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Urban Sustainability Indicator System for Small Cities: proposition and application in the municipality of Conde/PB

Lilian Ferreira Cardoso da Silva
Doctorate student PRODEMA, UFPB, Brazil.
lilian.silva@ifpb.edu.br

Gesinaldo Ataíde Cândido
Professor Doctor, UFPB, Brasil.
gacandido01@gmail.com

Eduardo Rodrigues Viana de Lima
Professor Doctor, UFPB, Brazil.
eduvianalima@gmail.com

José Augusto Ribeiro da Silveira
Professor Doctor, UFPB, Brazil.
ctlaurbe@gmail.com

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Sistema de Indicadores de Sustentabilidade Urbana para Pequenas Cidades: proposição e aplicação no município do Conde/PB

RESUMO

A utilização de sistemas de indicadores de sustentabilidade urbana tem adquirido cada vez mais importância como instrumento para criação e redefinição de políticas públicas e para a gestão urbana. A agenda 2030 ressalta a necessidade da adaptação desses sistemas para contextos locais, em especial, as cidades de menor porte. Nesse sentido, o objetivo do artigo é propor um sistema de indicadores de sustentabilidade urbana para uma cidade de pequeno porte do Estado da Paraíba. Em termos metodológicos, trata-se de uma pesquisa exploratória com levantamento de dados secundários e primários de forma quantitativa e qualitativa. Os resultados obtidos apontam para um conjunto de 65 indicadores com aderência ao processo de urbanização no escopo territorial da cidade estudada, representando aspectos a serem priorizados nas políticas públicas e na gestão urbana do município, assim como, podendo ser adaptados e aplicados em outros recortes territoriais semelhantes.

PALAVRAS-CHAVE: Gestão e planejamento urbano. Indicadores urbanos. Pequenas Cidades sustentáveis.

Urban Sustainability Indicator System for Small Cities: proposition and application in the municipality of Conde/PB

ABSTRACT

The use of urban sustainability indicator systems has become increasingly important as a tool for creating and redefining public policies and for urban management. The 2030 Agenda emphasizes the need to adapt these systems to local contexts, especially in smaller cities. The objective of this article is to propose a system of urban sustainability indicators for a small city in the State of Paraíba. In methodological terms, this is an exploratory study with a quantitative and qualitative survey of secondary and primary data. The results obtained point to a set of 65 indicators that adhere to the urbanization process in the territorial scope of the city studied, representing aspects to be prioritized in public policies and urban management in the municipality, as well as being able to be adapted and applied in other similar territorial areas.

KEYWORDS: Urban management and planning. Urban indicators. Sustainable small towns.

Sistema de Indicadores de Sostenibilidad Urbana para Ciudades Pequeñas: propuesta y aplicación en el municipio de Conde/PB

RESUMEN

El uso de sistemas de indicadores de sostenibilidad urbana ha adquirido cada vez más importancia como herramienta para la creación y redefinición de políticas públicas y para la gestión urbana. La Agenda 2030 destaca la necesidad de adaptar estos sistemas a los contextos locales, especialmente en ciudades de menor tamaño. En este sentido, el objetivo del artículo es proponer un sistema de indicadores de sostenibilidad urbana para una ciudad pequeña del estado de Paraíba. En términos metodológicos, se trata de una investigación exploratoria con recopilación de datos secundarios y primarios de manera cuantitativa y cualitativa. Los resultados obtenidos apuntan a un conjunto de 65 indicadores que se ajustan al proceso de urbanización dentro del alcance territorial de la ciudad estudiada, representando aspectos que deben ser priorizados en las políticas públicas y en la gestión urbana del municipio, y que además pueden ser adaptados y aplicados en otros contextos territoriales similares.

PALABRAS CLAVE: Gestión y planificación urbana. Indicadores urbanos. Ciudades pequeñas sostenibles.

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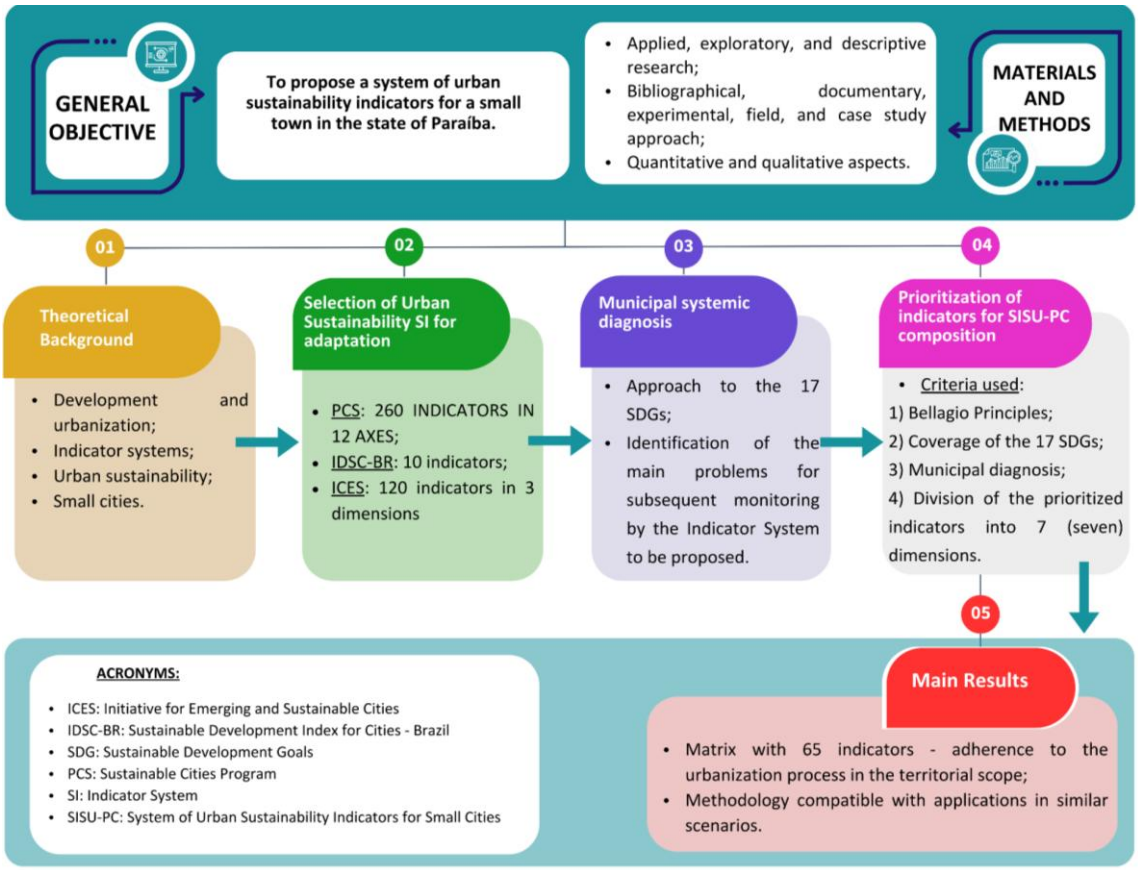
GRAPHIC SUMMARY

