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Global Sustainability Index (GSI) construction: an evaluation tool for public policies directed at sustainable milk production in contemporary time

Construção de Índice Global de Sustentabilidade (IGS): um instrumento de avaliação para políticas públicas direcionadas a produção de leite sustentável na contemporaneidade

Contrucción del Índice Global de Sustentabilidad (IGS): herramienta de evaluación de políticas públicas dirigidas a la producción sostenible de leche en la contemporaneidad

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Abstract
Sustainable development refers to agricultural and industrial activities and the understanding of sustainability assumes greater complexity, which requires economic, social, environmental, institutional, technological, cultural and geographical emphasis to be considered, because what is sustainable for one region may not be for another. The article aims to show methodological criteria for the construction of the Global Sustainability Index (GSI) and its importance in the evaluation of public policies of sustainable milk production in contemporary times. The methodology considers the economic, social, environmental, institutional and technological dimensions, for better assessing the sustainable of economically active activities. The survey took place in Rondônia with 400 dairy farmers, where we obtained the GSI that achieved average sustainability, GSI = 0.42. The economic dimension presented an index of 0.52, being the most sustainable among the analyzed dimensions. Following the decreasing order, comes the social and environmental, with average sustainability of 0.44 and 0.41, and, with low sustainability, was the technological dimension, which showed an index of 0.39, and, the institutional with 0.32 decimal points of sustainability. This result indicates the need for political and technological efforts for better performance in the sector.
Keywords: Dairy farming; Sustainability; Index.

Resumo
Desenvolvimento sustentável se refere a atividades agropecuárias e industriais e o entendimento da IGSe assume maior complexidade, que exige ênfases econômica, social, ambiental, institucional, tecnológica, cultural e geográfica a serem consideradas, pois, o que é sustentável para uma região pode não ser para outra. O artigo objetiva mostrar critérios metodológicos para a construção de Índice Global de Sustentabilidade (IGS) e sua importância na avaliação de políticas públicas da produção de leite sustentável em épocas contemporâneas. A metodologia considera as dimensões econômica, social, ambiental, institucional e tecnológicas, por melhor avaliarem a sustentabilidade de atividades economicamente ativas. A pesquisa ocorreu em Rondônia com 400 produtores de leite, onde se obteve o IGS que alcançou sustentabilidade média, IGS=0,42. A dimensão econômica apresentou índice de 0,52, sendo a mais sustentável entre as dimensões analisadas. Seguindo a ordem decrescente, vem a social e ambiental, com sustentabilidade média de 0,44 e 0,41, e, com baixa sustentabilidade, ficou a dimensão tecnológica, que apresentou índice de 0,39, e, a institucional com 0,32 pontos decimais de sustentabilidade. Tal resultado indica a necessidade de esforços políticos e tecnológicos para melhor desempenho do setor.
Palavras-chave: Pecuária leiteira; Sustentabilidade; Índice.

Resumen
Desarrollo sostenible y se refiere a las actividades agrícolas e industriales, la comprensión de la sustentabilidad asume una mayor complejidad, lo que requiere un énfasis económico, social, ambiental, institucional, tecnológico, cultural y geográfico para ser considerado, porque lo que es sostenible para una región puede no serlo para otra. El artículo tiene como objetivo mostrar criterios metodológicos para la construcción del Índice Global de Sustentabilidad (IGS) y su importancia en la evaluación de políticas públicas para la producción sostenible de leche en la contemporaneidad. La metodología considera las dimensiones económica, social, ambiental, institucional y tecnológica, ya que evalúan mejor la sustentabilidad de las actividades económicamente activas. La investigación se realizó en Rondônia con 400 productores de leche, donde se obtuvo el IGS, que alcanzó la sustentabilidad media, IGS=0,42. La dimensión económica presentó un índice de 0,52, siendo la más sostenible entre las dimensiones analizadas. En orden descendente, viene la social y ambiental, con sustentabilidad media de 0,44 y 0,41, y, con sustentabilidad baja, la dimensión tecnológica, que presentó un índice de 0,39, y la dimensión institucional con 0,32 decimales de sustentabilidad. Este resultado indica la necesidad de esfuerzos políticos y tecnológicos para mejorar el desempeño del sector.
Palabras clave: Ganadería lechera; Sustentabilidad; Índice.

1. Introduction

The contemporary age begins in 1789, with the French revolution, and lasts to the present day. Period marked by profound transformations in the organization of society and conflicts of global magnitude. Among this, there is the sustainability of economically active activities that are based on responsible management of the environment, in order to develop more efficient productive methods, with increasing consumption of natural resources, but without compromising economic growth.

Although contemporary life coexists with globalized actions, which requires increasing integration between nations to the detriment of economic activities and increased competitiveness; which in turn forces changes in habits, induces the use of products and requires quality, price, productivity and constant production scale, causing economic and technological subordination of underdeveloped countries in relation to developed ones. However, this process requires technological changes at the world level that provide prosperity and regional development with environmental preservation.

