CRITICAL EVALUATION OF SUSTAINABLE DEVELOPMENT IN URBAN AREAS OF LATIN AMERICA: SYSTEMATIC REVIEW

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ABSTRACT

The objective of this research article is to analyze the level of sustainable development in urban areas of Latin America. To this end, a systematic review was carried out based on the PRISMA method, limiting the search from January 2018 to July 2023, using the Scopus and Scielo databases and the Google Scholar search engine, to systematize and analyze the articles. on sustainable development. In this way, 15 articles from different authors, languages , and countries were analyzed. As a result, it was specified that Latin American countries show three levels of sustainable development: advanced, intermediate, and low, the latter being the most predominant in the region with 46.67%, among the articles analyzed. Additionally, it could be seen that the situation constantly changes based on the approach and dimension addressed. As a conclusion to the study, it is pointed out that, although there are advances in areas such as university education and renewable energies, there are different challenges in water management and waste control, technological innovation, and sustainability in the extractive industry.

KEYWORDS: Sustainable development, Latin America, national preservation, technological innovation, extractive industry.

INTRODUCTION

Latin America has undergone a profound transformation in recent decades, characterized by dizzying demographic and economic growth (Fuentes, 2021). This dynamism has resulted in an accelerated urbanization process that has led to a significant increase in the population living in urban areas (Marchant et al., 2022). The region is one of the most urbanized areas in the world, and this trend is expected to continue shortly (ECLAC, 2020).

This rapid urban growth has generated a series of challenges and opportunities for the sustainability of Latin American cities, which is a consequence of the constant increase in the demand for urban infrastructure (Paquette Vassalli, 2020; Delgadillo, 2021). New buildings and urban developments have emerged, transforming the landscape and altering the dynamics of cities (Galimberti et al., 2020).

However, this growth has not been uniform and has exposed deep social disparities (Lemma, 2022). The emergence of informal and precarious settlements, known as "slums" or "favelas" in some countries, is a testament to this reality (Córdoba and Pérez, 2020). These areas lack basic infrastructure, such as adequate access to drinking water, sanitation, and health services, which subjects their inhabitants to conditions of vulnerability, exclusion, and marginalization (Therán-Nieto et al., 2022).

In addition to social challenges, urban development has had a significant environmental impact (Montecinos, 2021). Infrastructure expansion and urbanization have led to deforestation of natural areas, habitat degradation, and biodiversity loss (Reyes-Palomino and Cano, 2022). Air and water pollution, along with solid waste generation, has increased, threatening the health and well-being of citizens and contributing to climate change (Bobatto et al., 2020).

Given this reality, many countries in the region have recognized the need to adopt approaches and policies oriented toward sustainable development (Blanco and Duk, 2019). These approaches seek to harmonize economic growth with the preservation of the environment and the improvement of the living conditions of the population (Romero et al., 2020). The Sustainable Development Goals (SDGs) established by the United Nations have been an important guide for countries to articulate their sustainability strategies and orient their actions towards a more responsible management of natural and social resources (Feuillet-Alzate et al., 2022).

However, the effectiveness and degree of implementation of these policies vary widely among countries and cities. Some cities have made significant progress in promoting sustainability, implementing efficient public transport projects, recycling programs, environmental protection initiatives, and inclusive housing plans (Blanco and Díaz Barrado, 2020). In contrast, other cities still face challenges in implementing sustainable policies, due to economic, political, and cultural constraints, among other reasons (López and Alves, 2021).

Thus, the accelerated urban development in Latin America has given rise to a series of challenges and opportunities for the sustainability of cities (Mattioli, 2023). Addressing environmental, social, and economic issues in an integrated and collaborative manner is imperative to achieve more sustainable and resilient cities (Jiménez, 2023). In this sense, this article aims to analyze the level of sustainable development in urban areas of Latin America; based on a multidimensional literature review, to contribute to the analysis and development of concrete actions that promote sustainability.

The proposed review presents the SDGs as a theoretical reference since they are used to describe each social actor involved in the problems analyzed. These actors are essential in

the consolidation and implementation of the necessary measures to facilitate and provide an opportunity for sustainable development in urban areas of Latin America.

