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SUSTAINABLE REGIONAL DEVELOPMENT INDEX APPLIED TO MUNICIPALITIES OF THE CARIRI METROPOLITAN REGION

ÍNDICE DE DESENVOLVIMENTO REGIONAL SUSTENTÁVEL APLICADO AOS MUNICÍPIOS DA REGIÃO METROPOLITANA DO CARIRI

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Abstract

Sustainability indexes or indicators are useful tools for measuring and evaluating the development of territories and organizations. The present paper aimed to compare the level of sustainable development achieved by the nine municipalities of the Cariri Metropolitan Region, Brazil (MRC), according to environmental, economic, and social indicators. The updated data was selected based on the document IDS BRASIL (2014) of the Brazilian Institute of Geography and Statistics (IBGE), and obtained from platforms like the IBGE Cidades, the IPECE yearbook and Atlas Brazil. The data was normalized to better compare their performance regarding various sustainability factors. After being transformed into indicators, the values were then classified in critical, warning, acceptable or ideal. The basic set of information that involves income and labor, education, health, safety, infrastructure, access to public policies of income distribution, drainage, basic sanitation, urbanization, vegetation, wealth, among others, and their respective performances, were compiled and averaged for each city. The most developed cities of the region are Juazeiro do Norte, Crato and Barbalha, respectively. On the other hand, the city that needs the most attention regarding its development is Santana do Cariri.

Keywords: Sustainability indicators. Cities. Development level.

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Resumo

Índices ou indicadores de sustentabilidade são meios úteis para mensurar e avaliar o desenvolvimento de territórios e organizações. O presente trabalho buscou comparar o nível de desenvolvimento sustentável alcançado entre os nove municípios da Região Metropolitana do Cariri (RMC), analisando indicadores ambientais, econômicos e sociais. Os dados atualizados foram selecionados com base no documento IDS BRASIL (2014) do Instituto Brasileiro de Geografia e Estatística (IBGE), e coletados por meio das plataformas IBGE cidades, anuário do IPECE e Atlas Brasil. Os dados foram normalizados, facilitando a comparação de desempenho nas diversas dimensões da sustentabilidade. Depois de transformados em índices, os valores foram categorizados entre: crítico, estado de alerta, aceitável ou ideal. O conjunto de informações básicas que envolve renda e trabalho, educação, saúde, segurança, infraestrutura, acesso a políticas públicas de distribuição de renda, drenagem, saneamento, urbanização, vegetação, rendimentos, entre outros, e seus respectivos desempenhos, foi compilado e agregado por meio de uma média obtida a partir dos resultados individuais em cada município de estudo. Os municípios mais desenvolvidos da região são Juazeiro do Norte, Crato e Barbalha, nessa mesma ordem. Santana do Cariri é o município que necessita de maior atenção quanto ao seu desenvolvimento.

Palavras-chave: Dimensões da sustentabilidade. Cidades. Nível de desenvolvimento.

Introduction

A few decades ago, the concept of development did not prompt reflections that went beyond understanding economic growth. Over the years, however, the intensification and speed of globalization, together with concerns about the impacts caused by this growth, among other factors, contributed to the expansion of this point of view. It is no longer possible to think about development in such a unilateral way, since there are also environmental, social, cultural and institutional dimensions and other aspects that embrace the plurality of current human societies. Sachs (2009), concisely reinforces sustainable development as the one that meets present needs without compromising the needs of future generations.

According to Feil & Schreiber (2017), the terms sustainability and sustainable development, despite being used synonymously, are different concepts. For them, the term sustainability has its origin and focus on an environmental bias, which comes from environmental concerns about the deterioration of global ecology in favor of economic development, related to the solution for the scarcity of natural resources linked to energy issues and other activities. Meanwhile, sustainable development aims at economic growth without harming the environment, proposing long-term changes that go beyond the environmental perspective, involving human behavior through strategies, processes and practices.

In the present paper, ways of measuring sustainable development through indexes and indicators will be presented, even though it is known that the current knowledge states that sustainability is immeasurable. Carvalho & Barcellos (2009), have two lines of thought on why sustainability is immeasurable. Firstly, they claim that there is no universal definition for sustainability that is precise, does not generalize and can be accepted in all situations. That is, there is no consensus on the concept of this term, considering that it is constantly in construction and changing.

In this context, according to Carvalho & Barcellos (2009), since the 1980s, the environmental indicators began to be developed in several European countries, Canada and New Zealand, which were consolidated in the agreement generated by 179 countries during the Agenda 21, when it was stated that it was necessary to develop sustainable development indicators (SDI) by the signatory countries.