The public policies established for the agricultural exploitation of the Brazilian Amazon, a region known as the "lung of the world", could not fail to contemplate the ecological sustainability of the region, considering that the practice of sustainability occurs in the long term, because it requires sensitization and change of habits at all levels of society, so that, these avoid risks to nature, ensure the conservation, preservation and maintenance of natural resources and the survival of the human race on the planet earth.

This importance has already been perceived by the world scientific community, which has disclosed and believed that sustainability to assort effects of conservation and environmental preservation requires that economic exploitation, in all respects, respect the limits and finitude of natural resources, and it is necessary to articulate human action, economic exploitation and the potentialities that the environment offers. For exploration focused so only on maximizing profits will be a paradox to the process of sustainability of the planet.

The term sustainability is relatively old and has its origin agriculture of this the nineteenth century, but only entered the discussion of modern ecologists in the 80's after the publication of the Report Our Common Future which brings in its content the concept of sustainable development.

For Ruscheinsky (2003) when it comes to sustainable development and refers to agricultural and industrial activities, the understanding of sustainability assumes greater complexity, which requires economic, social, environmental, institutional, technological, cultural and geographical emphasis to be considered, because what is sustainable for one region may not be for another. The sustainable in the legal Amazon differs from the cerrado, for example.

These reflections led Research Institutions and the Academic Community to notify that development cannot be thought of only as an economic factor, it would be necessary to broaden the vision for the sociological, environmental and technological institutional.

In the 20th century, post-war period, several environmental problems associated with air contamination, mercury poisoning, deficits in aquatic life and bird mortality occur at the world level. Bovo (2007) records some historical facts that draws the attention of the world community in the face of episodes such as air contamination in London and New York in the years 1952 to 1960, cases of mercury poisoning in Minamata and Niigata, in the years 1953 to 1965, the decrease in aquatic life in North American lakes, the mortality of birds from the side effects of DDT and other pesticides, and, the contamination of the sea caused by the sinking of the Torrei Canyon tanker in 1966.

With these events that occurred between the 1950s and 1960s, Research Institutions and the Academic Community began to notify that development cannot be thought of only as an economic factor, it would be necessary to broaden the vision for sociological and environmental. Along this path, Raquel Carson (1962) publishes "Silent Spring" - *Silent Spring* and Meadows (1972) "The Limits of Growth". These publications have become references, record an environmental framework and an ecological awakening for the various nations of the world. They warn, therefore, that development cannot be thought of in an isolated, limited way, and that it would be necessary to associate it with factors such as social and environmental.

The economic crisis of capitalism in 1970, due to low growth rates and high inflation. Triggered mainly by the oil crisis and the consequent rise in its price. It was realized that resources were limited, and that the pace of growth imposed so far would lead to the depletion of oil, or its obtaining in a non-economic way. These events have awakened to the finitude of natural resources and in 1972 the United Nations Conference on the Human Environment, known as the Stockholm Conference, takes place, where the concept of sustainability begins to be developed (Brito, et al., 2020). These events have awakened to the finitude of natural resources and from there the Stockholm Conference takes place in 1972. Where a new perception of development emerges giving rise to eco-development, whose concept was launched by Maurice Strong (1973), which referred to the judicious use of local resources without compromising the exhaustion of nature.

Sachs (1980) reworked the concept of eco-development and includes the understanding of sustainability based on the economic, social, ecological, spatial and cultural dimensions. With the concept of economic efficiency and resource management, reduction of social differences, understanding and intensification of the use of ecosystems compatible with their deterioration, as well as avoiding geographical concentration of populations, activities and power in search of a balanced relationship in the field – city, and that, respect the cultural, local and specific differences of all ecosystems.

With this the concept of ecodevelopment is being known as: endogenous development and depending on its own forces, submitted to the logic of the needs of the population as a whole, aware of its ecological dimension and seeking to establish a relationship of harmony between the man and nature (SACHS, 1980).

Furthermore, according to Sachs (2004), the objectives of development go beyond the mere multiplication of material wealth. Growth is a necessary condition, but by no means enough - let alone a goal in itself, to achieve the goal of a better, happier and more complete life for all.

The United Nations (UN) in 1983 created the World Commission on Environment and Development (WCED) and began to work on the theme of economic growth with conservation and environmental preservation. And in 1987 the World Commission on Environment and Development (WCED) published the Report Our Common Future (BRUNDTLAND, 1987). It was in this document that for the first time the concept of sustainable development was established, as: "development that meets the present needs, without compromising the capacity of future generations to meet their own needs".

From this report the term sustainability begins to be introduced in the discourse of development if "sustainable development" is being made, and the world no longer conceives the idea of growth, progress, based only on the economic advancement of society and an increase in Gross Domestic Product (GDP) and begins to understand the need to associate economic growth with the social, conservation and environmental preservation, and promote technological institutional strengthening.

At the United Nations Conference on Environment and Development (ECO-92), held in Rio de Janeiro in 1992, Agenda 21 was produced, a global document with global guidelines for sustainable development, that the concept of sustainable development has acquired its full dissemination and has been the axis of all discussions on sustainability to date (BOFF, 2012).

