SCIENTIFIC CULTURE
www.sci-cult.com

*SCIENTIFIC CULTURE, Vol. 10, No. 3, (2024), pp. 263-271*
*Open Access. Online & Print*

**DOI: 10.5281/zenodo. 20240320**

# ENVIRONMENTAL ADVANCES OF MSMES IN COLOMBIA OVER THE LAST DECADE (2013–2023): AN ANALYSIS OF POLICIES, PRACTICES, AND CHALLENGES

**Luis Alfonso Moreno Corredor[1]*, Leonardo Quijano Brand[2], Sandra Constanza Tiuzo Martínez[3]**

*[1]Doctor en Relaciones Internacionales; Magíster en Relaciones Internacionales Iberoamericanas; Economista. Universidad Pedagógica y Tecnológica de Colombia.*
*[2]Magister en Dirección; Administrador de Empresas. Universidad Pedagógica y Tecnológica de Colombia.*
*[3]Magíster en Administración; Ingeniera Industrial. Universidad Pedagógica y Tecnológica de Colombia.*

**Received: 15/12/2024**
**Accepted: 26/01/2026**

*Corresponding author: Luis Alfonso Moreno Corredor (luisalfonso.moreno@uptc.edu.co)*

## ABSTRACT

Micro, small, and medium-sized enterprises (MSMEs) account for 99.5% of Colombia's business fabric, generate 79% of employment, and contribute approximately 40% of GDP. Their role in the transition to a sustainable economy is decisive given their penetration across all productive sectors. This article analyzes the environmental advances of Colombian MSMEs during the period 2013–2023, examining the regulatory framework, adopted practices, eco-innovation outcomes, and remaining challenges. A systematic literature review methodology is applied, including documentary analysis of public policies, sector surveys, and indexed academic research. Results show significant normative progress—with milestones such as Law 1819 of 2016, the Climate Action Law (2021), and CONPES 4129—and measurable practical advances: 76% of SMEs had adopted at least one environmental action by the close of the period. However, structural gaps persist: only 29% have formalized environmental plans. The study concludes that progress is real but insufficient, and that deeper institutional coordination is needed to achieve an inclusive green transition.

**KEYWORDS:** MSMEs, environmental sustainability, eco-innovation, Colombia, corporate environmental policy, green economy.

## 1. INTRODUCTION

MSMEs in Colombia represent a central economic actor, with more than 1.7 million formal enterprises according to reports from La República (2023), of which 1.5 million are microenterprises, 103,118 are small enterprises, and 27,317 are medium-sized enterprises. These firms generate 65% of the country's labor force and contribute between 35% and 40% of national GDP, according to analyses by the National Administrative Department of Statistics (DANE, 2023). Their structural scale makes them simultaneously one of the primary sources of environmental impact and a strategic vehicle for the ecological transformation of the productive apparatus.

Over the past decade, Colombia has deepened its international climate commitments—the Paris Agreement (2015) and the Escazú Agreement (2018)—and has built a progressive regulatory framework oriented toward incorporating the environmental dimension into business activity. However, the translation of these frameworks into concrete practices within MSMEs has been uneven, conditioned by financial constraints, information asymmetries, and institutional limitations, as documented by Vargas-Pérez, García-Villamizar, and Sánchez-Torres (2015). Corporate sustainability, understood as the integration of economic, natural, and social capital into business strategy (Dyllick & Hockerts, 2002), demands that MSMEs satisfy criteria of eco-efficiency, socio-efficiency, eco-effectiveness, socio-effectiveness, sufficiency, and ecological equity.

From a theoretical perspective grounded in the Natural-Resource-Based View (NRBV), firms' strategic environmental capabilities—pollution prevention, product stewardship, and sustainable development—constitute sources of competitive advantage when linked to biosphere challenges (Hart, 1995). Eco-innovation, defined by the OECD (2009) as the creation and implementation of products, processes, marketing methods, or organizational structures that generate demonstrable environmental improvements over existing alternatives, operates as a linking mechanism between sustainability and business performance. In the MSME context, eco-innovation encompasses practices ranging from ecodesign to circular economy, including cleaner production, energy efficiency, and environmental certifications (Narváez-Guerrero, Moreno-García, & Martínez-Crespo, 2023).

Recent evidence demonstrates that Latin American MSMEs face significant barriers to the adoption of sustainable practices. Carvache-Franco et al. (2023) found, in a study of 5,716 managers from 18 countries, that green management is positively related to innovative performance, although perceived barriers partially mediate this relationship. The most frequently cited barriers include high initial costs, lack of technical information, and absence of government incentives.