In 2000, 147 heads of state and government from 189 countries, including Brazil, met at the UN Millennium Summit in New York, committing themselves to the Millennium Development Goals (MDGs) by 2015, through specific actions to tackle hunger and poverty, promotion of health, sanitation, education, housing, gender equality and environment policies, among others. In order to continue the treaty after 2015, the Sustainable Development Goals (SDGs) were launched in the final

document of the Rio+20 Conference (2012), entitled "The future we want", where intergovernmental working groups were designated for the preparation of the SDGs (CARVALHO & BARCELOS, 2015).

For Abramovay (2010), sustainable development indicators are a tool with great potential to governance. The systematization of sustainability indicators involves the construction of a model capable of reflecting the causal chain of anthropic actions (CARVALHO & BARCELLOS, 2009).

Regarding the concept attributed to the indicators, it may be a quantitative or qualitative measure, that carries an intrinsic value capable of measuring or expressing information about some aspects of reality or concepts. According to IBGE (2014), the indicators of sustainable development are "statistics, which can be absolute values, ratios or other indexes, used to measure the level of social, environmental, economic and institutional sustainability of a society or territory", which aim to represent elements of the real world through values.

According to Silva et al. (2009), although it is difficult to choose and gather the main factors that influence development, they are present in concerns related to current and future lifestyles, quality of life, economic prosperity and, in general, to the future of the Planet Earth. Sustainability indexes or indicators are useful and of great importance to describe the sustainability of systems, even though, it is necessary to take into account their real meaning and extent (SICHE et al., 2007).

All these things considered, this study aims to compare, in a local scale, the level of sustainable development achieved by the nine municipalities in the Metropolitan Region of Cariri (MRC), by analyzing environmental, economic and social indicators. More specifically, indicators from government agencies that were submitted to the index construction method developed by the Inter-American Institute for Cooperation on Agriculture (IICA).

The present work was subdivided into four sections that address, in the following order: introduction; bibliographic review, which covers the themes of sustainable development and sustainability index; methodological procedures; results and discussions and conclusions.

Fundamental concepts

Sustainable development

The concept of sustainable development is placed in a historically constructed debate. For Veiga (2015), defining Sustainable Development is to understand development in a historical, political, and socio-economic context, covering the protection of human rights, access to education and the participatory condition intrinsic to democracy. Regarding the problematization around sustainability, it comes from a scenario of uncertainties facing humanity and the biosphere and the use of natural resources that are too scarce to sustain forms of production and consumption, which make it necessary to find strategies of economic, social and environmental sustainability.

Thus, it is necessary to integrate the dimensions of sustainability in the process of building knowledge. Sometimes, sustainability refers to natural resources; at times, to the by-products of these resources, like the production or consumption levels. Also, there is the notion of temporality underlying the concept of sustainable development, considering a reference system of the present, to project a new future model, taking into account the current model of capitalist production and its deep social inequalities (MARCOMIN; SILVA, 2009) .

The studies on sustainability are currently guided not only for social well-being and economic growth, but also on respect for nature, the application of science, technological impacts, and ethics in the relationship between man and environment. As transformations require different teaching resources, it is recommended to observe the impacts of globalization and technological developments in order to think about long-term sustainable strategies (BURSZTYN, 2001).

Sachs (1993) developed his studies in a sustainability perspective that addresses aspects of eco-development, respecting the importance of natural and environmental resources. However, he started to expand the vision of development to a sustainable perspective, covering the integrality of the social, economic, ecological, spatial and cultural dimensions. Therefore, sustainable development is then aimed at the effective universalization of human rights (SACHS, 2008).

Sustainability indexes

Strengthening the concept of Carvalho & Barcellos (2009), the indicators constitute an absolute (real quantity) or relative (percentage) value, as well as a function of several other indicators (composite indicator or index), that can be objective and quantitative or qualitative and

subjective, constituting an inversely or directly proportional relationship between factors or the measurement of the social effectiveness of a given action.

The word "indicator" has a Latin etymology (*indicare*) and it means to point out, that in a statistical analysis, can be called a variable (VAN BELLEN, 2004). One of the main features of indexes and indicators is to simplify complex phenomena and information through quantification, which facilitates analysis, comparison, and better understanding, making intelligent decision-making possible.