After ECO 92, major other events took place as Kyoto protocol in 1992, Rio + 10 in Johannesburg and Rio +20 in Brazil in 2012, which resulted in the document "The Future We Want". Certainly, these events played a fundamental role in the popularization and dissemination of what sustainable development means.

According to Cândido et al. (2010), the concept of sustainable development has been permanently reconstructed due to the evolution and importance of this theme. However, its indiscriminate use and with little criteria make it difficult to understand while it opens the way for different meanings. Buarque (1999), says that development with the environmental, social and economic aspects must be based on ethical assumptions that require two interconnected solidarity's: the synchronic - current generation, and the diachronic - future generations. And finally, Siche et al. (2007, p.140) cite that the word "sustainability comes from Latin s*ustentare* which means to sustain, sustain, support, keep in good condition, maintain, resist. In this way, sustainable is all that is capable of being supported, maintained."

Sustainability is the magic word of today, considered as a term not restricted to a few cases that inspires dynamic perspective and is not characterized as something static. It consists of a very broad concept, but the pure and simple meaning of the word sustainable is what sustains someone or something, which, for which one should pay close care (RUSCHEINSKY, 2003).

In present times, an example of the applicability of sustainable processes is the practice of the Green Economy that represents a change of mentality and cultural profile of society in the search for sustainable procedures.

According to the United Nations Environment Program (UNEP, 2011) the Green Economy is an economic model that results in improved human well-being and social equality, while significantly reducing environmental risks and ecological scarcity. It has low carbon emissions, is efficient in its use of resources and is socially inclusive. Income and employment growth must be driven by public and private investments that reduce pollution, increase energy efficiency and prevent the loss of biodiversity and ecosystem services. It should be a dynamic of the economy that should happen through the expansion of sectors with low environmental impact, such as encouraging actions to sustainable agriculture.

The Green Economy therefore refers to activities of rational and equitable use of so-called socially inclusive natural resources, which emit low rates of greenhouse gases, these so-called decarbonized economies, and their activities harm the environment minimally. It is an economy supported by three strategies: i) reduction of carbon emissions; (ii) greater energy efficiency; iii) prevention of biodiversity and ecosystem services (UNEP, 2011).

It is verified that the concept of "development" and subsequently "sustainable development" depends on the understanding of several segments: economic, social, ecological, spatial, cultural, institutional technological policy, without this understanding, will be compromised, incomplete, to the time when, it should not be seen in a fragmented way, considering that these segments are configured in the form of inherent dimensions and interdependent among themselves in the search for understanding sustainable development.

On the discussion of the dimensions of sustainable development there are several authors from different backgrounds who write on the subject. This is a complex web of understanding, but with the common intention of reaching a unique and balanced understanding in favor of the sustainability of the planet and humanity. According to Froehlich (2014) the authors differ when it comes to the types of dimensions that make up sustainable development, but aim for the same focus: *the sustainability of the planet earth and the peoples that inhabit it*.

Table 1, composed of authors and dimensions, makes a synthesis that emphasizes a global and organizational context of the dimensions. In this context, all authors conceive the importance of the economic, social and environmental or ecological

dimension for the balance of sustainable development. Three of these highlight the importance of cultural and two of space, politics and institutional. But all converge to a single goal, "sustainability on planet Earth."

Table 1 - Authors and Types of Dimensions of Sustainability.

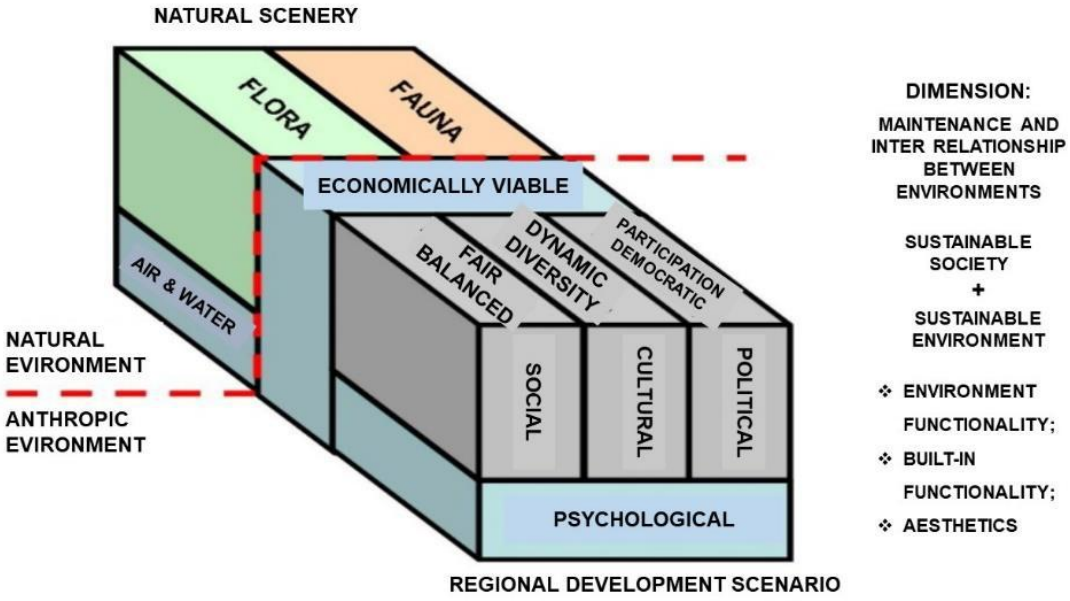
Authors	Dimensions	Emphasis
Sachs (1993)	Economic, Social, Ecological, Cultural and Spatial	Global context
OECD (1993)	Economic, Social, Environmental and Institutional	Global context
Elkington (1997)	Economic, Social and Environmental	Organizational context
Spangenberg e Bonniot (1998)	Economic, Social, Environmental and Institutional	Organizational context
Catalyze (2003)	Economic, Social, Environmental, Cultural, Spatial, Political and Ecological	Global context
Pawlowski (2008)	Economic, Social, Environmental, Moral, Legal, Technical and Political	Global context
Werbach (2010)	Economic, Social, Environmental and Cultural	Organizational context