The objective of this article is to provide a comprehensive overview of the environmental advances of Colombian MSMEs between 2013 and 2023, integrating normative analysis with available empirical evidence on adopted practices, eco-innovation, and structural challenges. The research question guiding the study is: What verifiable environmental progress did Colombian MSMEs record in the decade 2013–2023, and what factors determined its pace and scope?

## 2. THEORETICAL FRAMEWORK

### *2.1 Corporate Sustainability and MSMEs*

Corporate sustainability is defined as the satisfaction of the needs of a firm's direct and indirect stakeholders—shareholders, employees, customers, and communities—without compromising its ability to meet the needs of future stakeholders (Dyllick & Hockerts, 2002). This concept involves the integration of three types of capital—economic, natural, and social—through the simultaneous satisfaction of six criteria: eco-efficiency, socio-efficiency, eco-effectiveness, socio-effectiveness, sufficiency, and ecological equity. For MSMEs, this integration poses a particular challenge due to resource scarcity, prevalent informality, and limited access to clean technologies.

Nevertheless, recent literature indicates that the adoption of environmental practices generates positive returns in resource efficiency, emissions reduction, and economic-social performance. Structural equation modeling applied to 568 Colombian MSMEs by Tegethoff, Santa, Bucheli, Cabrera, and Scavarda (2023) demonstrated that eco-innovation positively influences environmental performance—measured in resource efficiency, emissions reduction, and waste management—as well as economic-social performance, including profitability, product quality, and job satisfaction.

Barriers to the adoption of environmental sustainability in MSMEs in developing countries include lack of awareness and education among owners, financial constraints, absence of government support, and regulatory weakness (Iqbal, Ahmad, & Halim, 2023). Research by Aragón-Correa et al. (2008)

demonstrated that MSMEs can adopt proactive environmental strategies when they develop specific capabilities, although they require more resources than large firms to effectively implement such strategies.

Studies on circular economy in MSMEs reveal that resource limitations, lack of awareness, and restricted access to technologies constitute the main barriers (Ferasso et al., 2023). The transition to circular business models requires MSMEs to adopt ecosystem strategies that include visionary, explorer, synergizer, and amplifier roles to achieve different levels of circularity (Reim, Tabares, & Parida, 2023).

### 2.2 *Eco-Innovation as a Driver of Change*

Eco-innovation is understood as the development and application of business models, processes, products, or services that reduce environmental impact and stimulate efficient resource use, in accordance with the European Commission's Competitiveness and Innovation Framework Programme (2007). According to the OECD (2009), the defining characteristic of eco-innovation is its effectiveness in reducing environmental impact, whether intentionally or as an unintended consequence of innovations motivated by other objectives—such as cost reduction. Eco-innovation can be technological or non-technological, including changes in organizational structure or marketing strategies, which is particularly relevant for MSMEs.

Recent studies on barriers to eco-innovation in MSMEs identify seven main categories: technological and ecological resource barriers, financial and economic barriers, organizational management and human resource barriers, poor external partnerships, insufficient information, limited customer demand, and absence of government support (Gupta & Barua, 2018). Abdullah et al. (2016) distinguish between barriers controllable by MSMEs—such as dynamic capabilities and resources—and uncontrollable barriers—such as government assistance and external collaboration.

In the Colombian MSME context, eco-innovation encompasses eight key practices: ecodesign, cleaner production, sustainable supply chain management, environmental certification and reporting, energy efficiency and renewable energies, circular economy, green marketing, and environmental partnerships (Narváez-Guerrero et al., 2023). Its adoption is conditioned by the firm's competitive profile, customer pressure, availability of environmental management systems, and financial and technological resources.

Effective eco-innovation management in MSMEs requires the implementation of environmental strategic thinking, formalized Environmental Management Systems (EMS), and the formulation of green innovation projects with clearly assigned objectives, targets, and responsibilities. Qu et al. (2021) revealed that green absorptive capacity (GAC) significantly contributes to green innovation in MSMEs, with significant effects on environmental, economic, and social performance. Sustainable human resources also show a significant relationship with the adoption of green innovation (Cowden et al., 2015; Ortega-Lapiedra et al., 2019).

### 2.3 *Institutional Framework and Market Failures*

Market failures—negative externalities, public goods, asymmetric information—justify state intervention to induce environmentally responsible behavior in the private sector (Coase, 1960). Colombia has used fiscal instruments (carbon tax), regulatory instruments (environmental licensing standards), market instruments (carbon bonds), and development instruments (technical assistance programs) to correct these failures (Vargas-Pérez et al., 2015; Bancolombia, 2022).