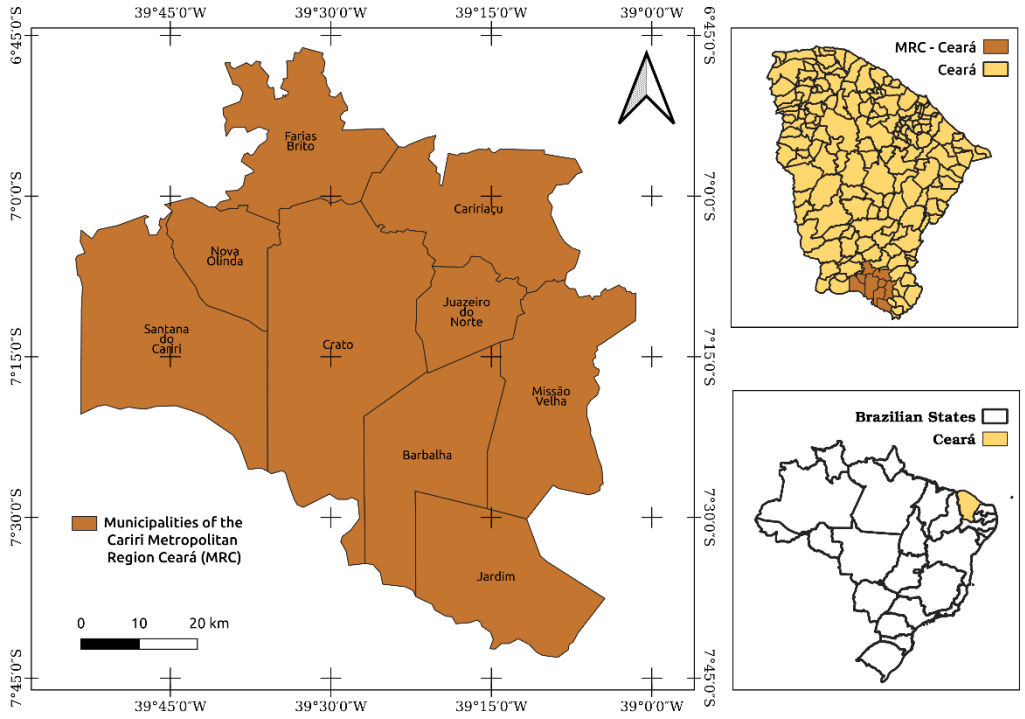
Sustainable development involves plural aspects with different approaches, coming from different dimensions, which are reflected in the indicator systems. The definition of dimensions and variables depends on the reality of the territories analyzed, which are delimited in a multidimensional way to notice differences and their own identities (MARTINS & CÂNDIDO, 2011).

The index used in this work is a methodological tool developed by Sepúlveda (2005) at the Inter-American Institute for Cooperation on Agriculture (IICA) that allows the verification of the sustainable development process in some countries in Latin America. This methodology consists of the collection and systematization of indicators that are representative of a set of dimensions of sustainable development, which allows for rapid assessments, as well as comparative analysis of the levels of sustainable development in different territories.

Methodological procedures

The research covers a study region, composed of the nine municipalities in the Metropolitan Region of Cariri, Ceará state, Brazil, namely: Juazeiro de norte, Crato, Barbalha, Caririaçu, Farias Brito, Missão Velha, Nova Olinda, Jardim and Santana do Cariri (Figure 1).

Figure 1: Location of the Metropolitan Region of Cariri, Ceará.



Source: Authors (2020).

Although the Cariri Region is located in the semi-arid region of northeastern Brazil, it has peculiarities in the vegetation compared to the surrounding areas, having remnants of Atlantic Forest, which is present in abundance in the Araripe National Forest (FLONA), as well as a higher humidity level promoted by the “Cariri Depresion”, mainly in the municipalities of Crato, Juazeiro do Norte and Barbalha (BRANDÃO, 2014). The Araripe National Forest was one of the first protected areas in Brazil, created through the Decree No. 9,226, on May 2th, 1946. According to the agency responsible for its administration, ICMBio, which is based in the municipality of Crato/CE, the area

was created to maintain water sources in the semiarid region and prevent the advance of desertification in the Northeast, and it currently constitutes a conservation unit (UC). The FLONA/ARARIPE is home to a great diversity of species, which maintains the hydrological, climatic, ecological, and edaphic balance of the Araripe Sedimentary Complex, and has social and economic importance, as it promotes the extraction of food products.

From the point of view of the data collection and its nature, the research is characterized as documentary and bibliographic, since it was based only on the acquisition of secondary data relevant to the theme. As for the characteristics of the study, it is an exploratory and descriptive research, which seeks to understand events from the evaluation of data in a given period of time.

The updated data was selected (Chart 1) based on the document IDS BRASIL (2014) from the Brazilian Institute of Geography and Statistics (IBGE), and acquired from the IBGE "Cidades" platform, from the municipal profile reports provided by the Research Institute of Economic Strategy of Ceará - IPECE and from Atlas Brasil. The Atlas of Human Development in Brazil is a search platform for the Development Indexes of Brazilian municipalities, states and regions, which includes more than 200 indicators for demography, education, income, work, housing and vulnerability, with data extracted from the Demographic Census of 1991, 2000 and 2010.