Cast iron: Froehlich (2014).

Froehlich (2014, p.161) says the following: "it is up to organizations and academics to reevaluate the need to include the other dimensions in organizational strategies and models for measuring results, since both are interconnected and interdependent and contribute to the pursuit of sustainability". Froehlich (2014) quotes Van Bellen (2008) as saying: making progress towards sustainability is a choice of society, organizations, communities and individuals, and there should be a great involvement of all segments.

Following this dynamic Mendes (2009) cites Sachs (1993) and makes the description of two scenarios: 1) The Natural Scenery represented by the ecological and natural environment – water, air, flora and fauna; 2) The Anthropoid Scenario represented by the anthropic environment – economic, social, cultural, political and psychological, which was altered by man in the construction of regional development. These topics of interest to humanity and the planet Sachs called them "dimensions of sustainable development", as shown in Figure 1, elaborated by Mendes (2009).

Figure 1. Dimensions of Sustainable Development.



Source: Mendes (2009).

For the Brazilian Institute of Geography and Statistics (IBGE, 2010), this new understanding of development extrapolates the domain of the economy by integrating the diverse aspects of sustainability, relying on new paradigms that can culminate in sustainable development capable of achieving the full sustainability of nations based on the systemic and balanced exploitation of economic dimensions, social, environmental and institutional.

The understanding of IBGE (2010), is that Sustainable Development that can achieve full and balanced sustainability must be made up of four dimensions: Economic, Social, Environmental and Institutional and characterizes them as follows:

1) Economic Dimension – Understands the macroeconomic and financial performance of the country through the use and depletion of natural resources, energy, as well as the production and management of waste.

2) Social Dimension – Understands the human social fabric with regard to meeting their needs, improving the quality of life and social justice.

3) Environmental Dimension – Understands the preservation and conservation of natural resources through their use rationally and without degrading the environment, essential for the current quality of life and future generations.

4) Institutional Dimension – Comprises the political orientation, capacity and effort expended by governments and society in implementing the changes required for the effective implementation of sustainable development.

In this dynamic of construction and evaluation of the sustainable development of economically active activities, Siche (2007), points out that, indexes or sustainability indicators constitute valid and important alternatives to describe the sustainability of production systems. Therefore, to evaluate sustainable development in its various dimensions, studies were developed in the sense of oncoming indicators and indexes that allow the measurement and monitoring of the activities in a unified, global way, facilitating the understanding of evaluations, analysis and feasibility of processes in their various dimensions.

The indiscriminate use of natural resources and the extractive production of livestock indicates the need to better evaluate this productive segment. Also, because the evaluation of dairy cattle at the level of Brazil has been based on different aspects of its reality, but independently, contemplating economic analysis, productivity, genetic quality of breeds, contribution

to national and regional GDP. However, social, environmental and institutional technological aspects, which are of great relevance to the current world, have been considered in isolation or irrelevant.

As well as the absence of management instruments that assess the level of sustainability of milk production and socioeconomic, environmental, institutional and technological impacts resulting from the disorderly implementation of agricultural policies, a situation that characterizes the sector's problem. And the research conducted, from which this article was extracted, seeks to answer the level of sustainability of dairy cattle in Rondônia, an experience that can be applied and deepened in other Brazilian realities.

Therefore, it is in this context that the article is presented that aims to show methodological criteria for the construction of a Global Sustainability Index (GSI) that better evaluates the level of sustainability of the dairy activity, producing reflections that guide public policies on milk production in contemporary times, enabling the generation of employment and income in an economically profitable way, socially just, environmentally correct, institutionally organized, competitive and technological innovation. The methodological procedures for the construction and calculation of the Global Sustainability Index (GSI) composed of economic, social, environmental, institutional and technological indicators, extracted from the thesis "Evaluation of Dairy Cattle of Rondônia".