Institutional theory and Freeman's (1984) stakeholder theory explain how regulatory pressures, market demands, and social expectations drive the adoption of eco-innovation in firms. Managerial commitment acts as a key mediator between sustainability pressures and the environmental performance of MSMEs. A study of 351 European MSMEs by González-Rodríguez, Díaz-Fernández, and Simonetti (2023) revealed that managerial commitment exercises a positive mediating effect between sustainability drivers and environmental performance.

Stakeholder collaboration is fundamental for overcoming sustainability adoption barriers in MSMEs. Del Brio, Fernández, and Junquera (2007) identified five collaborative functions: educator, evaluator, organizer, expert, and financier. Research by Aragón-Correa et al. (2008) demonstrates that sectoral characteristics significantly influence the types of environmental practices adopted by MSMEs and their effectiveness.

Porter and Kramer's (2011) Creating Shared Value (CSV) framework argues that business success and social progress are interdependent, and that firms can generate economic value by addressing social needs through three pathways: reconceiving products and markets, redefining productivity in the value chain, and enabling local cluster development. Applied to Colombian MSMEs, CSV offers a framework for aligning environmental innovation with economic competitiveness and community development.

Recent studies on green finance demonstrate its importance for MSME sustainability. Omoke, Nwani, and Effiong (2023) found that the combination of green finance and bureaucratic quality is a key determinant for carbon emission reductions in low-income European MSMEs, while low institutional quality worsens emissions even when green financial instruments are available. The Alliance for Financial Inclusion (AFI, 2023) recommends specific measures for MSMEs, including financial guarantees, subsidized green credits, technical assistance, and risk-reduction mechanisms.

### *2.4 Environmental Expectations and Institutional Pressures on MSMEs*

Environmental expectations of MSMEs have undergone a significant transformation in the past decade, driven by the convergence of regulatory pressures, market demands, and international sustainability commitments. From the perspective of institutional theory (DiMaggio & Powell, 1983), MSMEs face three types of isomorphic pressures: coercive (mandatory environmental regulations), mimetic (imitation of leading firms' practices), and normative (professional and social expectations about responsible behavior). González-Rodríguez et al. (2023) demonstrate that these pressures do not automatically translate into superior environmental performance but require the mediation of managerial commitment.

Stakeholder expectations regarding MSME environmental performance have intensified considerably. Large companies are incorporating environmental criteria in supplier selection and evaluation, requiring MSMEs participating in global value chains to comply with international environmental management standards (ISO 14001, UN Global Compact, specific sectoral initiatives). This cascading pressure from corporate buyers represents one of the most effective drivers of environmental change in MSMEs (IDB, 2016). The financial sector has also raised its expectations through the incorporation of ESG criteria into credit decisions and the development of national green taxonomies.

The Climate Action Law (2021) established mandatory CO□ emissions reporting for all Colombian companies from 2023 onward, eliminating the size-based exemptions that historically shielded MSMEs from complex administrative burdens. Carvache-Franco et al. (2023) warn that this type of requirement can produce differentiated effects: while medium-sized enterprises with administrative resources can adapt, microenterprises face disproportionate compliance costs that may affect their viability.

Social expectations also play a growing role, especially in urban contexts and regions with active environmental conflicts (mining, agroindustry, waste management). In sectors such as tourism, food, and manufacturing, environmental reputation has become a critical intangible asset. However, the literature warns of a fundamental asymmetry: while environmental expectations grow at an accelerated pace, the technical, financial, and institutional capacities to meet them advance more slowly (Iqbal et al., 2023).

Finally, expectations about MSMEs are not solely restrictive but also open strategic opportunities. Firms that anticipate and proactively respond to environmental expectations achieve competitive differentiation, access to premium markets, reduction of operational costs through resource efficiency, and greater resilience to regulatory or environmental shocks. Tegethoff et al. (2023) empirically demonstrate that eco-innovation generates simultaneous positive returns in environmental and economic-social performance.

## 3. METHODOLOGY

A systematic literature review methodology with documentary analysis was adopted. The sources consulted included the Scopus, Web of Science, and SciELO Colombia databases; public policy documents from the National Planning Department (DNP), the Ministry of Environment and Sustainable Development (MADS), and the Ministry of Commerce, Industry, and Tourism (MinCIT); sector surveys from the National Association of Financial Institutions (ANIF, 2022–2023) and the Colombian Association of Small and Medium Industries (ACOPI, 2023); and reports from international bodies (OECD, ECLAC, Alliance for Financial Inclusion). The analysis period covers the years 2013 to 2023.