Figure 1 - Graphic summary of the survey



Source: Authors (2024)

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1 INTRODUCTION

The phenomenon of global urbanization became more evident in the 20th century, starting in 1950. This rapid process of urban occupation in less developed countries, such as Brazil, has occurred without adequate compatibility of infrastructure and attention to social and environmental demands. In addition, territorial transformations reflect ideological paradigms about development, growth, and modernity, leading cities to expand in search of progress that in practice turns out to be unequal and inadequate to local needs. As a result, this economic development option continues to drive cities towards irrational land use and occupation, transforming valley bottoms into avenues, deforesting protected areas to build allotments, and disregarding the specificity of territories (Majewska, Denis e Krupowicz, 2020; Maricato e Cunha, 2022; Mendonça e Lima, 2020; Santos *et al.*, 2023).

In this complex scenario, where, on the one hand, there is no unanimous definition of the concept of development and, on the other, there is accelerated urban growth in search of this "development", urban planning has emerged as a fundamental tool for the analysis and urban management of these environments. However, given the multiplicity of factors involved, it is impossible to plan actions aimed at sustainability without systematized knowledge and the establishment of indicators.

Despite the advances in global indicator systems, the 2030 Agenda warns of the importance of local processes, placing cities as the basis for efforts to act locally, so that the indicators show what is essential for each place. In this regard, when we look at the municipal sphere, we see a gap in the indicator systems, since most of what has been built has had a geographical scope directed at countries and large cities, hindering the construction of specific development indices to measure the sustainability of smaller geographical spaces, as is the case of small towns (Malheiros; Coutinho; Philippi Jr., 2013a; Martins; Candido, 2012).

Included in this problem and also under pressure, small towns can be considered a challenge for the exercise of different urban and environmental management practices, given the preference of urban studies for metropolises and large cities. In addition, small towns face the constant pressure of modernization, urbanization, and economic growth, with weaknesses such as low institutional capacity and inefficient urban and territorial planning and management systems (Endlich, 2019; Majewska, Denis e Krupowicz, 2020; Terfa et al., 2020).

This is the reality experienced by the municipality of Conde, located on the southern coast of the State of Paraíba. The municipality has faced pressures resulting from accelerated urban growth, which has fragmented the city into two (2) distinct nuclei: the headquarters, with an administrative vocation, and the Jacumã district, which concentrates nine (9) beaches, with high scenic potential, environmental weaknesses, and strong real estate speculation (IBGE, 2022).

Based on these considerations, the objective of this article is to propose a system of urban sustainability indicators for a small town in the State of Paraíba. For this purpose, existing systems of urban sustainability indicators have been adapted to the context and characteristics of small towns. In methodological terms, this is a descriptive and exploratory study, using secondary and primary data, analyzed quantitatively and qualitatively.

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In terms of structure, in addition to this introductory content, the theoretical foundation of the article includes items related to an overview of the urbanization process from a development perspective and proposals for urban sustainability indicator systems. This is followed by the materials and methods used to achieve the proposed objective. The results and analysis of the collected data are then presented, followed by the final considerations.

2 THEORETICAL BASIS: DEVELOPMENT X URBANIZATION: THE ROLE OF INDICATOR SYSTEMS IN THE URBAN SUSTAINABILITY OF SMALL TOWNS

The concept of development emerged in 1943 with the article by Paul Rosenstein-Rodan, associated with the industrialization of Europe and with ideals strongly linked to progress. However, between 1960 and 1980, the long-term unsustainability of the model of industrial growth and development from an economic point of view culminated in discussions on concepts related to the model of sustainable development. Thus, in Europe and the United States, the debates on pollution, environmental degradation, unemployment, and unsustainable consumption of natural resources involved part of society and became the starting point for the creation of social movements and the organization known as the "Club of Rome". This group proposed zero growth as a way to reduce environmental imbalances and criticized underdeveloped countries for their high levels of poverty (Furtado, 2002; Theodoro & Leonardos, 2021).

The evolution of research on development and sustainability and the search for a multidimensional approach that includes other dimensions led to the term ecodevelopment in 1973, proposing an alternative development policy. Further developing the theory, the concept of sustainable development was defined in 1987 in the document "Our Common Future" (Brundtland Report) as that which meets the needs of the present without compromising those of the future. However, there is more disagreement than convergence on the subject, its concept, and the methods for achieving it (Gibbes et al., 2020; Theodoro e Leonardos, 2021; Vargas-Chaves, Gómez-Rey e Rodríguez, 2020).

Subsequently, Sachs (1993) dimensions for sustainable development from a new approach to existing development concepts and approaches in which the economic dimension is predominant. Understanding the ideological models of development and the challenges generated by this economic bias in the pursuit of growth and economic progress are essential elements for us to analyze the possible ways of seeking quality of life in cities, given that since 2007 the majority of the world's population has been concentrated in urban Spaces (UN-Habitat, 2022).

In Brazil, urbanization came later and presented peculiarities related to the social injustices that already existed since the country was a Portuguese colony, as well as the more recent slave regime, which was accentuated and culminated in serious socio-environmental problems. This is because the country has experienced one of the most accelerated urbanizations in history, creating a context known as "critical urbanization", for instance, when the urban does not reach everyone (Damiani, 2021; Mendonça; Lima, 2020).

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In addition, studies on urban spaces have generally focused on metropolises, and large and medium-sized cities, making publications on small towns relatively scarce. Defining small towns is a complex issue with little consensus. In this sense, despite the fragility of the quantitative approach, some authors have tried to make contributions, with minimum and maximum parameters for their classification. For example, small towns are those with less than thirty thousand inhabitants. Para cities are those with a maximum of fifty thousand inhabitants. Finally, the IBGE defines a small city as one with up to one hundred thousand inhabitants The quantitative approach, although initial, can be complemented by qualitative methodologies, such as analysis of the area of influence and role in the urban network, and investigation of socio-spatial formation (Bernadelli, 2004; Fernandes e Endlich, 2021; Lopes, 2010; Santos, 1977).