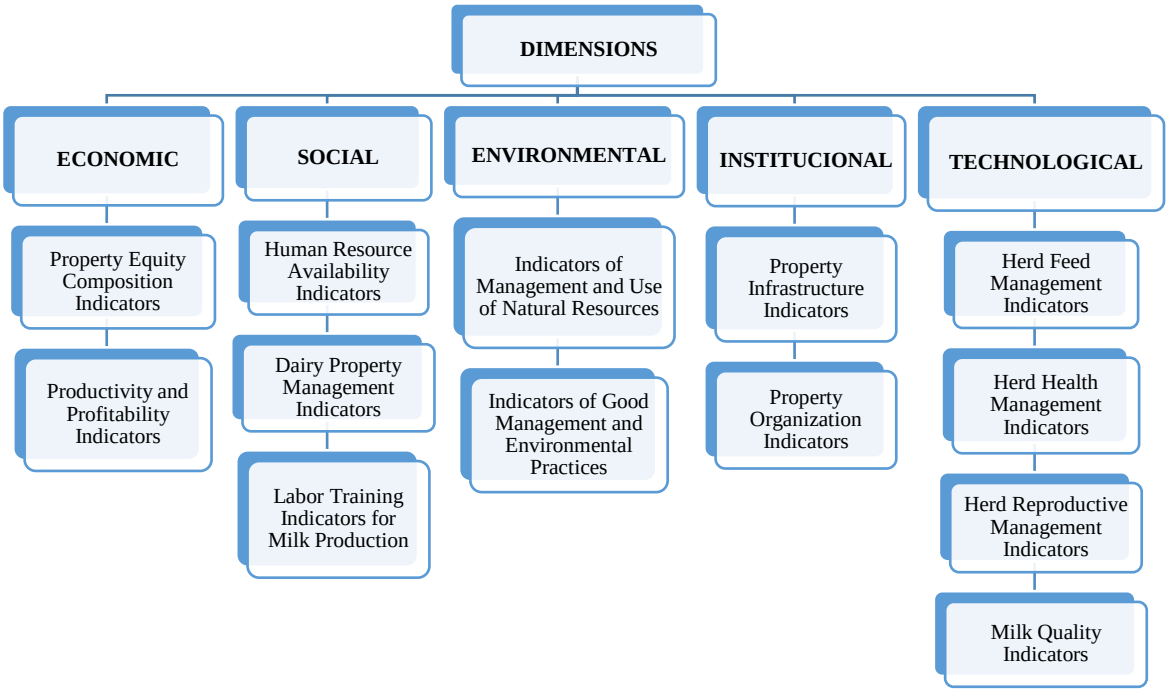
2. Methodology

The methodological formulation used for the construction of the Global Sustainability Index (GSI) of dairy cattle in Rondônia follows the precepts of the model adopted by the Brazilian Institute of Geography and Statistics (IBGE, 2010), where the aspects worked enable the analysis and evaluation of brazil's development in the economic, social, environmental and institutional dimensions. It also follows in part the methodology of González and Carvajal (2002). Both references consolidate the choice of dimensions and the way to evaluate the degree of sustainability of partial and global indices.

The research took place in the state of Rondônia composed of 52 municipalities, of which 20 were visited, the municipalities that produce 2% or more of the total milk produced in the State, which represent a sample of 38.5% of the existing municipalities. Distributed in these municipalities, it is estimated that there are approximately 40,000 dairy farmers in the State, in these, 400 qualitative and quantitative questionnaires were randomly applied, representing 1% of the number of milk producers in Rondônia.

For data processing and validation of the studied sample, the Statistical Package for the Social Sciences (SPSS) statistical program was used, which increased the reliability of the research and the selected indicators. In the performance of this procedure it was necessary to transform the answers extracted from qualitative and quantitative questionnaires into numbers. Where the indicator was 1 (it presents the itis of the indicator surveyed) and the other answers remained zero (does not present the itis of the indicator surveyed).

Figure 2. Chosen Aspects for the Methodological Sequence and Composition of Sustainability Dimensions.



Source: Author of the Research (2017).

A total of 123 indicators were established as follows: economic dimension 14; social 22; environment 13; 27 and technological 47. These indicators express the understanding of their respective dimensions, a fact that made it possible to construct the index of each dimension, called a partial or dimensional index, and the sum of these composed the GSI of dairy cattle in Rondônia. See figure 2, the layout of the dimensions and the composition of their respective indicators.

The set of indicators used to characterize milk production with environmental sustainability bias was submitted to descriptive analysis and Cronbach's Alpha test (PESTANA; STUTTERER, 2008). This test signals the internal consistency of the data, by mediating the correlation of the 123 indicators distributed in the 5 dimensions of sustainability and categorized in a Likert Scale (VIEIRA; DALMORO, 2008; DALMORO; VIEIRA, 2014), which were evaluated by experts, [1) awarding a score from 1 to 5, according to the importance (technological weight) of the indicator in the context of milk production work.

Cronbach's Alpha value varies between 0 and 1 and should be considered satisfactory when above 0.70. In this case, the value found was 0.765, demonstrating valid, satisfactory and good consistency of the data surveyed.

For each producer, the product of the evaluation was determined, as being, the value of each indicator (0 or 1) times the weight assigned by the specialists. The sum of the behavior of all producers results in the dimension note, according to the following descriptive formula.

$$D_{ij} = \sum_{k=s_j}^{t_j} N_{ik} \cdot P_k$$

Where:

D_{ij}: is the index of producer i in dimension j;

$N = [N_{ik}]$: is the evaluation matrix (producer score i on indicator k);

P_k: represents the weight of the importance of the k indicator within the dimension to which it belongs.