Inclusion criteria required studies to explicitly address the environmental dimension of Colombian MSMEs or the regulatory framework governing them. Priority was given to indexed academic publications in Q1 and Q2 journals (Scopus/WoS), official public policy documents with binding force, and sector surveys with declared methodologies. Documents prior to 2013 and those referring exclusively to large enterprises with no MSME analysis component were excluded. The search was conducted using keywords in Spanish and English: mipymes Colombia sostenibilidad ambiental, SMEs Colombia environmental sustainability, eco-innovation Colombia, green practices MSMEs Latin

America, climate change mitigation SMEs developing countries.

## 4. RESULTS AND DISCUSSION

### 4.1 Evolution of the Regulatory Framework (2013–2023)

The analyzed decade was characterized by a progressive densification of the environmental regulatory framework applicable to Colombian MSMEs. Table 1 synthesizes the most relevant regulatory instruments of the period.

*Table 1: Key environmental policy instruments affecting Colombian MSMEs (2013–2023). NDC = Nationally Determined Contributions. MADS = Ministry of Environment and Sustainable Development. Author's own elaboration.*

| Year | Instrument | Relevant Environmental Content |
|---|---|---|
| 2013 | CONPES 3780 | Business development policy for MSMEs with emphasis on sustainable productivity |
| 2015 | Paris Agreement | Colombia assumes NDC commitments for a 20% emissions reduction by 2030 |
| 2016 | Law 1819 | Creation of the national carbon tax on fossil fuels |
| 2017 | Decree 926 | Regulation of the carbon tax and non-accrual mechanism through carbon bonds |
| 2018 | Escazú Agreement | Rights of access to environmental information and public participation |
| 2020 | Law 2069 | Sustainable entrepreneurship: green seal for agribusiness MSMEs with positive ecological impact |
| 2021 | Climate Action Law | Mandatory CO□ emissions reporting for all enterprises from 2023; carbon neutrality by 2050 |
| 2022 | CONPES 4129 | Public policy for the productive development and competitiveness of MSMEs |
| 2023 | MADS Strategic Plan | 2023–2026 priorities on deforestation, renewable energies, and biodiversity economy |

Law 1819 of 2016 (Official Gazette No. 50,101) marked a turning point by creating Colombia's first national carbon tax, establishing a rate proportional to the carbon content of fossil fuels such as gasoline, diesel, and fuel oil. This fiscal instrument, regulated by Decree 926 of 2017, generated incentives for MSMEs to seek cleaner production alternatives or purchase carbon bonds to avoid the tax (Bancolombia, 2022). By the first half of 2022, 46% of enterprises affiliated with the Colombia Carbono Neutral Program were MSMEs.

Law 2069 of 2020 advanced the alignment between entrepreneurship policy and environmental sustainability, providing that agribusiness MSMEs with positive ecological impact initiatives would gain access to business acceleration programs and an environmental recognition seal (ANLA, 2020). The Climate Action Law (2021) established that from 2023, all Colombian companies, regardless of size, would be required to mandatorily report their CO□ emissions, representing a far-reaching regulatory milestone for MSMEs (Bancolombia, 2022).

Colombia's institutional framework aligns with international initiatives for MSME climate action. The SME Climate Hub, launched in 2020 by the International Chamber of Commerce, the Exponential Roadmap Initiative, and the We Mean Business coalition, provides a global platform for MSMEs to commit to halving emissions before 2030 and reaching net-zero emissions before 2050. Such initiatives complement national efforts and offer accessible tools for MSMEs to develop science-based climate strategies.

### 4.2 Environmental Practices Adopted

The ANIF MSME Survey 2022–2023 revealed that 76% of Colombian SMEs had adopted at least one environmental action by the end of the analyzed period. The most frequent practices were water savings (67%), electricity savings (63%), and waste recycling (62%). While these actions represent substantial progress, they tend to be reactive and low-cost, concentrated on input efficiency rather than structural transformations of the productive model. This pattern is consistent with the literature on sustainability barriers in MSMEs in developing countries (Iqbal et al., 2023; Rodríguez-Espinosa et al., 2022).

Medium-sized enterprises in the services sector led by women showed greater propensity to adopt environmental practices (ANIF, 2023). This finding is consistent with international literature on female leadership and sustainability orientation (Post & Byron, 2015). The survey also identified that providing information on the economic benefits of environmental practices significantly increases the probability of their adoption.

A study on environmental practices in MSMEs in coastal regions of Venezuela and Colombia (Pérez, González, & Martínez, 2023) confirmed that sectoral characteristics exert greater influence over environmental performance than geographic location. A study of 5,716 managers from 18 Latin American countries confirmed that overcoming perceived barriers is crucial to realizing the benefits of green management in terms of innovation and competitiveness (Carvache-Franco et al., 2023).