Through this research, we aim to shed light on the successful experiences and obstacles faced on the road to urban sustainability in Latin America. By sharing lessons learned and best practices, it aims to generate valuable knowledge that can guide concrete policies and actions to achieve more inclusive, resilient, and sustainable urban development in the region. Ultimately, this critical assessment seeks to contribute to the strengthening of Latin American cities as engines of progress, well-being, and equity, while protecting and preserving the natural and cultural heritage that gives them identity and meaning.

MATERIALS AND METHODS

This article was based on a systematic literature review to conduct a critical and comprehensive assessment of the state of sustainable development in urban areas of Latin America. This research methodology was selected because of its rigorous and transparent approach to systematically gathering and analyzing relevant information in the field of study (Barrios Serna et al., 2021).

The research question was designed to address the fundamental aspects of urban sustainability and critically analyze the current state and challenges facing cities in the region, considering a segment between January 2018 and July 2023.

We took into account the multidimensionality of the concept of sustainability, which encompasses environmental, social, and economic aspects, and sought to understand how these aspects are interrelated in the specific context of urban areas in Latin America. In this sense, the proposed research question is as follows: "What is the current level of progress in sustainable development in Latin America's main urban areas?

To conduct a rigorous and comprehensive search, a combination of keywords and terms related to sustainable development, cities, urbanization, and Latin America were used (Table 1). These terms were adapted to the specificities of each database or search engine used to ensure coverage of the most relevant literature. The most relevant academic and scientific databases were selected for the search, including Scopus, Scielo, and Google Scholar.

Table 1

Search engines and keywords

Search	Keywords	No. of investigations
Scopus	Sustainable Development and Latin America	1764
Scielo	Sustainable Development and Latin America	432
Google Scholar	Sustainable Development in South America	767

Source: Own elaboration (2023)

Selection criteria

Inclusion criteria were established to filter relevant studies and filters were applied to ensure the validity and relevance of the results obtained. Inclusion criteria were based on the thematic focus of the review, the language of publication, the type of study, and the PICO question.

Inclusion

Studies covering sustainable development in urban areas of Latin America were included, in addition to selecting research focused on strategies and policies that promote sustainability in urban areas, priority was given to obtaining articles, both quantitative and qualitative, that present empirical data on the situation in the region.