$Para\ j = 1, s_j = 1\ e\ t_j = 14$ (Dimension 1: economic);

$Para\ j = 2, s_j = 15\ e\ t_j = 36$ (Dimension 2: social);

$Para\ j = 3, s_j = 37\ e\ t_j = 49$ (Dimension 3: environmental);

$Para\ j = 4, s_j = 50\ e\ t_j = 76$ (Dimension 4: institutional);

$Para\ j = 5, s_j = 77\ e\ t_j = 123$ (Dimension 5; technological).

The Dij represents the value of the sustainability parameter achieved by producer i in dimension j. The sum of all dij, in a dimension j, gives the value of sustainability of dimension j. Thus, inferences can be made for each producer and for all of them in a dimension.

To calculate GSI, simply determine the simple arithmetic mean of the five dimensions, as described below:

$$IGS = \frac{\sum_{i=1\ldots n, j=1\ldots m}^{n=400\ m=5} Dij}{m} X\ 100$$

The sustainability levels of the GSI were constructed from the relationship between the General Average (AverageG) and the Standard Deviation (DesvP). As shown in table 2 below.

Table 2. Sustainability Criteria and Form of Evaluation of Dimensional Indices (ID).

Criterion	Classification	Sustainability Level
GSI>AverageG+2DesvP **GSI**>0,547420193	Excellent sustainability standard	5
AverageG+1DesvP<**GSI**<AverageG+2DesvP 0,483903785< **GSI**<0,547420193	Good sustainability standard	4
AverageG-1DesvP<**GSI**<AverageG+1DesvP 0,356870969<**GSI**<0,483903785	Medium standard of sustainability	3
AverageG-2DesvP<**GSI**<Average-1DesvP 0,293354562<**GSI**<0,356870969	Low sustainability standard	2
GSI<AverageG-2DesvP **IMS**<0,293354562	Poor sustainability standard	1

Source: Author of the Research (2017).

The classification criteria in excellent, good, medium, low and poor pattern of sustainability, follow the following methodological dynamics: **Level 5** (AZUL), considered excellent standard of sustainability, corresponds to a value higher than 0.54 decimal points or 54% of performance, which is equivalent to the general average found plus 2 (two) standard deviations, and the closer it approaches 1 or 100% more sustainable. **Level 4** (GREEN), considered a good sustainability standard, corresponds to a value less than 0.54 and greater than 0.48 decimal points, i.e., lower than the general average plus 2 (two) standard deviations and greater than the mean plus 1 (one) standard deviation. **Level 3** (YELLOW), considered a mean standard of sustainability, corresponds to a value less than 0.48 and greater than 0.35 decimal points, i.e., lower than the general average plus 1 (one) standard deviation and greater than the mean minus 1(one) standard deviation. **Level 2** (ORANGE YELLOW), considered a low standard of sustainability, corresponds to a value less than 0.35 and greater than 0.29 decimal points, i.e., lower than the general average minus 1(one) standard deviation and greater than the mean minus 2 (two) standard deviations. **Level 1** (RED), considered a poor sustainability standard, corresponds to a value less than 0.29, which is equivalent to the general average minus 2 (two) standard deviations, and the closer it approaches 0 (zero) the less sustainable it will be.

This classification of sustainability levels was validated by discriminant analysis. To Khattree and Naik (2000), discriminant analysis studies the characteristics of a population by mediation of two or more classes, considering the separation

of the object into parts and its ability to explain. In the present case, 5 classes of sustainability levels were used. The discriminant analysis consisted of two random tests based on the total number of selected producers. In the first, 274 producers were selected and the level of hit was 90.87% (249 out of 274) and in the second was 70.63% (89 of 126). The total efficiency of the analysis was 84.5%.

3. Results and Discussion

The dairy cattle of Rondônia resulted in the five dimensions considered, the values shown in table 3.

Table 3 - Dimension Performance Indexes.

Dimension	Index	Classification	Level
Economic Dimension	0,524918	Good sustainability standard	4
Social Dimension	0,443069	Medium standard of sustainability	3
Environmental Dimension	0,417758	Medium standard of sustainability	3
Institutional Dimension	0,3201550	Low sustainability standard	2
Technological Dimension	0,3960377	Medium standard of sustainability	3

Source: Survey Data (2017).

The economic dimension comprises the financial and political dynamics of rondônia's dairy activity with a sustainable vision of the state's milk production systems. In this dimension, it was observed Good Standard of Sustainability, level 4, reaching an average of 0.524 tenths or 52% of performance, being the best level enter and the five dimensions studied, showing positive contribution to the economic segment of dairy cattle in Rondônia. The level of education and access to technical assistance are determining factors to increase the economic-ecological efficiency of properties of those who perform livestock activities in municipalities in the Amazon (Silva et al., 2022).