It was used as a data source in the present study and is a simple, friendly and easily accessible tool that facilitates data handling and encourages analysis, offering an important view of the panorama of human development and internal inequality in a municipal scale (ATLAS, 2018). The number of households with garbage collection and water supply and the volume of treated water published by the IGBE (2010) were divided by the number of households in each municipality in order to reflect more accurately the services available in a proportional way. From the DATUSUS platform, it was collected data concerning the number of families benefited by "Bolsa Família[6]" and the number of families that were out of extreme poverty thanks to it. The number of homicides and the homicide rate (deaths per one hundred thousand people) were taken from the Ministry of Social Development (MDS). Each indicator was acquired according to the most recent data made available by each agency.

Chart 1: Selected indicators used in the analysis of each dimension of sustainability present in the municipalities.

Social Dimension		
Indicator	**Unit**	**Source (Year)**
Illiteracy	%	IBGE (2010)
Life Expectancy	Years	ATLAS (2010)
Child mortality	%	IBGE (2014)
Demographic density	%	IBGE (2010)
Dependency ratio	%	ATLAS (2010)
Municipal Development Index	Coeficient	IPECE(2016)
Social Development Index	Coeficient	IPECE (2015)
Human development Index	Coeficient	IBGE (2010)
Total health facilities per thousand inhabitants	Units/100 pop.	IBGE (2010)
Preschool Enrollment Rate	%	IPECE (2015)
Elementary School Enrollment Rate	%	IPECE (2015)
High School Enrollment Rate	%	IPECE (2015)
Population in households with running water	%	ATLAS (2010)
Population with toilet and running water	%	ATLAS (2010)
Population with two or more people per dorm	%	ATLAS (2010)
Population in households with garbage collection	%	ATLAS (2010)
Population in households with electricity	%	ATLAS (2010)
People in households with inadequate walls	%	ATLAS (2010)
Total population in permanent private households	Population	ATLAS (2010)
Number of families benefited by Bolsa Família	Families	MDS (2018)
Families out of extreme poverty due to Bolsa Família	Families	MDS (2018)
Number of homicides	Deaths	Datasus (2013)
Homicide rate	Deaths/100 thousand people.	Datasus (2013)
Environment Dimension		
Indicator	Unit	Source (Year)
Vehicles Fleet	Units	IBGE (2010)
Afforestation	%	IBGE (2010)
Urbanization	%	IBGE (2010)
Adequate sewage	%	IBGE (2010)
Inadequate sewage	%	IBGE (2010)
Semi-adequate sewage	%	IBGE (2010)

6 It is a direct income transfer program, aimed at families in situations of poverty and extreme poverty across the country, so that they can overcome the situation of vulnerability and poverty.

Garbage collection	Households	IBGE (2010)
Water supply	Households	IBGE (2010)
Water supply in households	Households	IBGE (2010)
Volume of treated water	m³/day	IBGE (2010)
Permanent farming área	Ha	IBGE (2010)
Total area allocated for APPs (Permanent Protected Areas)	Ha	IBGE (2010)
Economic Dimension		
Indicator	Unit	Souce (Year)
Gini Coefficient	Coefficient	IBGE (2010)
Employed population	Inhabitants	IBGE (2015)
Poverty rate	%	IBGE (2010)
Average monthly wage of formal workers	Minimum wages	IBGE (2015)
GDP per capita	R$	IBGE (2010)
Municipal finances	R$	IPECE (2015)
Electric power consumption	Mwh	IPECE (2015)
GDP at current prices	(X1000) R$	IBGE (2015)

Source: Prepared by the authors.

The method used to transform the gross values, with different units of measurement, into index values from 0 to 1, follows the methodology used by Waquil (2010) and was operationalized from the following normalization equations:

If the relationship is positive: $I = \frac{X-m}{M-m}$ If the relationship is negative: $I = \frac{M-x}{M-m}$

Where,
I = index calculated for each variable, for each analyzed municipality ;
x = specific observed value for that variable and municipality;
m = minimum observed value;
M = maximum observed value.

After being transformed into indexes, the results of each municipality were compared to one another and classified according to their performance, as shown in the Table 1 below:

Table 1: Classification of the sustainability index

Index (Range)	Evaluation	Color
0.0000 e 0.2500	Critical situation	Red
0.2501 e 0.5000	Warning situation	Yellow
0.5001 e 0.7500	Accecptable situation	Light Green
0.7501 e 1.0000	Ideal situation	Dark Green

Results and discussion

All the relevant information for the assessment of the development of the municipalities, whether in the social, economic, or environmental dimension, is presented below.