The relevance of studies on small towns in Brazil becomes clear when we consider that of the 5,570 municipalities in the country, only 657 have more than 50,000 inhabitants, i.e. 4,913 (88%) of Brazilian municipalities are considered small. What public policies are being created for these small towns? In this scenario, indicators can play a crucial role by providing objective and measurable information on various aspects of the urban environment, as well as helping to raise awareness and engage the Community (IBGE, 2022).

The use of indicators as tools to monitor development originated in the United States in the 1940s, focusing on economic measures such as Gross Domestic Product (GDP) and Gross National Product (GNP), without taking into account the associated social and environmental costs. Measuring processes through sustainability indicators is essential to enable and monitor decisions and policies at all stages and to make the concept of development operational. To this end, the measurement process must take into account the multidimensional nature of the phenomena related to sustainability, including social, environmental, economic, institutional, and quality of life variables. From this perspective, indicators are understood as tools that bring together complex information about a system or phenomenon, guiding the understanding of the world based on quantitative and/or qualitative data. (Alcântara e Sampaio, 2020; Melo e Bellen, Van, 2019; Niemann e Hoppe, 2021).

To contribute to the process of building development indicators in their multiple dimensions, in 1996 a group of researchers proposed a set of principles that became known worldwide as the Bellagio Principles. The ten principles were organized systemically, covering everything from the selection of the indicator system, data analysis, and communication, to the analysis of institutional capacity for continuous monitoring: 1) Focused vision and goals; 2) Holistic perspective; 3) Essential elements; 4) Appropriate scope; 5) Practical focus; 6) Openness/transparency; 7) Effective communication; 8) Broad participation; 9) Constant evaluation; and 10) Institutional capacity, to continue the evaluation (Malheiros; Coutinho; Philippi Jr., 2013b).

The progress of indicator systems has been remarkable since the 2030 Agenda and the Sustainable Development Goals (SDGs) were drawn up in 2015 (United Nations, 2015). With 17 goals, 169 targets, and more than 230 associated indicators, the SDGs provide a collaborative monitoring framework, highlighting the importance of local processes and cities as the basis for local action, while underscoring the need to fill the gap in indicator systems, historically focused

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on countries and large urban centers (Cordero e Rodriguez, 2022; Rama et al., 2020; Sotto et al., 2019; Steiniger et al., 2020).

Given the complexity of this issue and the particularities of small Brazilian cities, along with the conceptual update provided by the 2030 Agenda, three urban sustainability indicator systems were selected for detailed analysis: the Sustainable Cities Program (PCS), the Sustainable Development Index for Cities-Brazil (IDSC-BR) and the Emerging and Sustainable Cities Initiative (ICES) methodology.

2.1 Urban Sustainability Systems Chosen for Adaptation to SISU-PC

Because of the systemic conception of Sustainability (Ojeda-Zaga *et al.*, 2024), the first system of indicators chosen was the Sustainable Cities Program (PCS), which, since its revision in 2016, has been associated with the SDGs and now includes in its 260 indicators the 17 SDGs, divided into 12 (twelve) thematic axes: 1) Governance, 2) Common natural goods; 3) Equity, social justice and a culture of peace; 4) Local management for sustainability; 5) Urban planning and design; 6) Culture for sustainability; 7) Education for sustainability and quality of life; 8) Local, dynamic, creative and sustainable economy; 9) Responsible consumption and lifestyle choices; 10) Better mobility, less traffic; 11) Local action for health and 12) From local to global (PCS, 2016, 2020).

Subsequently, the Sustainable Development Index for Cities - Brazil (IDSC-BR) was chosen. This index is basically a prioritization of the 260 indicators of the PCS, where 100 indicators were chosen that covered the 17 SDGs and had greater flexibility and access to data for the majority of Brazilian cities. The same set of indicators was applied to all municipalities to produce comparable scores and rankings (IDSC-BR, 2022).

Finally, given the urban challenges arising from the rapid urban expansion of the location under analysis, the Initiative for Emerging and Sustainable Cities (ICES) was selected, which was created in 2010 to support urbanization in the Latin American and Caribbean regions. The ICES methodology consists of six phases, divided into two major stages. The first stage starts with a process of diagnosing the most urgent challenges for the sustainability of cities. Later, still in the first stage, the information obtained is ranked using priority filters. The second phase of the approach focuses on implementing the initial action plan and setting up a citizen monitoring system (Artes; Oliveira, 2019; ICES, 2014).

Given the complexity of urban and environmental issues, it became essential for this research to recognize that a single indicator would not be sufficient to fully represent the state of a place, highlighting the need to combine a set or system of indicators. However, the dimensions of development are not always easy to measure, which demonstrates the need to integrate these dimensions. In addition, it was necessary to make the scales of different systems and indicators compatible and to analyze the feasibility of different spatial approaches.

3 MATERIALS AND METHODS

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The research in question is classified as applied. In terms of objectives, it is exploratory, as well as descriptive, recording, describing, and analyzing the characteristics of a population, phenomenon, and specific variables. The technical procedures, involve a bibliographical, documentary, experimental, field, and case study approach, using already published materials, official municipal, state, and national documents, and applying variables in the study area. Considering the complexity of the subject, it was necessary to take a quantitative and qualitative approach. Thus, given the proposed objectives, the research was structured in three stages, as described below:

- Stage 1 - Analysis of measurement tools and contextual analysis: the theoretical and methodological foundations that characterize the main issues involved in the research were analyzed, as well as the measurement tools for the dimensions of sustainability focused on urban and environmental issues. This stage was divided into two phases, the first related to the construction of the theoretical framework, and the second related to the analysis of the main urban sustainability indicator systems, in this case, the Sustainable Cities Program (PCS), the Sustainable Cities Development Index (IDSB-BR) and the Emerging and Sustainable Cities Initiative (ICES).
- Stage 2- Systemic diagnosis of the municipality of Conde: a systemic diagnosis was carried out covering the themes of the selected indicator systems, as well as all the dimensions of the SDGs. The study was carried out through bibliographical research and documentary analysis, based on official municipal, state, and national materials such as master plans, zoning and land use plans, reports, cartography, etc., including technical visits to analyze the study area.
- Stage 3 - Analysis and prioritization of the System of Urban Sustainability Indicators for Small Cities (SISU-PC): To define the prioritization of the indicators, the following criteria were taken into account: 1) the Bellagio Principles, which provide guidelines for the entire evaluation process, from the choice of indicators, access to data, scalability, their interpretation, communication and even their subsequent monitoring by the community; 2) the coverage of the 17 SDGs, given the multiple dimensions of sustainability; 3) the municipal diagnosis, where the most critical situations requiring monitoring by SISU-PC were identified; and 4- the division of the prioritized indicators into 7 (seven) dimensions, covering the 17 SDGs.