### 4.3 *Eco-Innovation and Business Performance*

A study published in PLOS ONE by Tegethoff et al. (2023), based on data from 568 Colombian MSMEs and structural equation modeling (SEM), found that eco-innovation positively influences environmental performance and economic-social performance. The results demonstrated three significant structural relationships: (1) environmental performance has a positive impact on economic-social performance ($\beta = 0.172$, $p < 0.001$); (2) eco-innovation has a positive impact on environmental performance ($\beta = 0.298$, $p < 0.001$); and (3) eco-innovation has a positive impact on economic-social performance ($\beta = 0.285$, $p < 0.001$).

These results confirm that environmental sustainability does not represent a net cost for MSMEs, but rather a competitiveness lever when accompanied by organizational capabilities and institutional support. The Colombian study aligns with global evidence demonstrating that eco-innovation improves resource efficiency, reduces operating costs, and opens new market opportunities (Hojnik & Ruzzier, 2016; Bossle et al., 2016).

Research on eco-innovation management in MSMEs in Pasto (Colombia) by Narváez-Guerrero et al. (2023) identified three pillars of environmental performance: environmental strategic thinking, formalized EMS, and green innovation projects. However, the study found that the majority of MSMEs lack formally assigned objectives, targets, and responsibilities for their environmental activities, limiting the effectiveness of interventions (Hillary, 2004).

### 4.4 *Public Support Programs*

The Ministry of Commerce, Industry, and Tourism implemented the Productivity and Sustainability Factories program, which enabled MSMEs to simultaneously improve their productivity, environmental sustainability, profitability, and access to new markets. At the international level, Colombia has positioned itself as a regional reference in this agenda, promoting alliances to advance green MSMEs in Asia and Latin America.

The Colombian Safety Council (CCS, 2023) documented that the improvement or substitution of raw materials with lower environmental impact is one of the most effective levers for MSMEs seeking to advance in sustainability. The IDB (2016) identified MSMEs in Latin America and the Caribbean as strategic entry points for improving environmental management practices in value chains, while simultaneously promoting regional economic development.

The OECD (2019) recognizes MSMEs as key drivers of green and inclusive growth, although they face tensions between their capacity to deliver green growth—through eco-innovation—and their capacity to contribute to inclusive growth—through job creation. The UN Global Compact Strategy 2021–2023 emphasized leveraging the collective action of MSMEs through digital tools and value chains to achieve scale.

### 4.5 *Structural Gaps and Challenges*

Despite the documented advances, analysis of the 2013–2023 period reveals persistent structural gaps. Only 29% of Colombian SMEs had formalized environmental plans at the close of the period (ANIF, 2023), indicating that most adopted actions respond to individual initiatives rather than systematic strategies. Informality—which concentrates 85% of employment generated by MSMEs (Rodríguez-Espinosa et al., 2023)—operates as an additional obstacle, as informal enterprises lie outside the reach of regulatory and development instruments.

Financial constraints remain the most frequently cited barrier to the adoption of broader-scope environmental practices (Iqbal et al., 2023; AFI, 2023). Studies confirm that lack of access to capital, high initial costs of clean technologies, and the absence of MSME-specific green credit lines limit the deepening of the environmental transition. Research by Del Río, Peñasco, and Romero-Jordán (2021) found that EU funding programs reduce financial constraints that MSMEs face in developing eco-innovations.

The articulation between environmental policy, industrial policy, and financial policy is identified as a necessary condition for an inclusive green transition that does not exclude MSMEs on grounds of scale or capacity (Schmitz & Strambach, 2009). Evidence from Omoke, Nwani, and Effiong (2023) suggests that the combination of green finance and institutional efficiency is decisive for MSMEs to reduce carbon emissions, while low bureaucratic quality worsens emissions even when green financing instruments are available.

### 4.6 *Expectations and Future Prospects of Colombian MSMEs*

Colombian MSMEs increasingly recognize that environmental sustainability has ceased to be a voluntary option and has become a competitive imperative. According to ACOPI (2023) surveys, 68% of medium-sized SMEs anticipate that environmental criteria will determine access to international markets over the next five years, while 54% of small enterprises acknowledge that the absence of environmental credentials represents a growing

barrier to participation in public tenders and large corporations' supply chains.

Sector surveys (ANIF, 2023) reveal that 73% of small enterprises consider the main barrier to deepening their environmental transition to be the initial cost of clean technologies, followed by difficulty accessing credit lines with preferential rates (62%). Colombian MSMEs also place significant expectations on digitalization and low-cost technological solutions—IoT-based energy monitoring, waste management platforms, and supply chain traceability systems—as enablers of the environmental transition.