Social dimension

The set of basic information regarding income and work, education, health, security, infrastructure, access to public policies for income distribution and their respective performances, derived from the arithmetic mean of the individual results obtained in each municipality, is shown in Table 2 .

Table 2: Set of Social Dimension Indicators, considering the average of each variable in the municipalities of the MRC, extracted from data selected between the years of 2010 and 2016.

Indicator	Index	Evaluation
Total population in permanent private households	0.206	Critical situation
Number of families benefited by Bolsa Família	0.232	Critical situation
Total health facilities per thousand inhabitants	0.323	Warning situation
Municipal development index	0.370	Warning situation
Population in households with garbage collection (%)	0.378	Warning situation
High school enrollment rate	0.424	Warning situation
Illiteracy	0.457	Warning situation
Human development Index	0.471	Warning situation
Social development index	0.478	Warning situation
Population in households with running water (%)	0.506	Accectable Situation
Population with toilet and running water (%)	0.513	Accectable Situation
People in households with inadequate walls	0.525	Accectable Situation
Homicide rate	0.526	Accectable Situation
Families out of extreme poverty due to Bolsa Família	0.529	Accectable Situation
Preschool enrollment rate	0.531	Accectable Situation
Elementary School enrollment rate	0.532	Accectable Situation
Dependency ratio	0.537	Accectable Situation
Child mortality	0.559	Accectable Situation
Life Expectancy	0.571	Accectable Situation
Population with two or more people per dorm (%)	0.615	Accectable Situation
Population in households with electricity (%)	0.734	Accectable Situation
Number of homicides	0.800	Ideal Situation
Demographic density	0.856	Ideal Situation
Average	0.507	Accectable Situation

Regarding education, we observed that Crato, Juazeiro do norte and Barbalha have the lowest illiteracy rates, which correspond to 15%, 16.2% and 18.7%, respectively. However, municipalities such as Caririaçu and Santana do Cariri have 31.7% and 29.9%, respectively, which are approximately the double. The enrollment rate in preschool, elementary and high school had a similar behavior in all municipalities. Preschool enrollment rate ranged from 47.61 in Caririaçu to 61.49 in Jardim. As for the elementary school enrollment rate, it was 100% in Barbalha, Jardim and Farias Brito, whereas the lowest rate was 88.09% in Juazeiro do Norte. Finally, the high school enrollment rate ranged from only 43.56% in Santana do Cariri to 71.64% in Nova Olinda. The schooling data provided by IPECE (2016) are from SEDUC, which adopted the INEP / MEC methodology when calculating this indicator, so that it could be compatible with other federation units.

For Braga & Mazzeo (2017), Brazil has a high number of people over the age of 15 who cannot read and write. Based on data from the Brazilian Institute of Geography and Statistics (IBGE, 2015), through the National Household Sample Survey (Pnad), it was estimated that in 2015 about 8% of the population was illiterate (12.9 million people). This index reveals the contrasts present in the Brazilian society regarding the differences between geographic regions, generations and races. It is observed that, among the illiterate population, 16.2% are concentrated in the Northeast and about 4% in the Southeast and South; only 0.8% are young people aged from 15 to 19 years old and 22.3% among people aged 60 years old or over; in addition to composing only 5% of the white and 11.2% of the black population. The data indicates an evident correlation between illiteracy rates and poverty, exclusion, and low economic development (Braga & Mazzeo, 2017).

The schooling rate in high school, as well as illiteracy, are considered to be in a warning situation in the studied municipalities and may be due to the lack of availability of places in the public school system or the social conditions of each individual, since they often leave school in order to work. In this case, the state should look more after these young people and work to guarantee more conditions for them to finish high school.

It is also essential that this schooling respects the characteristics of each student: their age, economic condition, gender, race, ethnicity and whether they live in rural or urban areas.

In this work, the high demographic density was considered in the calculations as a negative factor, inferring a negative relation to the index since the high concentration of people in a given area can cause several social problems, related often to the inefficiency of the state in managing resources and meeting the needs of that population. Some problems inherent of densely populated areas that can be easily observed are: the buildup of garbage, the easy spread of diseases, deficiencies in urban mobility, low infrastructure, the low capacity of public sectors in meeting health, education and security demands, among others.

However, it is up to the present research to identify and discuss the reasons why these agglomerations are formed, as populations often migrate to large urban centers in search of a better quality of life and more job offers. Therefore, other factors will be considered. To be sustainable, the municipality must offer conditions proportional to the size of its population.

As an example, we can mention the municipality of Juazeiro do Norte, which has the highest population density in the region. While Nova Olinda has 20.7 people per km², Juazeiro do Norte has 1,004.45 people per km², followed by Crato and Barbalha, even if they have approximately ten times less demographic density. However, Juazeiro do Norte offers 56.78% of all job posts available for the region.