The SISU-PC was divided into 7 (seven) dimensions, grouped according to the similarity between the SDGs, in order to make it easier for the population and municipal management to understand: a) DIMENSION 1 (D1) - Eradication of hunger and poverty, includes SDG 1 (eradication of poverty) and SDG 2 (zero hunger and sustainable agriculture); b) DIMENSION 2 (D2) - Health and quality education, includes SDG 3 (health and well-being) and SDG 4 (quality education); c) DIMENSION 3 (D3) - Reducing inequalities and promoting equity, which includes SDG 5 (gender equality) and SDG 10 (reducing inequalities); d) DIMENSION 4 (D4) - Sustainable cities and urban infrastructure, which includes SDG 6 (drinking water and sanitation), SDG 11 (sustainable cities and communities) and SDG 7 (clean and affordable energy); e) DIMENSION 5 (D5) - Work, economic growth and innovation, which includes SDG 8 (decent work and economic growth) and SDG 9 (industry, innovation and infrastructure); f) DIMENSION 6 (D6) - Natural and common goods, which includes SDG 12 (responsible production and consumption), SDG 13

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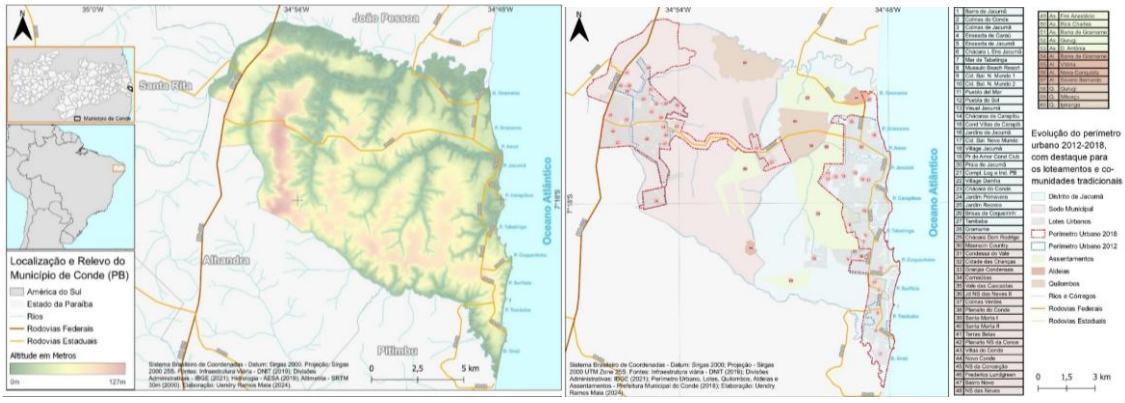
(action against global climate change), SDG 14 (life on water) and SDG 15 (life on land); and g) DIMENSION 7 - Peace, justice and governance, which includes SDG 16 (peace, justice and effective institutions) and SDG 17 (partnerships and means of implementation).

4 CHARACTERIZATION, CONTEXTUALIZATION OF THE TERRITORIAL SCOPE, AND PRIORITIZATION OF THE SISU-PC (ANALYSIS OF RESULTS)

The municipality of Conde is located in the micro-region of the south coast of the state of Paraíba, in the meso-region of the Zona da Mata Paraibana, and is part of the metropolitan region of João Pessoa. It borders the municipalities of João Pessoa, Alhandra, Pitimbu, and Santa Rita and the Atlantic Ocean to the east. The municipality covers an area of 171.267 km², with a low population density of 161.18 inhabitants per km² (Figure 2) (Costa et al., 2021; IBGE, 2022).

The urban expansion of Conde was stimulated after its political emancipation in 1963. Since then. There has been a tendency to subdivide the fragmentation of large plots of land, initially used as farms and later urbanized, both to create residential allotments and to change the use of existing allotments. It is important to note that this urban growth took place without any territorial planning or other planning by the municipal administration, which acted only as an authorizing body for the new towns. This way, the spontaneous growth of two independent nuclei, but dependent on the capital, led to the consolidation of two “cities” 13km apart. Until 2003, Conde was administratively divided into two districts: Sede (or Conde) and Jacumã, divided into rural-urban areas (Figure 2) (Costa et al., 2017).

Figure 2 - Montage showing the location and perimeter with demarcation of the urban areas (allotments), delimitation of the districts of Sede and Jacumã Districts, and rural areas (settlements and traditional communities)



Source: Prepared by Maia, Uendry (2024)

In the rural areas of Conde, there are stories of struggles for land, reinforced by the existence of its original peoples (Tabajara Indigenous People) and traditional quilombola communities. Therefore, given the importance of Indigenous peoples, traditional communities, and rural areas in the context of Sustainability, the indicator for **Dimension 1 (Eradication of hunger and poverty)** were prioritized: D1.1 (Titles issued to Indigenous lands in the municipality), D1.2 (Titles issued to quilombola communities); and for **Dimension 6 (Natural and common goods):** D6.51 (Production and consumption of natural resources) (Figure 3)

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In terms of urban sprawl, in both districts, there is a massive presence of urban voids, characterized by real estate speculation and the lack of land for permeable areas, as well as community facilities. Urban sprawl is a characteristic of places with large territories, where growth occurs without territorial planning, as in the case of Conde (Silva e Vergara-Perucich, 2021; Urrutia-Mosquera et al., 2024). Thus, comparing the total urban area (Sede and Jacumã districts) of 2012, defined by the Master Plan - Municipal Law 716/2012, which was 32.7 km², with the urban area of 2018, increased to 85.64 km² by Law 156/95 of 2018, shows a significant increase of 161.89%.

Particularly noteworthy in this scenario is the urban expansion of the Main District, which alone grew by 223.44%. As a result, the municipality has seen the creation of fragmented areas, segregation, greater pressure on ecosystems, and the existence of urban voids, making journeys longer and favoring car culture. Given the identified panorama of significant urban expansion and its correlations with issues of income, education, segregation, lack of mobility, real estate speculation, and the consequent pressure on ecosystems, indicators from **Dimension 4 (Sustainable cities and urban infrastructure)** were prioritized: D4.32 (Green area in the urban zone), D4.33 (Weight of public transport fare in the monthly budget), D4.35 (Annual urban growth rate), D4.36 (Net urban population density), D4.38 (Public recreational spaces), D4.40 (Kilometers of bicycle paths), D4.41 (Traffic accident fatalities), D4. 42 (Number of cars for personal use per capita); and **Dimension 6 (Natural and common goods):** D6.55 (Coastal zone in areas of conservation and scientific interest), and D6.57 (Full protection and sustainable use conservation units) (Figure 3).