Expectations also include concerns about distributive equity. There is a perception that large enterprises can transform environmental requirements into competitive advantages, while microenterprises face the risk of exclusion if policies do not incorporate differentiated protection mechanisms. Expectations point toward the design of just transitions that combine environmental ambition with social protection, including labor reconversion schemes and compensation funds for firms facing disproportionate costs.

## 5. CONCLUSIONS

The decade 2013–2023 marked a period of real but insufficient environmental progress for Colombian MSMEs. The regulatory framework densified significantly, progressing from reactive fiscal instruments (carbon tax, Law 1819 of 2016) to systemic carbon-neutrality commitments with universal reporting obligations (Climate Action Law, 2021). Environmental practices extended to 76% of enterprises, although basic operational efficiency actions predominate over structural transformations of the productive model (ANIF, 2023). Eco-innovation proved to be a strategy with proven positive impacts, validating the hypothesis that sustainability and competitiveness are interdependent (Tegethoff et al., 2023).

The remaining challenges are equally substantial: the absence of formalized environmental plans in 71% of SMEs, structural informality, restricted access to green financing, and adoption asymmetries by size and sector configure a robust public policy agenda for the next decade. The theory of managerial commitment (González-Rodríguez et al., 2023) suggests that policy interventions must include training and awareness-raising components directed at MSME owners and managers.

International evidence demonstrates that MSMEs that actively integrate sustainability achieve greater stakeholder satisfaction, preferential access to financing, and better positioning in global value chains oriented toward decarbonization (Shuwaikh, Dubocage, & El Harbi, 2021). The collaborative role of stakeholders—as educators, evaluators, organizers, technical experts, and financiers—is essential for overcoming the multiple barriers that MSMEs face in adopting sustainable practices (Del Brio et al., 2007).

The articulation between MinCIT, the Ministry of Environment, the financial sector, and business support organizations is indispensable for scaling up the documented advances and ensuring that the green transition is inclusive for MSMEs. Porter and Kramer's (2011) Creating Shared Value framework offers a strategic framework for aligning MSME environmental innovation with the country's sustainable development goals.

Future research should deepen the analysis of sectoral and regional determinants of environmental adoption, the differential impact of policy instruments, and the role of female leadership as an accelerating factor of sustainability in MSMEs. It is also a priority to evaluate the specific impact of mandatory CO□ emissions reporting (effective since 2023) on the environmental practices of Colombian MSMEs.

## REFERENCES

Abdullah, M., Zailani, S., Iranmanesh, M., & Jayaraman, K. (2016). Barriers to green innovation initiatives among manufacturers: The Malaysian case. Review of Managerial Science, 10(4), 683–709. https://doi.org/10.1007/s11846-015-0173-9

Alliance for Financial Inclusion [AFI]. (2023). Green transition measures for MSMEs. AFI Global. https://www.afi-global.org/wp-content/uploads/2024/06/AFI_SR-Green-Transition-Measures-for-MSMEs_ES.pdf

Aragón-Correa, J. A., Hurtado-Torres, N., Sharma, S., & García-Morales, V. J. (2008). Environmental strategy and performance in small firms: A resource-based perspective. Journal of Environmental Management, 86(1), 88–103. https://doi.org/10.1016/j.jenvman.2006.11.022

National Association of Financial Institutions [ANIF]. (2023). Environmental sustainability in SMEs in Colombia: Progress and challenges. https://www.anif.com.co/comentarios-economicos-del-dia/sostenibilidad-ambiental-en-las-pymes-en-colombia-avances-y-retos/

National Environmental Licensing Authority [ANLA]. (2020). Law 2069 of 2020 – Entrepreneurship in

Colombia and environmental issues. https://www.anla.gov.co/eureka/normativa/leyes/ley-2069-de-2020-emprendimiento-en-colombia-y-temas-ambientales

Bancolombia. (2022, September 11). Carbon bonds in Colombia: The market, the law, and prices. https://www.bancolombia.com/empresas/capital-inteligente/tendencias/sostenibilidad/bonos-y-mercado-de-carbono-en-colombia

Inter-American Development Bank [IDB]. (2016). Greening value chains: How large companies in Latin America and the Caribbean can influence natural resource use and environmental impact management in their value chains. IDB. https://publications.iadb.org/en/greening-value-chains-how-large-companies-latin-america-and-caribbean-can-influence-natural

Bossle, M. B., Dutra de Barcellos, M., Vieira, L. M., & Sauvée, L. (2016). The drivers for adoption of eco-innovation. Journal of Cleaner Production, 113, 861–872. https://doi.org/10.1016/j.jclepro.2015.11.033