As for the percentage of the population living in households with running water, there is a contrast between Juazeiro do Norte and Jardim, which reaches a percentage of, respectively, 95.04 and 48.75% of the population. As for the percentage of the population living in households with toilets and running water, Santana do Cariri has the lowest rate, 44.32%, while the highest is in Juazeiro do Norte, with 90.63%. In all municipalities, the percentage of the population living in households with electricity exceeds 92%.

Therefore, the authorities responsible for these municipalities should pay greater attention to these indicators, which are essential for the socio-environmental balance. The absence of basic sanitation and the accumulation of solid waste in urban and rural areas present risks to the health of the population. In addition, environmental health risks include lack of access to drinking water, which can cause food contamination with pathogenic organisms as well as proliferation of disease vectors (EZAKI, 2011).

Thus, life expectancy reflects whether factors inherent to society that guarantee better living conditions for the population are being provided. Among the municipalities studied, Caririaçu has the lowest average life expectancy, 68.81 years, while Crato has the highest, 74.3 years, according to data from IBGE Cidades (2010). Comparing to Japan, which is the country with the highest life expectancy in the world, 84 years (APEX-BRASIL, 2015), the Cariri is far below. However, it is closer to the Brazilian average in 2010, which was 73.5 years, increasing to 75.8 in 2018, according to IBGE.

Nova Olinda and Santana do Cariri have the lowest total health facilities per thousand inhabitants, with only seven. Meanwhile, Juazeiro do Norte has ninety-five health facilities per inhabitant. Built in Juazeiro do Norte in 2010, the Hospital Regional do Cariri was a public hospital built by the state government in the interior of Ceará. With 27,126.47 m² and 294 beds, it assists a population of 1.5 million inhabitants, from 44 municipalities in the Cariri macro-region (ISGH, 2017).

Frainer et al. (2017), applying similar methodology in the state of Mato Grosso do Sul (MS), concluded that the index constitutes a very complex diagnosis for the analysis of public management. Therefore, a deep understanding of the generated information is necessary in order to define the best strategies responsible for improving the qualification of labor, the investment in science and technology and the provision of public services.

Environmental Dimension

The data used to analyze the environmental dimension within the context of sustainable regional development was the most elementary in order to estimate and achieve the research objectives, given the complexity of the theme and the possibilities that fit the present study. The selected data are shown in Table 3 below.

Table 3: Set of Indicators of the Environmental Dimension, considering the average of each of the variables in the municipalities of the MRC, extracted from data selected between the years 2010 and 2016.

Indicator	Index	Evaluation
Permanent crop área	0.238	Critical situation
Total area allocatedfor APPs (Permanent Protected Areas)	0.356	Warning situation
Volume of treated water	0.358	Warning situation
Garbage collection	0.422	Warning situation
Urbanization	0.456	Warning situation
Adequate sewage	0.467	Warning situation
Water supply	0.488	Warning situation
Inadequate sewage	0.547	Acceptable situation
Afforestation	0.610	Acceptable situation
Semi-suitable sewage	0.644	Acceptable situation
Vehicles Fleet	0.809	Ideal situation
Average	**0.424**	**Warning situation**

In the environmental dimension, the high vehicle fleet was considered as a negative indicator while calculating the index, since it is directly related to CO2 emissions and contributes to the greenhouse effect. While, in 2010, Santana do Cariri had 3,250 vehicles, Juazeiro already had a total of 109,058. Despite being a negative factor for the environment, it can also indicate the level of economic and social development, associated with the level of urbanization and the growth of cities and the income of the population. Overall, the vehicle fleet at MRC is in an ideal range from an environmental perspective, according to the index used.

The level of urbanization of the municipalities of the MRC revealed a warning situation, with a low rate of areas of permanent crops. The afforestation rate includes a minimum of 64.7% in Nova Olinda and a maximum of 97.4% in Barbalha and Crato.

The management of water resources is a factor that deserves attention, classified in the present study as being in a warning situation. Although it is an essential element, water can pose health risks if it is of poor quality and used without the proper treatment. For the World Health Organization (WHO) and its member countries, "everyone, at any stage of development and socioeconomic conditions, has the right to access an adequate supply of safe and drinkable water". “Safe”, in this context, refers to a water supply that does not represent a significant health risk, in enough quantity to meet all domestic needs, that is available continuously and has an affordable cost.