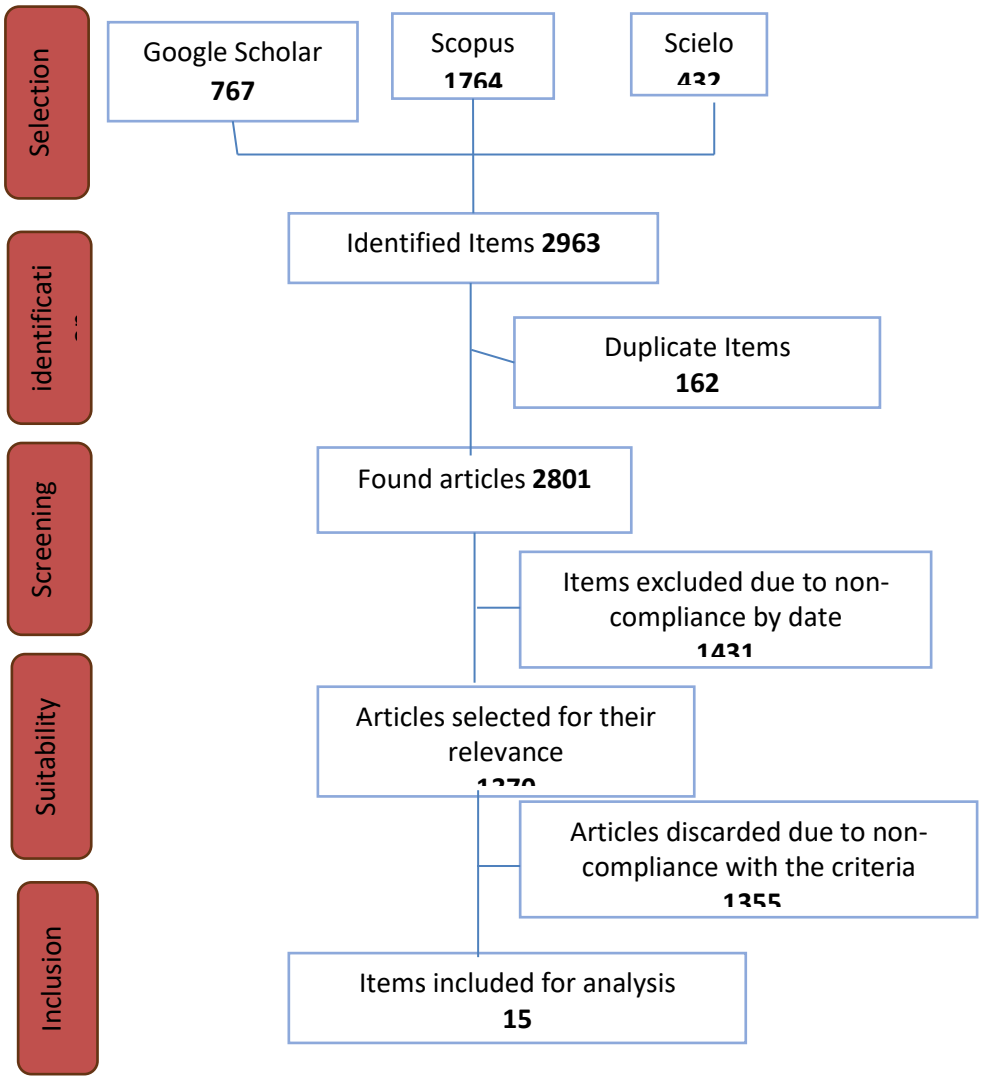
Exclusion

Studies that do not focus on urban sustainable development outside the geographic scope of Latin America were differentiated. Likewise, those that do not specifically address interventions or policies to promote sustainability in urban areas were excluded, as were studies that do not present empirical data and that do not provide significant information for research concerning sustainable development.

Once the literature search was completed, we proceeded to the selection of relevant studies for the systematic review. This selection was carried out in two stages: the initial review of titles and abstracts and the detailed evaluation of the complete studies (Figure N°1).

Graph 1

PRISMA *method flow*



Source: Own elaboration (2023)

In the first stage, the titles and abstracts of the studies obtained through the literature search were reviewed. Studies that did not meet the inclusion criteria were discarded at this stage. Studies that were considered potentially relevant or whose focus was not clear from the abstract were selected for the next stage.

In the second stage, the complete studies were evaluated to determine whether they met the inclusion criteria and were adequate to answer the research question. This detailed evaluation made it possible to select the studies that provided relevant and high-quality information for the review (Figure No. 1). The studies selected for the systematic review include those that directly address the issue of sustainable development in urban areas of Latin America, as well as those that provide data, analysis, and conclusions relevant to the understanding of the challenges and opportunities faced by cities in the region. Through

rigorous selection, the quality and validity of the systematic review are guaranteed, which will make it possible to obtain solid and well-founded results to address the research question posed in this article.

RESULTS AND DISCUSSION

In the current global scenario, sustainable development has emerged as a fundamental premise to guarantee an equitable and prosperous future for present and future generations (Eschenhagen and Vázquez, 2023). Latin America, a region rich in natural and cultural diversity, faces significant challenges in its quest for sustainability in the midst of changing socioeconomic and environmental dynamics (Samper and Martínez, 2023). In this context, compliance with the Sustainable Development Goals becomes an essential tool for analyzing and understanding the current state of sustainable development in the region.

The results of the systematic review, presented in Table No. 2, showed that a The results of the systematic review, presented in Table N°2, captured a selection of 15 research articles that directly or indirectly address the progress of sustainable development in Latin America. These articles have been categorized into three levels: "Advanced", "Intermediate" and "Low", concerning the progress they show on sustainable development in major cities and the Sustainable Development Goals (SDGs) in the region. Each article offers a unique perspective on key aspects of sustainable development, from the impacts of the COVID-19 pandemic to natural resource management and technological innovation, and the current level of sustainable development progress in Latin America's major urban areas.