Given the problem of urban growth, Law 156/95 was approved in 2018, which regulates the subdivision, use, and occupation of land in the municipality of Conde. The legislation presented territorial zoning, which included specific parameters for the parceling, use, and occupation of land, dividing the territory into 9 (nine) Zones. However, in 2021, Law 1110/2021 revoked some land parceling parameters, in a way that weakened an important initiative, since it designated a large part of the zones for priority densification, including those with low infrastructure coverage and environmental weaknesses. For this reason, qualitative indicators assessing the existence and implementation of these laws were prioritized in **Dimension 4 (Sustainable cities and urban infrastructure):** D4.34 (Participatory master plan) and D4.39 (Existence and active implementation of a land use plan) (Figure 3).

Considering the context of rapid urban growth identified in the municipality, it is crucial to guarantee development supported by an equitable distribution of infrastructure, with the aim of democratizing access to urban services and avoiding the worsening of socio-spatial disparities. The total number of households will increase by 73% between 2010 and 2022. However, it is important to highlight the large number of vacant homes, representing 17% of the total, and the significant number of homes in occasional use, amounting to 34.96% of the total. Occasional use signals the massive construction of second homes, a culture typical of coastal cities, but which needs to be well directed by urban planning instruments, in order to guarantee the social function of the city, inhibiting real estate speculation, and at the same time seeking to guarantee the provision of housing, especially those of social interest (IBGE, 2022).

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About the implementation of collective infrastructure, the following were analyzed: electricity supply, solid waste disposal, water supply and treatment, how the bathroom or toilet drains, and the state of the drainage network. In Conde, electricity services are provided by Energisa Paraíba. 11,008 connections to the electricity network were identified, but there are still 710, corresponding to 6.06% of households, without electricity, mostly located in rural areas. The destination of solid waste is mostly municipal public collection, representing 84.76%. However, 1,797, equivalent to 15.24% of households, are disposed of inappropriately, such as by burning, burying, or open-air disposal (IBGE, 2022).

The water that supplies the municipality comes from the Gramame River Basin, which is responsible for about 70% of the water supply of João Pessoa, Cabedelo, Bayeux, part of Santa Rita and Pedras de Fogo, and has faced conflicts such as excessive irrigation, siltation and industrial pollution. CAGEPA supplies water to the municipal capital and the Jacumã neighborhood. A total of 8,336 (68%) households were registered as having a piped connection, and 2,885 (23.60%) households were supplied by artesian wells, of which 15.49% were located in urban areas (IBGE, 2022).

The municipality does not have a sewage collection and treatment system. It was found that the majority of households use rudimentary pits, characterized as those built without technical criteria, totaling 7,983 (65.31%) households, of which 6,008 (63.88%) are located in urban areas. Septic tanks, on the other hand, are those built under the supervision of inspection bodies, totaling 3,545 (29%) urban and rural households, of which 2,206 (23.46%) are located in urban areas (IBGE, 2022).

In this scenario, considering that a large part of the water supply is provided by artesian wells and that wastewater is mostly discharged without technical control, there is a risk of contamination of the water table. Three pieces of information about the water supply stand out: 1- the inadequate and intermittent coverage of the network in the urban areas, especially if we consider the number of second homes and the tourist vocation of the region, generating a floating population; 2- the coverage of part of this inadequacy by artesian wells, since there are wells even in areas where there is a water network, justified by the inhabitants by the recurrent interruption of the supply and 3- the high number of unregistered wells, which does not guarantee a proper control, quality and quantity of the water consumed.

In addition, the municipality does not have a sewerage system. Three situations stand out in the municipality due to the lack of coverage of this system: 1- The rainfall rate is high and the rains cause flooding and impede pedestrian and vehicular traffic; 2- The significant urban growth in areas with fragile soils, causing deforestation in the remaining areas of the Atlantic Forest, thus reducing the soil's capacity to absorb rainwater, which can stimulate urban flooding; and 3- the high slope of the land in large areas of the territory, especially in the Jacumã District, which, together with the factors mentioned above, has generated erosion processes shaped by surface water runoff, forming furrows, gullies, gullies and canyons.

Given the panorama of incompatibility between rapid urban and population growth and the provision of basic sanitation and housing infrastructure, and the consequent social and environmental impacts related to this issue, the indicators of **Dimension 4 (Sustainable Cities and Urban Infrastructure)** have been prioritized for monitoring: D4.30 (share of renewable

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energy sources in the municipality's energy matrix), D4.31 (households with access to electricity), D4.37 (quantitative housing deficit); **Dimension 5 (employment, economic growth and innovation)**: D5.49 (public investment in urban infrastructure per inhabitant); and from **Dimension 6 (natural and common goods):** D6.50 (access to waste collection), D6.52 (waste deposited in landfills) and D6.53 (population covered by selective collection) (Figure 3).

In addition, from a systemic point of view, the problems of access to water through artesian wells, lack of sanitation and drainage, combined with high rates of deforestation and rugged terrain, indicated the prioritization of the indicators of **Dimension 4 (Sustainable Cities and Urban Infrastructure):** D4.27 (community participation in the watershed committee), D4.28 (percentage of households connected to the municipal water system), D4.29 (percentage of households connected to the sewer system); and **Dimension 6 (natural and common goods):** D6.54 (municipal natural disaster monitoring and warning center), D6.56 (deforested area), (Figure 3).

In order to contribute to the quantitative analysis, some relevant indicators for the municipality were evaluated. Thus, in terms of income and economy, the total GDP for 2020 was R$ 892,756.00. In that year, Conde stood out as the 11th among the 223 municipalities of Paraíba, and the 3rd in terms of GDP per capita in the State of Paraíba. However, this prominence did not translate into improved income for the population, since the average monthly salary is 1.8 minimum wages, ranking 18th among the 223 municipalities in Paraíba (IBGE, 2021, 2022; SEPLAG-PB; IBGE, 2022).

Looking at the income and economic panorama of Conde, we highlight the low proportion of employed people in relation to the total population, which is 24.5%, and also that households with a monthly income of up to half of the minimum wage per person represent 48% of the total. In addition, the official E-SUS systems, collected by the municipal CHAs, show that 70.26% of families live on up to 1 minimum wage. It is possible to see a complex scenario that highlights the weaknesses in municipal issues related to social inequality, unemployment and low income (IBGE, 2022).