The region has a low percentage of both inadequate and adequate sewage, with most sewers in a semi-adequate situation. It has an average of 23.2% of inadequate sewage, with a minimum of 2.5% in Juazeiro do Norte and a maximum of 48.3% in Jardim; Average of 24% of adequate sewage, with minimum of 5.2% in Caririaçu and maximum of 45.6% in Juazeiro do Norte and an average of 52.7% of semi-adequate sewage, with minimum of 20.2% in Caririaçu and maximum of 70,7% in Juazeiro do Norte. Garbage collection, water supply and volume of treated water, on average, are in a warning situation, given the large discrepancy between municipalities. While Juazeiro do Norte treats 93.58 m³ of water/ day, Farias Brito treats only 11.14 m³ / day. While Juazeiro’s water supply reaches 90.38% of its population, Santana do Cariri supplies only 38.08% of the population, and while Juazeiro do Norte collects garbage from 92.67% of its households, Jardim garbage collection reaches only 33.19% of them.

Juazeiro do Norte is one of the most developed cities and with the highest growth rate in the interior of the state of Ceará. However, despite offering more opportunities, it concentrates major problems resulting from disorderly growth and inefficient public planning. The high homicide rate is worrying, requiring a detailed investigation of the factors that affect and cause these results. Also, more public policies (efficient and effective) must be developed and implemented not only in the studied regions, but also in other regions from the state of Ceará and other Brazilian states. While Jardim registered 2 homicides in 2013, Juazeiro do Norte registered 140, with a death rate per 100 thousand inhabitants equivalent to 53.58. Public security is a vital factor to be observed by the respective government bodies.

In the study by Moura-Fé et al. (2019), entitled "Metropolitan Region of the Cariri (MRC), Ceará: environment and sustainability", it is stated that, despite the socioeconomic importance of the MRC in the state, a complex picture of environmental issues has been established, in parallel to its economic and urban growth, jeopardizing the environmental maintenance of several natural assets, as well as the sustainability of the established and developing economic model.

Economic Dimension

The data representing the economic sector in the region (Table 4) is summarized, since under some points of view, some aspects have already been represented in the social dimension. They comprise the amount available to the municipality and to each citizen if the income was divided equally, as well as the consumption of electric energy that can indicate the level of development of the economic activities present in the industry, commerce, presence of domestic equipment, and more.

Table 4: Set of Indicators of the Economic Dimension considering the average of each of the variables in the municipalities of the MRC, extracted from data selected between the years of 2010 and 2016.

Indicator	Index	Evaluation
GDP at current prices	0.183	Critical Situation
Municipal finance	0.214	Critical Situation
Employed population	0.363	Warning situation
GDP per capita	0.412	Warning situation
Gini Coefficient	0.506	Accecptable situation
Poverty rate	0.507	Accecptable situation
Average monthly wage of formal workers	0.644	Accecptable situation
Electric power consumption	0.813	Ideal situation
Average	0.405	Warning situation

According to Wolffenbüttel (2004), in a text linked to the magazine "Desafios do Desenvolvimento" (IPEA), the Gini Coefficient is a tool used to measure the degree of concentration of income in a given group, showing the difference between the income of the poorest and the richest, whose result ranges from zero to one. If each individual of the whole population had the same amount of income, the Gini Coefficient value would be 0 (zero), as it represents an equal situation to everybody. On the other hand, the value 1 (one) would represent an extreme situation where only one person holds all the wealth. The Gini Coefficient among the studied municipalities remained between 0.4 and 0.49, and considering that, according to the IBGE, Brazil obtained a Gini Coefficient corresponding to 0.491 in 2015, the municipalities are in accordance with the national average.

Crato has the lowest poverty rate at 44.3%, in contrast to the municipality of Santana do Cariri, which has 71.78%. This percentage is calculated based on the population with a per capita monthly family income of up to half the minimum wage, in a given geographic and time space. Although the "Bolsa Família" program helps some poor families to survive and to be out of extreme poverty, the index of the number of families benefited from it is considered critical. Therefore, it is necessary to expand the program so that other families can be benefited.

The Dependency Ratio is the number of dependent people in the municipality (0 to 14 years old and over 65 years old) over the total economically active population (14 to 64 years old), multiplied by 100. In the region, this percentage is between 50.20% (Crato) and 67.70% (Santana do Cariri). This can be an indicator of the level of employment opportunities for young people.

In the economic dimension, energy consumption is highlighted, presenting an ideal index. However, it is necessary to work more and more on conservation, since energy savings are associated not only with cost reduction, but also with factors such as the preservation of natural resources. Regarding the environment, energy saving promotes water preservation in many regions of Brazil. Restraining the use of electric energy can help in the management of the Brazilian hydrological

cycle, considering that almost all energy generated in the country is done through hydroelectric plants.

The gross domestic product (GDP) per capita is in a warning situation, whereas the GDP at current prices, which represents the gross nominal value obtained that year, without monetary correction for inflation, collected in all sectors of society, as well as the municipal finances, which comprises the amount available by the city for its administration, are in a critical situation.