Authors Yuan et al. (2023) highlight an advanced level of setback in progress toward the SDGs due to the spillover effects of the COVID-19 pandemic. On the other hand, Fuchs et al. (2023) expose an intermediate level of progress at the university level concerning the integration of SDGs into curricula and institutional operations. Similarly, Ibrahim et al. (2023) examine progress in energy-environmental efficiency, suggesting an intermediate level of progress in the adoption of renewable energy, but also noting persistent challenges in waste management and environmental pollution.

Table 2

Qualitative results

Title	Author(s)	Level
Progress towards the Sustainable Development Goals has been slowed by indirect effects of the COVID-19 pandemic	(Yuan et al., 2023).	Advanced
Sustainable Development Goals (SDGs) in Latin-American Universities	(Fuchs et al., 2023).	Intermediate
Assessing sustainable development goals attainment through energy-environmental efficiency: The case of Latin American and Caribbean countries	(Ibrahim et al., 2023).	Intermediate
Integrated Water Resources Management in Cities in the World: Global Challenges	(Grison et al., 2023).	Under
Global modeling of the socioeconomic, political, and environmental relations of farmer seed systems (FSS): Spatial analysis and insights for sustainable development	(Zimmerer et al., 2023).	Advanced
Strategic management of patents on electrochemical conversion fuel cells and batteries in Latin America as a mechanism for moving toward energy sustainability	(Guevara-Ramírez et al., 2023).	Under
Circulatory Pathways in the Water and Wastewater Sector in the Latin American Region	(Soto-Rios et al., 2023).	Under
The Role of Science, Technology, and Innovation for Transforming Food Systems in Latin America and the Caribbean	(Hodson de Jaramillo et al., 2023).	Intermediate
Sustainability and Technology: Proposals and Recommendations for the 2050 Amazon	(Moura et al., 2023).	Intermediate
Latin American drylands: Challenges and opportunities for sustainable development	(Ocampo et al., 2022).	Under
Citizen security and urban commuting in Latin America	(Giménez-Nadal et al., 2023).	Under
Global Urban Development Frameworks Landing in Latin America: Insights from Ecuador and Bolivia	(Blanc and Cotella, 2023)	Under
Evaluation of the Sustainable Development Goals in the Diagnosis and Prediction of the Sustainability of Projects Aimed at Local Communities in Latin America and the Caribbean	(García Villena et al., 2022).	Intermediate
Addressing the SDGs in sustainability reports: An analysis of Latin American oil and gas companies	(Borges et al., 2022).	Under
The Impact of Sustainable Bond Issuances in the Economic Growth of the Latin American and Caribbean Countries	(Bernabé Argandoña et al., 2022).	Intermediate

Source: Own elaboration

The aspects that stood out in the review were the environment, food safety, and the use of technologies. In terms of these, the research of Grison et al. (2023) and Guevara-Ramírez et al. (2023) show that there is a low level of progress in sustainable development concerning water resource management (environment) and strategic management of patents in clean energy technologies, respectively. Soto-Rios et al. (2023) also identify a low level of progress in water and wastewater supply and management circuits, revealing challenges in the equity and efficiency of water management.

On the other hand, intermediate research such as that of Hodson de Jaramillo et al. (2023) explores the role of science, technology, and innovation in the transformation of food systems, highlighting an intermediate level of progress in this area. Moura et al. (2023) propose the use of advanced technologies to balance economic development and environmental preservation in the Amazon region, reflecting an intermediate level of progress in terms of understanding technological possibilities.

At this point, the review showed that a social appropriation of technology is necessary since citizens must appropriate scientific and technological knowledge to achieve better social, economic, and environmental conditions. In other words, a social appropriation of science and technology consists of a series of social, productive, and educational initiatives aimed at benefiting and promoting the culture of science and technology, not only in the scientific and academic communities but also in all citizens (Hodson de Jaramillo et al. 2023; Moura et al. 2023).