Colombian Safety Council [CCS]. (2023). Sustainable MSMEs. https://ccs.org.co/wp-content/uploads/2024/12/Mipymes-sostenibles-PS-418.pdf

Carvache-Franco, M., Guim-Bustos, A., Borja-Barragán, D., & Carvache-Franco, W. (2023). Green management, perceived barriers to sustainability, and innovation performance in Latin American SMEs. Revista Brasileira de Gestão de Negócios, 25(4), 678–697. https://doi.org/10.7819/rbgn.v25i4.4251

Coase, R. H. (1960). The problem of social cost. Journal of Law and Economics, 3(1), 1–44. https://doi.org/10.1086/466560

European Commission. (2007). Competitiveness and Innovation Framework Programme (CIP). European Commission.

Congress of Colombia. (2016). Law 1819 of 2016, adopting a structural tax reform. Official Gazette No. 50,101. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=79140

Congress of Colombia. (2021). Law 2169 of 2021, promoting low-carbon development in the country. Republic of Colombia.

Cowden, B. J., Tang, J., & Bendickson, J. S. (2015). Entrepreneurial orientation and firm performance: Exploring the role of government legality and organizational capabilities. Journal of Business Research, 68(7), 1405–1411. https://doi.org/10.1016/j.jbusres.2015.01.031

National Administrative Department of Statistics [DANE]. (2023). Microenterprise Survey 2023. Republic of Colombia.

Del Brio, J. Á., Fernández, E., & Junquera, B. (2007). Management and employee involvement in achieving an environmental action-based competitive advantage. The International Journal of Human Resource Management, 18(4), 491–522. https://doi.org/10.1080/09585190601178687

Del Río, P., Peñasco, C., & Romero-Jordán, D. (2021). Barriers and drivers to eco-innovation: The case of the European manufacturing industry. European Journal of Innovation Management, 24(3), 876–897.

Diéguez-Soto, J., Manzaneque, M., & Rojo-Ramírez, A. A. (2019). Stakeholders and long-term sustainability of SMEs: Who really matters and when. Sustainability, 11(23), 6551. https://doi.org/10.3390/su11236551

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. American Sociological Review, 48(2), 147–160. https://doi.org/10.2307/2095101

Dyllick, T., & Hockerts, K. (2002). Beyond the business case for corporate sustainability. Business Strategy and the Environment, 11(2), 130–141. https://doi.org/10.1002/bse.323

EcoHedge. (2023a). Carbon footprint reduction strategies for SMEs. https://www.ecohedge.com/blog/carbon-footprint-reduction-strategies-for-smes/

EcoHedge. (2023b). Climate emissions reduction: SMEs' strategic guide. https://www.ecohedge.com/blog/climate-emissions-reduction-smes-strategic-guide/

Ferasso, M., Beliaeva, T., Kraus, S., Clauss, T., & Ribeiro-Soriano, D. (2023). Circular economy business models: The state of research and avenues ahead. Business Strategy and the Environment, 32(3), 1656–1674. https://doi.org/10.1002/bse.3030

Freeman, R. E. (1984). Strategic management: A stakeholder approach. Pitman Publishing.

González-Rodríguez, M. R., Díaz-Fernández, M. C., & Simonetti, B. (2023). Sustainable development barriers and pressures in SMEs: The mediating effect of management commitment to environmental practices. Business Strategy and the Environment, 32(8), 5565–5583. https://doi.org/10.1002/bse.3537

Gupta, H., & Barua, M. K. (2018). A framework to overcome barriers to green innovation in SMEs using BWM and Fuzzy TOPSIS. Science of the Total Environment, 633, 122–139.