Given the social and economic situation identified in the municipality, indicators from **Dimension 1 (Eradication of hunger and poverty)** were prioritized: D1.3 (Percentage of people registered in the Unified Register who receive a family allowance), D1.4 (People with an income of up to ¼ of the minimum wage); **Dimension 3 (Reducing inequalities and promoting equity):** D3.24 (Human Development Index), D3.26 (Gini coefficient); and **Dimension 5 (Work, economic growth and innovation)**: D5.43 (average income from main job), D5.44 (GDP per capita), D5.45 (unemployment rate), D5.47 (households with internet access), and D5.48 (share of industry in municipal GDP), (Figure 3).

In the health and quality of life dimension, the Municipal Health Plan of Conde (PMC; SMS, 2021) establishes guidelines and priorities for the period 2022-2025, highlighting the need to monitor certain indicators agreed upon by the Ministry of Health: 1) pregnancy trends among children and adolescents aged 10 to 19; 2) number of prenatal consultations per pregnant woman; 3) low birth weight; 4) chronic non-communicable diseases (CNCD); 5) mortality from

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external causes (accidents and violence, including femicide); and 5) infant mortality (children under one year of age).

Given the relevance of the health dimensions to sustainability and quality of life, as well as the guidelines of the National Pact of the Ministry of Health and the Municipal Health Plan of Conde, the indicators for **Dimension 1 (Eradication of hunger and poverty)** were included: D1.5 (low birth weight), D1.6 (child malnutrition); and **Dimension 2 (quality of health and education)**: D2.7 (Mortality from chronic non-communicable diseases), D2.8 (Municipal support policy for drug and alcohol users), D2.9 (Inadequate prenatal care), D2.10 (Immunization coverage), D2.11 (Child mortality), D2.12 (Life expectancy at birth), and D2.13 (Teenage pregnancy) (Figure 3).

In addition, the Municipal Health Plan calls for the inclusion of guidelines for monitoring the reduction of mortality from external causes, which is why the indicators for **Dimension 7 (Peace, Justice, and Governance)** were included: D7.59 (homicide rate), and from Dimension 3 (reducing inequalities and promoting equity): D3.23 (feminicide rate), (Figure 3).

In the field of education, the 2017 Municipal Education Plan (PME), in force until 2025, establishes guidelines such as eradicating illiteracy, overcoming educational inequalities, training for work and citizenship, improving the quality of education, and promoting human rights. In addition, priority goals include universalizing primary education, improving the IDEB, increasing the schooling of the population aged 18-29, reducing functional illiteracy by 50%, and expanding care for students with disabilities (PMC, 2017).

Conde's PME also addresses issues related to the impact of education on the income and employability of youth and adults. This is because the problem of the inactivity of the population aged 15 to 29 who are neither studying nor working, popularly known as "neither-nor", is a challenge for many countries. In 2014, the PNAD registered 48,962,173 young people between the ages of 15 and 29 in the country, representing 24.1% of the total population. Of these, nearly 50 million (13.9%) were "neither nor." Moreover, proving that the gender issue is an inseparable topic from the vulnerability of the universe studied, 74.7% were women (Cardoso and Hermeto, 2021; CONDE, 2017; Pereira and Queiroz, 2023).

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Figure 3: Urban Sustainability Indicators System for Small Cities (SISU-PC)

DIMENSION 1 - ERADICATION OF HUNGER AND POVERTY

SI/COD	INDICATOR	JUSTIFICATION
PCS / D1.1	Titles issued to Indigenous Lands in the municipality	Existence of 4 undemarcated Indigenous villages of the Tabajara people
PCS / D1.2	Titles issued to Quilombola communities in the municipality	Quilombos have not yet been granted title (INCRA)
IDSC / D1.3	Percentage of people on the Single Registry receiving Bolsa Família	Diag. Unemployment, low income + IDSC-BR very low development (SDG 1- % enrolled in CADunico and Bolsa Família)
IDSC / D1.4	People earning up to ¼ of the minimum wage (%)	48% of households earning up to ½ of the minimum wage + IDSC-BR MBD
IDSC / D1.5	Low birth weight	MS National Pact + Indicator prioritized by the Conde Municipal Health Plan (PMSC) 2022-2025
IDSC / D1.6	Child malnutrition	National Pact Ministry of Health (MS) + Conde Health Plan 2022-2025

DIMENSÃO 3 - REDUCING INEQUALITIES AND ENCOURAGING EQUITY

SI/COD	INDICATOR	JUSTIFICATION
IDSC / D3.20	Young women aged 15 to 24 who neither study nor work	IDSC-BR prioritized as an indicator of a very low level of development + National diagnosis
IDSC / D3.21	The presence of female councillors on the city council	IDSC-BR indicator of very low level of development + (SDG 5- female councillors on the city council)
IDSC / D3.22	Gender pay gap (women's pay/men's pay)	IDSC-BR very low level of development + SDG 5
IDSC / D3.23	Femicide rate	IDSC-BR very low level indicator + (SDG 5 + SDG 16)
PCS / D3.24	Municipal Human Development Index (HDI)	Municipal diagnosis (low income, health issues, and illiteracy)
PCS / D3.25	People with disabilities employed in municipal government	Legal inclusion + municipal diagnosis
IDSC / D3.26	Gini coefficient (IN)	High GDP + low investment in infrastructure + low average income)

DIMENSION 4 - SUSTAINABLE CITIES AND URBAN INFRASTRUCTURE

SI/COD	INDICATOR	JUSTIFICATION
PCS / D4.27	Participation of the municipality in the Basin Committee	Municipal Master Plan + Municipal diagnosis Gramame basin
ICES / D4.28	Percentage of dwellings with household connections to the city's water network	Municipal diagnosis + IDSC-BR low level of development (SDG 6)
ICES / D4.29	Percentage of household connections to the sewage system	Municipal diagnosis + very low IDSC-BR + 0% population served by sewage)
PCS / D4.30	Share of renewable sources in the municipal energy matrix	Municipal diagnosis + low development SDI-BR (SDG 7)
IDSC / D4.31	Households with access to electricity	Municipal diagnosis + low development SDI-BR (SDG 7)
PCS / D4.32	Green area in the urban area	Municipal diagnosis (deforestation) + very low development SDI-BR (SDG 15)
PCS / D4.33	Weight of public transport fare in the monthly budget	Municipal diagnosis: urban sprawl + low average income of the population
PCS / D4.34	Participatory Master Plan	Municipal diagnosis + Master Plan expired (2022)
ICES / D4.35	Annual urban growth rate	Municipal diagnosis: urban sprawl
ICES / D4.36	Urban population density (net)	Municipal diagnosis: urban sprawl + incompatibility of urban infrastructure + urban voids
ICES / D4.37	Quantitative housing deficit	Municipal diagnosis: urban sprawl + identified deficit components + real estate speculation
ICES / D4.38	Public recreational spaces per 100,000 inhabitants	Municipal diagnosis: urban sprawl + low average income of the population
ICES / D4.39	Existence and active implementation of a land use plan	Municipal diagnosis + Municipal Law 1110/2021 (fragility of planning law)
ICES / D4.40	Kilometers of cycle paths per 1000 inhabitants	Urban sprawl + incompatibility of urban infrastructure)
ICES / D4.41	Traffic accident fatalities per 1000 inhabitants	Urban sprawl + city bordered by BR 101, PB 018 and PB008
ICES / D4.42	Number of cars for personal use per capita	Urban sprawl + incompatible urban infrastructure (public transport)