The Social Dimension of production, which comprises the human social fabric of milk, as a producer and family, had quality of life and social justice, an index in the order of 0.443 sustainability standards or 44% of performance, classifying itself as Medium Sustainability Standard. , level 3, performing below an economic dimension, but in context, meets the second level of sustainability among the five best analysis dimensions. According to Silva et al (2022), they also prove that the social dimension as a level of education, where educational policies are being improved, which promotes a more sustainable environment in agricultural practices.

For the environmental dimension that represents the preservation and conservation of natural resources through the rational use of the environment, essential for the quality of current and future generations, you see a performance index of 0.417 tenths or 42%, classified with Medium Standard sustainability, Level 3. With this performance, the dimension remains at the third level of sustainability in relation to the five dimensions studied. Abrahão and Natel (2022), working with environmental sustainability indexes, considered the parameters of water quality and permanent preservation areas (APP) in different regions of Brazil, highlight that this index is sufficient to classify the level of sustainability of the property and provide the owner with sufficient information about their production methods and whether they are good or bad.

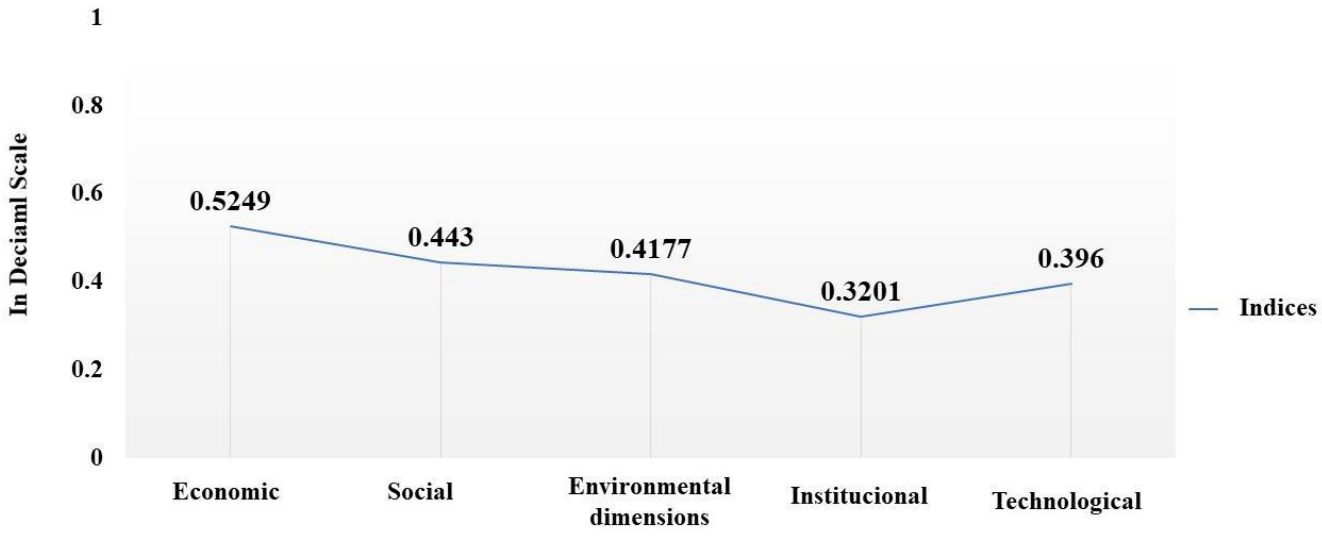
The institutional dimension comprises the political orientation, capacity and effort strapped by governments and society in the implementation of the changes required for the effective implementation of sustainable development, in general and sectoral, from the improvement of milk production activities. In this composition the performance index of the dimension was 0.320 decimal points or 32%. With this performance, the dimension had the worst classification among the dimensions

researched, being classified with low standard and framed in the level 2 of sustainability. Access to public policies such as the National Program for Strengthening Family Agriculture (NPSFA) can provide an increase in agricultural production and make it more sustainable (Pereira, 2022).

Finally, the technological dimension that comprises the political orientation, capacity and effort released by governments and society in the implementation of research, development and technological innovation required for effective change of productive scenarios. The performance of producers in this dimension led to the level 3 of sustainability, considered a standard medium, with a performance index of 0.396 tenths or 39.6% of sustainability, presenting the second worst performance among the dimensions surveyed. In contrast, the results obtained by Rempel et al. (2022), pointed out that the indicator of technological evolution in milk producing properties in Taquari/RS was classified as "excellent" proving that the adoption of technologies can promote more sustainable production. The technological dimension was superior only to the institutional dimension that presented the lowest performance index of the activities developed.

In summary, figure 3 below shows the partial composition indices of the Global Sustainability Index (GSI), where the different performances of the studied dimensions are expressed.

Graph 1. Partial composition indices of the Global Sustainability Index (GSI).



Source: Survey Data (2017).

As can be seen from the Global Sustainability Index (GSI) of Dairy cattle de Rondônia, it was constructed by the partial indexes of the economic, social, environmental, institutional and technological dimension that participated positively or negatively for the level of sustainability of the activity. See table 4, the calculation and contribution index of each dimension in the construction of GSI.

Table 4 - Calculation of the Global Sustainability Index (GSI).