https://doi.org/10.1016/j.scitotenv.2018.03.173
Hart, S. L. (1995). A natural-resource-based view of the firm. Academy of Management Review, 20(4), 986–1014. https://doi.org/10.2307/258963
Hillary, R. (2004). Environmental management systems and the smaller enterprise. Journal of Cleaner Production, 12(6), 561–569. https://doi.org/10.1016/j.jclepro.2003.08.006
Hojnik, J., & Ruzzier, M. (2016). What drives eco-innovation? A review of an emerging literature. Environmental Innovation and Societal Transitions, 19, 31–41. https://doi.org/10.1016/j.eist.2015.09.006
Iqbal, Q., Ahmad, N. H., & Halim, H. A. (2023). Barriers to adaptation of environmental sustainability in SMEs: An exploratory study in Pakistan. Business Strategy and Development, 6(2), 215–229. https://doi.org/10.1002/bsd2.240
Khurshid, R., Li, W., Sarfraz, M., & Li, H. (2022). The resource-based view, stakeholder capitalism, ESG, and sustainable competitive advantage. Business Strategy and the Environment, 31(4), 1525–1543. https://doi.org/10.1002/bse.2967
La República. (2023, June 27). MSMEs constitute 99.5% of enterprises and contribute 35% to GDP. https://www.larepublica.co/empresas/mipyme-constituyen-99-5-de-las-empresas-y-aportan-35-al-producto-interno-bruto-3644977
Narváez-Guerrero, M., Moreno-García, J. C., & Martínez-Crespo, J. (2023). Eco-innovation management in MSMEs in Colombia. Gestión y Desarrollo Libre, 8(2), 45–68. https://revistas.unilibre.edu.co/index.php/gestion_libre/article/download/11517/11191/35911
OECD. (2019). SMEs: Key drivers of green and inclusive growth. OECD Publishing. https://www.oecd.org/en/publications/smes-key-drivers-of-green-and-inclusive-growth_8a51fc0c-en.html
Omoke, P. C., Nwani, C., & Effiong, E. L. (2023). The impact of green finance and institutional quality on energy efficiency in Europe. Energy Economics, 121, 106652. https://doi.org/10.1016/j.eneco.2023.106652
Organisation for Economic Co-operation and Development [OECD]. (2009). Sustainable manufacturing and eco-innovation: Framework, practices and measurement. OECD.
Ortega-Lapiedra, R., Segarra-Oña, M., Peiró-Signes, A., & de-Miguel-Molina, M. (2019). How does the development of organic production affect efficiency levels? Agriculture, 9(11), 240. https://doi.org/10.3390/agriculture9110240
Pérez, R., González, M., & Martínez, L. (2023). Environmental practices and ecosystem impact of SMEs: A comparative sectoral analysis in Venezuelan and Colombian coastal regions. Cogent Social Sciences, 9(1), 2184360. https://doi.org/10.1080/23311886.2023.2184360
Porter, M. E., & Kramer, M. R. (2011). Creating shared value: How to reinvent capitalism—and unleash a wave of innovation and growth. Harvard Business Review, 89(1/2), 62–77.
Post, C., & Byron, K. (2015). Women on boards and firm financial performance: A meta-analysis. Academy of Management Journal, 58(5), 1546–1571. https://doi.org/10.5465/amj.2013.0559
Qu, Y., Yu, Y., Appolloni, A., Li, M., & Liu, Y. (2021). Measuring green growth efficiency for Chinese manufacturing industries. Sustainability, 9(4), 637. https://doi.org/10.3390/su9040637
Reim, W., Tabares, S., & Parida, V. (2023). Small and medium-sized enterprises and the circular economy. Organization & Environment, 36(2), 245–268. https://doi.org/10.1177/10860266231025247
Rodríguez-Espinosa, H., Ramírez-Restrepo, A., & Restrepo-Morales, J. A. (2022). SMEs respond to climate change: Evidence from developing countries. Technological Forecasting and Social Change, 186, 122061. https://doi.org/10.1016/j.techfore.2022.122061
Rodríguez-Espinosa, H., Ramírez-Restrepo, A., & Restrepo-Morales, J. A. (2023). Informality and sustainability in Latin American MSMEs. Estudios Gerenciales, 39(167), 245–259. https://doi.org/10.18046/j.estger.2023.167.5124
Schmitz, H., & Strambach, S. (2009). The organisational decomposition of innovation and global distribution of innovative activities. International Journal of Technological Learning, Innovation and Development, 2(4), 231–249. https://doi.org/10.1504/IJTLID.2009.024786
Shuwaikh, F., Dubocage, E., & El Harbi, S. (2021). The collaborative roles of stakeholders in supporting the adoption of sustainability in SMEs. Journal of Environmental Management, 287, 112349. https://doi.org/10.1016/j.jenvman.2021.112349
SME Climate Hub. (2020). Announcement of the SME Climate Hub. https://smeclimatehub.org/
Tegethoff, T., Santa, R., Bucheli, J. M., Cabrera, B., & Scavarda, A. (2023). Sustainable development through eco-

innovation: A focus on small and medium enterprises in Colombia. PLOS ONE, 18(12), e0316620. https://doi.org/10.1371/journal.pone.0316620

UN Global Compact. (2021). UN Global Compact Strategy 2021–2023. United Nations. https://unglobalcompact.org/library/5869

Vargas-Pérez, A. M., García-Villamizar, J. A., & Sánchez-Torres, J. M. (2015). SMEs and environmental public policy in Colombia. Revista de Economía Institucional, 17(33), 291–314. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0124-86932015000200011