DIMENSION 7 - PEACE, JUSTICE AND GOVERNANCE

SI/COD	INDICATOR	JUSTIFICATION
PCS / D6.58	Executed budget decided in a participatory manner	Fragmented participatory instances, (perceived during the definition of the methodology) + IDSC-BR
IDSC / D6.59	Very low	IDSC-BR homicide rate (SDG 16- male juvenile homicide + firearm-related deaths + homicide rate)
IDSC / D6.60	Degree of structuring of internal control and anti-corruption policy	Municipal diagnosis + IDSC-BR
IDSC / D6.61	Degree to which transparency policies are structured	Municipal diagnosis + Transparency Law

DIMENSION 2 – SAÚDE E EDUCAÇÃO DE QUALIDADE

SI/COD	INDICATOR	JUSTIFICATION
PCS / D2.7	Chronic non-communicable disease modality	National Health Ministry Pact + Indicator prioritized by the Conde Municipal Health Plan 2022-2025
PCS / D2.8	Municipal assistance policy for drug users and alcohol addicts	National Pact MS + PMSC - Expansion of Comprehensive Change for users of alcohol and other drugs
PCS / D2.9	Insufficient prenatal care	National Pact MS + PMSC 2022-2025 + IDSC-BR prioritized as a low-level indicator
IDSC / D2.10	Vaccination coverage (%)	MS National Pact + Indicator prioritized by the Conde Municipal Health Plan 2022-2025
IDSC / D2.11	Childhood mortality (number of infant deaths between 0 and 4 years of age, per thousand live births)	MS National Pact + Indicator prioritized by the Conde Municipal Health Plan 2022-2025
IDSC / D2.12	Life expectancy at birth (years)	Indicator strongly linked to the quality of life envisaged in the Conde Municipal Health Plan 2022-2025
IDSC / D2.13	Teenage pregnancy (%)	MS National Pact + PMSC 2022-2025 + IDSC-low level
IDSC / D2.14	Internet access in public primary and secondary schools	LDB (2023) + Municipal Education Resolution No 003 04/03/2019
IDSC / D2.15	Schools with facilities suitable for people with disabilities LDB	LDB (2023) + Prioritized target PME (2022-2025) + Municipal Education Resolution No 003 04/03/2019
IDSC / D2.16	Basic Education Development Index (IDEB) - final	Compulsory assessment + OMF (2022-2025) + IDSC-BR very low level
IDSC / D2.17	Basic Education development index (BED) - inicials	Compulsory assessment + PME (2022-2025) + IDSC-BR very low level
IDSC / D2.18	Illiteracy in the population aged 15 and over (%)	PME target (2022-2025) + very low IDSC-BR + PMSC 2022-2025
IDSC / D2.19	Cultural centers, houses and spaces (100,000 inhabitants)	SME target (2022-2025) + IDSC-BR low level development

DIMENSION 5 - WORK, ECONOMIC GROWTH AND INNOVATION

SI/COD	INDICATOR	JUSTIFICATION
PCS / D5.43	Average income from the main job of people aged 16 and over	Municipal diagnosis + IDSC-BR very low level of development
IDSC / D5.44	GDP per capita (R$ per capita)	Municipal diagnosis + Gini index (income distribution inequalities) + IDSC-BR very low level of development
IDSC / D5.45	Unemployment (rate)	Municipal diagnosis + IDSC-BR prioritized as an indicator of low level of development (SDG 8- unemployment)
IDSC / D5.46	Young people aged 15 to 24 are neither studying nor working	Municipal diagnosis + SME targets + IDSC-BR very low level of development
PCS / D5.47	Households with internet access	Municipal diagnosis
PCS / D5.48	Industry's share of municipal GDP	Municipal GDP (industry accounts for 22%) + high employment + low average income + low education level
PCS / D5.49	Public investment in urban infrastructure per inhabitant (R$ per capita)	Municipal diagnosis: + very low development IDSC-BR (SDG 9- investment in infrastructure per inhabitant)

DIMENSION 6 - NATURAL AND COMMON GOODS

SI/COD	INDICATOR	JUSTIFICATION
PCS / D6.50	Access to domestic waste collection service	Municipal diagnosis: insufficient waste collection
PCS / D6.51	Organic production andconsumption	Rural settlements and traditional communities + low development IDSC-BR
PCS / D6.52	Waste deposited in landfills	Municipal diagnosis: insufficient waste collection
IDSC / D6.53	Population served by selective waste collection (%)	Municipal diagnosis: insufficient waste collection
PCS / D6.54	Municipal monitoring and warning center for natural disasters	Urban sprawl + lack of drainage + deforestation + fragile soil + altimetry) + very low developmental IDSC-BR
PCS / D6.55	Coastal zone in an area of conservation and scientific interest	Municipal diagnosis: Urban sprawl, fragile ecosystems, preservation areas (especially on the 9 beaches of the Jacumã District)
PCS / D6.56	Deforested area	Urban sprawl, deforestation + very low development IDSC-BR
IDSC / D6.57	Conservation units for integral protection and sustainable use	Municipal diagnosis: (APA Tambaba) + IDSC-BR very low level of development

SI/COD	INDICATOR	JUSTIFICATION
PCS / D6.62	Up-to-date indicators produced by management	Municipal diagnosis (lack of data from various sectors)
PCS / D6.63	Cooperation policies in the municipality	Planned cooperative actions: Master Plan, Health and Education Plan
IDSC / D6.64	Total municipal revenue collected (%)	Municipal Diagnosis + Transparency Law + Very low development SDI-BR (SDG 17)
IDSC / D6.65	Debt growth	Diagnosis + Transparency Law + very low IDSC-BR (SDG 17- public investment)

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Source: Authors (2024)

Considering the educational scenario in the municipality and its correlation with the quality of life of the population, as well as the guidelines established in the Municipal Education Plan, the indicators for **Dimension 2 (Health and Quality Education)** have been included: D2.14 (Internet access in primary and secondary schools, in the public network), D2.15 (Schools with facilities suitable for people with disabilities), D2.16 and 17 (Basic Education Development Index (IDEB) - final and final years), D2.18 (Illiteracy in the population aged 15 and over (%)), D2.19 (Cultural centers, houses and spaces of culture). Also in the context of inclusion and accessibility and their impact on the world of work, the indicator for **Dimension 3 (Reducing inequalities and promoting equity)** has been included: D3.25 (Persons with disabilities employed in local government), (Figure 3).