Dimensions	**Indexes**	$IGS = \frac{\sum_{i=1\ldots n, j=1\ldots m}^{n=400,\ m=5} Dij}{m} X\ 100$	**GSI (%)**
Economic	0,5249	0,42038 x 100	42,04
Social	0,4430		
Environmental	0,4178		
Technological	0,3960		
Institutional	0,3202		

Source: Survey Data (2017).

The GSI of 42%, is classified as average standard of sustainability, level 3, understood as an area of shading, meaning that the dairy cattle of Rondônia is not in the field of good and excellent sustainability, because the activity will be much more sustainable the more the index approaches 1 or 100%. The result requires alertness and vigil of activities, considering that at any time it can reach the low or terrible level of sustainability, making the extractive activity and characterizing it as unfavorable, and should review all the actions of the segment.

In this construction of the GSI, the economic dimension made the best contribution among the five dimensions studied. The following contributions come from the social, environmental and technological dimension with the second, third and fourth participation. Unlike these, the institutional dimension presented the worst participation and consequent contribution, influencing for an GSI of Medium Sustainability Standard.

Although the economic area has made a good contribution, it has not yet been enough for GSI to achieve a good or excellent standard of sustainability. These performance levels correspond to the determination and involvement of each producer in the execution of the daily activities of the production unit, thus enabling the measurement and classification of the level of sustainability of the producer in rationing the overall average of the sample studied. See table 5 below for the level of sustainability of producers in the general context of the 400 properties surveyed.

Tabela 5 – Producers' Performance in the Composition of the Global Sustainability Index (GSI).

Criterion	**Classification**	**Number of Producers**	**%**	**Sustainability Level**
X>AverageG+2S **X**>0,547420193	Excellent sustainability standard	18	4,5	5
AverageG+1S<**X**<AverageG+2S 0,483903785< **X**<0,547420193	Good sustainability standard	39	9,75	4
AverageG-1S<**X**<AverageG+1S 0,356870969<X<0,483903785	Medium standard of sustainability	289	72,25	3
AverageG-2S<**X**<Average-1S 0,293354562<**X**<0,356870969	Low sustainability standard	51	12,75	2
X<AverageG-2S **X**<0,293354562	Poor sustainability standard	3	0,75	1
Total		400	100	
GSI	Medium standard of sustainability	0, 42038		3

Source: Author of the Research (2017).

The general classification of sustainability standards placed in table 5 shows that 18 and 39 producers of the total surveyed achieved excellent and good sustainability standards, categories of levels 5 and 4, representing only 4.5% and 9.75% of the sample surveyed, respectively. Whereas 54 producers were classified at level 2 (51) and 1 (3), low and poor sustainability

standard, representing 13.5% of the total producers. The vast majority were at level 3, the average sustainability standard, with a total of 289 producers or 72.25% of the 400 producers interviewed.

The analysis presented through the constructed methodology shows the need for actions that promote the level of organization and infrastructure of producers, as well as, technological adoption, activities less aggressive to the environment, qualification of labor, diversification of production and adding value to the product, among other measures, which should be implemented to improve the institutional, technological, environmental and social conditions of producers involved in milk production in Rondônia to enhance the sustainability of the productive segment.

4. Conclusions

The Global Sustainability Index (GSI) found for evaluation of the dairy segment of Rondônia was 42%, this allows us to conclude that the development of Dairy Cattle in the State is of medium sustainability standard, having exceeded only the low and lousy standard, levels 2 and 1 of sustainability, requiring institutional strengthening and technological innovation so that it can reach levels 4 and 5, considered good and excellent standards of sustainability.

The good economic sustainability and the average environmental conservation of the activity express the perspective of capitalist development with accelerated growth of cattle culture in the State, where financial capital is prioritized to the detriment of Natural Capital, generating environmental impacts. This evidences the progress of the economic segment in relation to the indiscriminate use of the environment, reflecting the disorganization of the process of occupation and colonization of the State, which occurred randomly, without planning and public policies that directed an adequate and rational exploration respecting the finitude of natural resources. It lacked knowledge about the rational use of the environment, without causing waste and abuse, which guides the present generations to preserve the environment so as not to compromise the ability of future generations to meet their own needs.

Perhaps, this is one of the biggest problems of cattle culture when explored at random, without planning and correct management of herds and natural resources, made extensively, using large areas of pastures with felling of native forest, destruction of the forest, ecosystems and instability of conservation and environmental preservation.

Therefore, public and private actions are necessary that involve, in addition to the institutional and technological dimensions, which are being the most sacrificed in the segment, but also, the environmental and social, with the conservation and preservation of the Amazon biome and quality of life of present and future generations. As for the economic, the financial flow and viability of the activity should be maintained without harming the intrinsic relationship between the other existing dimensions.

Therefore, the global sustainability index represents an essential tool for evaluating the sustainability of dairy activities in the Amazon biome. The outcomes from the GSI evaluation may provide reliable information to run public policies for dairy activity. Although its importance for dairy farmers and for the sustainability of the activity, further studies should be performed to verify the real impact of the use of GSI in the dairy industry.

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