It should be noted that the care of the environment, the use of technology, and food security are based on ancestral knowledge, which is essential to achieving food autonomy. This is because, over time, it can be observed that farmers have forgotten the knowledge that their ancestors instilled in them and, for the sake of convenience, have settled for conventional agriculture, where the environment is drastically affected. Because of this, all those actions that allow to cultivation of the land using ecological practices, in which ancestral knowledge is present, should be valued.

Similarly, ancestral knowledge is evident in the technology that is currently used and which is not only observed in the conservation of food products but also in the technical equipment used to estimate crop risk; in this particular case, they are used as a strategy to recover local ancestral knowledge, to take the necessary measures to reduce the risk of disasters in the face of extreme climatic events. In addition, the documents examined show the importance of recovering ancestral techniques and improving them with new technologies that help to enhance their functionality.

On the other hand, the work of Ocampo et al. (2022) highlights the particular challenges of drylands in Latin America, highlighting a situation in which a low level of progress has been achieved in terms of land management and food security in these areas. Giménez-Nadal et al. (2023) delve into citizen security and urban mobility, identifying the need to address challenges in transportation infrastructure and crime prevention in the region's cities.

In contrast, research such as that of Ocampo et al. (2022) identifies a low level of progress in sustainable development in drylands in Latin America, pointing to the need to address specific challenges. Giménez-Nadal et al. (2023) address citizen security and urban mobility, revealing a low level of progress in these critical areas. Blanc and Cotella (2023)

analyze the adaptation of global urban development frameworks, indicating a low level of progress in the effective integration of these strategies.

Borges et al. (2022) assess the integration of the SDGs in the sustainability reporting of oil and gas companies, indicating a low level of progress in terms of commitment and concrete action. Bernabé Argandoña et al. (2022) examine the impact of sustainable bond issues on economic growth, reflecting an intermediate level of progress in this financial area. In summary, it can be seen that 7 of the 15 articles analyzed show a low level of sustainable development in Latin America, representing 46.67%. Similarly, 6 articles, representing 40%, agree that the level is intermediate and the rest, barely 13.33%, indicate the existence of an advanced level of development.

The fundamental question that permeates this research is: What is the current level of progress in sustainable development in Latin America's major urban areas? To address this question, multidisciplinary analyses have been deployed that explore various angles and dimensions of sustainable development in the region. Through the work of leading researchers in the field, such as Yuan et al. (2023), Fuchs et al. (2023), and Ibrahim et al. (2023), conceptual maps have been drawn that delineate a comprehensive perspective on the current state and emerging trends.

Fuchs et al. (2023) elaborate on the integration of the Sustainable Development Goals at the university level in the region. At the same time, persistent challenges are identified in the effective implementation of the SDGs in university research and operations, something that requires greater commitment and action; therefore, this analysis indicates an intermediate level of progress. For their part, Ibrahim et al. (2023) assessed energy-environmental progress and noted the continuing challenges of waste management and pollution mitigation. This reflected the intermediate level of progress, since, although there are significant advances, there are still areas for improvement.

In contrast, research that reflects a low level of progress, such as those by Grison et al. (2023), Guevara-Ramirez et al. (2023), Soto-Rios et al. (2023), Ocampo et al. (2022), Gimenez-Nadal et al. (2023), Blanc and Cotella (2023), and Borges et al. (2022) reveal the most prominent obstacles on the road to sustainability. These investigations point to areas where significant gaps are observed between sustainable aspirations and reality.

In the study of Grison et al. (2023), a deficiency in integrated water resources management is evident, highlighting the need for a more effective approach to urban water planning and management. Guevara-Ramirez et al. (2023) suggest that patent management in clean energy technologies in Latin America still faces significant challenges, indicating a low level of progress in this specific area. Soto-Rios et al. (2023) delve into the challenges in water

and wastewater supply and management circuits, indicating a low level of progress in terms of access and adequate management of these essential resources.

In the same vein, Blanc and Cotella (2023) analyze the adaptation of global urban development frameworks in local contexts, indicating that the effective implementation of sustainable development strategies is still a challenge in Latin America. Borges et al. (2022) highlight the importance of addressing the integration of the SDGs in the sustainability reporting of oil and gas companies, revealing a low level of progress in the transparency and commitment of this industry to sustainability.