In addition, considering the links between education, employability, and gender issues identified in the municipality, indicators from **Dimension 3 (Reducing inequalities and promoting equity)** were selected: D3.20 (young women aged 15-24 who are neither studying nor working), D3.21 (presence of women councilors in the city council), D3.22 (gender pay gap); and from **Dimension 5 (work, economic growth and innovation): D5.46 (young people aged 15 to 24 who are neither studying nor working)**, (Figure 3).

The promotion of peace, justice, and good governance in the Sustainable Development Goals (SDGs) is also crucial at the municipal level. Therefore, given the low level of the institutional organization identified, the quantitative and qualitative indicators of **Dimension 7 (Peace, Justice, and Governance)** were prioritized for monitoring: D7.58 (Budget executed in a participatory manner), D7.60 (Degree to which internal control and anti-corruption policy are structured), D7.61 (Degree to which transparency policy is structured), D7.62 (Current indicators produced by management), D7.63 (Cooperation policy in the municipality), D7.64 (Total municipal revenue collected), and D7.65 (Debt growth), (Figure 3).

Thus, based on the critical issues identified in this diagnosis, the indicators that make up the SISU-PC were prioritized, resulting in a matrix of 65 (sixty-five) indicators, with columns containing information on the indicator systems used as a basis for adaptation, the title, the definition of each indicator, as well as all the information justifying their choice (Figure 3).

Given the complexity of the issue of urban sustainability, in preparing this Diagnosis we sought to analyze the impact of economic growth and spontaneous urban growth on the various dimensions of sustainability that directly affect the quality of life of the population. In addition, a systemic approach has been taken to the 17 (seventeen) SDGs, looking at priority issues that need to be continuously monitored by the indicators.

5 FINAL CONSIDERATIONS

In view of the complexity of the subject, the chosen theoretical basis sought to present the challenges generated by the mimetic reproduction of development ideologies from an economic point of view, in the process of urban expansion, generating a "critical urbanization" that does not reach the entire population and favors social and environmental imbalances. In addition, it identified the relevance and the lack of studies and, consequently, policies that

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address the specificities of measuring and targeting sustainability in small cities, highlighting urban sustainability indicator systems as fundamental tools for urban management and planning, insofar as they provide objective and measurable information on various aspects of the urban environment, as well as contributing to community awareness and engagement.

In this sense, the research showed that measuring urban sustainability and its multiple dimensions requires a systemic approach. Therefore, it was necessary to build a system of indicators, as a single indicator would not be sufficient to fully represent the state of a place.

Thus, during the preparation of the Municipal Diagnosis, which sought to cover all the dimensions of the SDGs, several situations were identified that require attention in the municipality and need to be followed up and continuously monitored through indicators. These include 1) Spontaneous growth of two urban centers within the same municipality (Sede and Jacumã neighborhoods), independent of each other, leading to the consolidation of two "cities"; 2) Significant urban expansion between 2012 and 2018, corresponding to an increase of 161.89% in the urban area of the municipality, with emphasis on the Jacumã neighborhood, which alone grew by 223. 44%; 3) The absence and inefficiency of instruments that regulate the parceling, use, and occupation of land; 4) The existence of indigenous and traditional communities in areas that lack basic infrastructure such as sanitation, paving, transportation, and public lighting; 5) Incompatibility between urban growth and infrastructure coverage, inefficiency or lack of coverage of basic services such as water, sanitation, drainage, housing and transportation; 6) Social inequality, unemployment, and low income; 7) Low educational attainment, which affects employability and income; and 8) Alarming indicators of teenage pregnancy and chronic non-communicable diseases, among others.

Based on the identified scenario, the indicators that make up SISU-PC have been prioritized. This system aims to contribute to policies that guide the municipality towards sustainability, based on 65 indicators adapted to the specificities and main challenges of urban expansion in Conde, taking into account the 17 SDGs. It is believed that the methodology used in this research can be useful for the analysis of other small towns, and for the construction of sustainability indicator systems adapted to their realities.

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DECLARAÇÕES

CONTRIBUIÇÃO DE CADA AUTOR

Ao descrever a participação de cada autor no manuscrito, utilize os seguintes critérios:

- **Concepção e Design do Estudo**: Lilian Ferreira Cardoso da Silva; Gesinaldo Ataíde Cândido; Eduardo Rodrigues Viana de Lima.
- **Curadoria de Dados**: Lilian Ferreira Cardoso da Silva; Gesinaldo Ataíde Cândido; Eduardo Rodrigues Viana de Lima, José Augusto Ribeiro da Silveira.
- **Análise Formal**: Lilian Ferreira Cardoso da Silva; Gesinaldo Ataíde Cândido; Eduardo Rodrigues Viana de Lima.
- **Aquisição de Financiamento**: Eduardo Rodrigues Viana de Lima.
- **Investigação**: Lilian Ferreira Cardoso da Silva; Eduardo Rodrigues Viana de Lima.
- **Metodologia**: Lilian Ferreira Cardoso da Silva; Gesinaldo Ataíde Cândido; Eduardo Rodrigues Viana de Lima; José Augusto Ribeiro da Silveira.
- **Redação - Rascunho Inicial**: Lilian Ferreira Cardoso da Silva; Gesinaldo Ataíde Cândido.
- **Redação - Revisão Crítica**: Gesinaldo Ataíde Cândido; Eduardo Rodrigues Viana de Lima; José Augusto Ribeiro da Silveira.
- **Revisão e Edição Final**: Lilian Ferreira Cardoso da Silva; Gesinaldo Ataíde Cândido; Eduardo Rodrigues Viana de Lima; José Augusto Ribeiro da Silveira.
- **Supervisão**: Eduardo Rodrigues Viana de Lima; Gesinaldo Ataíde Cândido; José Augusto Ribeiro da Silveira.

DECLARAÇÃO DE CONFLITOS DE INTERESSE

Nós, **Lilian Ferreira Cardoso da Silva, Gesinaldo Ataíde Cândido, Eduardo Rodrigues Viana de Lima** e **José Augusto Ribeiro da Silveira,** declaramos que o manuscrito intitulado "**Sistema de Indicadores de Sustentabilidade Urbana para Pequenas Cidades: proposição e aplicação no município do Conde/PB** ":

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