programs and vice versa as a means of better prepare future professionals for real-world challenges. This curricular integration is essential for develo-

ping more effective public policies that consider both economic and psychological factors.

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