At the extreme of intermediate levels of progress, Moura et al. (2023) suggest an intermediate level of progress in the Amazon region, since it is necessary to understand the reality of the environment to introduce suitable and efficient technologies. Bernabé Argandoña et al. (2022) evaluate the impact of sustainable bond issues on economic growth in Latin America and the Caribbean. These authors pointed out the progress in the incorporation of sustainable considerations in the financial sphere. In addition, they indicated the need for constant evaluation.

Importantly, a thorough and critical exploration of progress in sustainable development in Latin America's major urban areas concurs to provide an enriching and nuanced perspective on the dynamics, achievements, and challenges shaping the path to sustainability in the region. Through a diversity of approaches and levels of analysis, discernible patterns have been delineated that shed light on the multifaceted stages and nuances inherent in this vitally important process (Zimmerer et al., 2023).

A preeminent finding that emerges from this analysis is the influence of exogenous factors, particularly the COVID-19 pandemic, on progress toward the Sustainable Development Goals (SDGs). The indirect and dislocating impact of the pandemic, as illustrated by Yuan et al. (2023), has reverberated through the achievement of multiple goals, evidencing the imperative need to build resilient strategies to safeguard and catalyze progress on sustainability. In the study by Fuchs et al. (2023), it can be observed that the integration of the SDGs in the curricula of institutions in the region shows the commitment to sustainability in a gradual and differentiated manner.

Concerning some country's use of renewable energy, the report by Ibrahim et al. (2023) highlights the need to address waste management and pollution to achieve stronger progress in crucial areas, reflecting the independent nature of sustainability-driven factors. Similarly, challenges associated with water management emerge as a common denominator in several low-level investigations. Grison et al. (2023), Guevara-Ramírez et al. (2023) and Soto-Rios et al. (2023) point out obstacles in the planning and implementation of sustainable water policies,

highlighting the need to address issues of equity, waste management, and clean technologies to ensure adequate and equitable use of this vital resource.

The recommendations and perspectives provided by intermediate-level research highlight the centrality of technology and innovation in the search for comprehensive solutions. From the transformation of food systems (Hodson de Jaramillo et al., 2023) to the adoption of advanced technologies to drive a balance between development and preservation in the Amazon region (Moura et al., 2023), these proposals demonstrate how technology can be a transformative driver for sustainability.

CONCLUSIONS

The current reality of urbanization in Latin America in terms of production, distribution, and consumption of urban-environmental goods and services confirms that the development model and the growing economic, social, political, and environmental costs are unfeasible; this situation demands the mobilization of different more sustainable development paths. For this to happen, it is necessary to incorporate the political relations that make life in the urban spaces of the region.

Likewise, it is imperative to understand that different societies are interconnected; this element is of utmost importance since the emergence of new technologies such as those related to information constitutes a great advance in the relationships generated between people, which undoubtedly transforms citizen participation in the management of cities. Thus, having new production technologies allows the incorporation of aspects of the territorial approach in public policies, which facilitates the much-needed balance between the environment and urban growth.

He also highlighted the fact that the achievement of sustainable development objectives will only be achieved when there is a balance between the inconveniences generated in any management of public funds and the development that values the requirements and desires of the population, allowing local initiatives to occur spontaneously without rigorous control. The reality of Latin America shows a very significant experience in terms of integral improvement, in this case, of popular neighborhoods and settlements on the outskirts of large cities, which have been consolidated over time.

Latin America faces a great challenge in terms of sustainable urban development; this translates into the construction of more resilient, inclusive, and equitable cities, where citizens can participate in decision-making. In addition, sustainable models of production, land use, consumption, energy use, and risk zone management must be applied, thus allowing for a new way of planning and managing cities in environmental terms. In this regard, it should be noted that Latin America and the Caribbean do not have a rural approach that takes into account this

sector to achieve food security, combat climate change, reduce inequalities, and ensure sustainability.

REFERENCES

Please refer to the articles in Spanish Bibliography.

BIBLIOGRAPHICAL ABSTRACT

Please refer to articles Spanish Biographical abstract.