According to the report Economic Cooperation and Development (OECD, 2018), Brazil needs to increase investments in order to grow more, once the country occupies one of the worst positions among the member countries and partners of the group. In a ranking of OECD countries, Brazil appears in the fourth worst investment position in relation to the Gross Domestic Product (GDP), considering the values from 1990 to 2016. In that period, the country's investments did not reach 20% of its GDP - sum of all goods and services produced by the country. The level of investment has been declining continuously since 2013 and is low when compared internationally. The report points out that a higher level of investment would raise the growth potential of the economy and strengthen productivity growth, enabling wage increases without jeopardizing the competitiveness of domestic producers.

Silva et al. (2018), applying the construction of a sustainable development index (IDS) and spatial analysis of inequalities in Ceará municipalities, identified that the Cariri region constitutes one of the economic centers (urban and industrial) in Ceará, as well as, one of the places with the highest level of sustainable development in the state. In their study, the municipality of Crato stands out in the state as one of the municipalities with the best social development.

Municipal overview

From the analysis of all dimensions, Crato, Juazeiro do Norte and Barbalha show acceptable performance, whose triangle is formed by the cities considered to be the best developed in the region. The other municipalities: Missão Velha, Caririaçu, Jardim, Farias Brito and Nova Olinda are in warning situation, followed by Santana do Cariri, which presents a critical situation when compared to other municipalities in the region, having the lowest indexes in the three dimensions analyzed (Table 5).

Table 5: Set of Indicators of the Social, Environmental and Economic Dimension in the municipalities of the Metropolitan Region of Cariri Cearense. The best results for each dimension are in bold.

Municipality	Dimension			Average	Evaluation
	Social	Environmental	Economic		
Santana do Cariri	0.263	0.198	0.234	0.232	Critical situation
Jardim	0.428	0.257	0.345	0.343	Warning situation
Nova Olinda	0.473	0.281	0.350	0.368	Warning situation
Farias Brito	0.547	0.291	0.349	0.396	Warning situation
Caririaçu	0.367	0.547	0.395	0.437	Warning situation
Missão Velha	0.429	0.612	0.518	0.520	Acceptable situation
Barbalha	0.602	0.692	0.565	0.620	Acceptable situation
Crato	0.696	0.600	0.586	0.627	Acceptable situation
Juazeiro do Norte	0.641	0.546	0.756	0.647	Acceptable situation

In the social dimension, Crato has the highest index compared to other municipalities. In the environmental dimension, the municipality of Barbalha stands out with the highest rate. The economic dimension is more expressive in the municipality of Juazeiro do Norte. This can be related to the religiosity that drives a constant flow of visitors and pilgrims and ends up causing a significant economic growth in the municipality.

Resende et al. (2017), applying a similar methodology to the present study in the municipality of Barra do Garças (MT), identified that the current economic development model in the

municipality is unsustainable. Likewise, this study can provide information to society and public authorities, guiding actions within the municipality.

Rodrigues & Rippel (2015), in their essay "sustainable development and measurement techniques", point out the lack of information as one of the main obstacles to the application of municipal development indexes. They emphasize that, in summary, development is economic, social, environmental, and institutional. The dynamism of this concept shows the importance of understanding development through the construction of measurement mechanisms.

Conclusions

Sustainable regional development is a fundamental issue that must be discussed in all cities, especially those in underdeveloped countries that need strategies to foster their development.

Comparing municipal indicators, with parameters stated by the current knowledge in documents made by scholars and organizations around the world, is a powerful tool for the transformation of societies and the environment and for reviving the hope of guaranteeing survival and for the well-being of future generations.

Within the parameters analyzed, the most developed municipalities in the region, as of general knowledge, are Juazeiro do Norte, Crato, Barbalha and Missão Velha in this order. Santana do Cariri is the municipality that needs more attention from the public authorities regarding the issue of sustainability. Overall, the variables that presented a critical situation were: Total population in permanent private households, Number of families benefited by Bolsa Família, Permanent crop area, Municipal finances, and GDP at current prices.

The selected data is sufficient to generate a more general picture of sustainability and regional development. However, due to the plurality of transitivity and the divergence of opinions surrounding the theme, this diagnosis does not necessarily determine a precise verdict on reality, but only from within the analyzed variables.

As a suggestion for future studies, it is possible to broaden the discussion and focus in specific variables, such as the relation between work and study for young people given the opportunities; the eradication of diseases or their presence in municipalities; the preservation of the fauna and flora, predominantly in the Chapada do Araripe, analyzing the engagement of the federal, state and municipal governments.

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