LOCAL ECONOMIC DEVELOPMENT INDEX FOR BRAZILIAN MUNICIPALITIES

Índice de desenvolvimento econômico local para municípios brasileiros

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Resumo: O artigo objetiva constituir um novo índice capaz de medir o nível de desenvolvimento econômico dos municípios brasileiros. Foi escolhido um conjunto de variáveis, representando em parte as dimensões econômica, social, demográfica e ambiental, observando os aspectos rurais e locais dos municípios. Este índice foi concebido por meio de análise fatorial (componente principal), com dados do Censo Agrícola e Demográfico do IBGE, IPEADATA, DATASUS, o Atlas do Desenvolvimento Humano do Brasil, e fornece uma alternativa ao IDH-M e ao IFDM-G, complementando-os, para explicar o hiato de desigualdade entre as regiões brasileiras com maior fidedignidade.

Palavras-chave: Desenvolvimento Econômico Local, Desenvolvimento Rural, Ruralidade, Análise Fatorial. Índice.

Abstract: *The article aims to constitute a new index capable of measuring Brazilian municipalities' level of economic development. A set of variables were chosen, partly representing the economic, social, demographic, and environmental dimensions, observing the municipalities' local and rural aspects. This index was conceived through factor analysis (principal component), with data from the IBGE Agricultural and Demographic Census, IPEADATA , DATASUS , the Human Development Atlas of Brazil, and it provides an alternative to the HDI-M and IFDM-G , complementing them, to explain the inequality gap between Brazilian Regions with greater reliability.*

Keywords: *Local Economic Development, Rural Development, Rurality, Factor analysis. Index.*

Resumen: *El artículo pretende constituir un nuevo índice capaz de medir el nivel de desarrollo económico de los municipios brasileños. Se ha elegido un conjunto de variables que representan en parte las dimensiones económica, social, demográfica y medioambiental, observando los aspectos rurales y locales de los municipios. Este índice fue diseñado mediante análisis factorial (componente principal), con datos del Censo Agropecuario y Demográfico del IBGE, IPEADATA, DATASUS, el Atlas de Desarrollo Humano de Brasil, y proporciona una alternativa al IDH-M y al IFDM-G, complementándolos, para explicar la brecha de desigualdad entre las regiones brasileñas con mayor fiabilidad.*

Palabras clave: *Desarrollo económico local, Desarrollo Rural, Ruralidad, Análisis Factorial. Índice.*

INTRODUCTION

In the utilitarian approach, the level of economic development or welfare enjoyed by individuals is determined by the fulfillment of desires in the act of consuming goods and services. Thus, the variables related to income become relevant as they are directly correlated to consumption (SEN, 2010). Unlike this approach, which associates welfare and consumption, according to Stiglitz, Sen and Fitoussi (2009), well-being is related to the capacity, or functionality, obtained through the good or service. These authors point out that well-being stems from the individuals' freedom to access goods and services, and thus expand their respective capacities to function in specific ways and not just consuming products. Following this line of thought, freedom and well-being are related. Therefore, the well-being of individuals is limited by the ability of goods and services to provide them with a particular way of being or doing.

As a result, in agreement with Sen (2010), it is possible to indicate a set of functions that may provide well-being to individuals, such as the degree of exposure to mortality, access to adequate food, educational and health services, among others. Therefore, the idea of well-being, according to this perspective, surpasses that described by utilitarianism and helps to outline the guidelines for the constitution of the human development index (HDI) (UNDP, 2013).

In a guideline similar to that used to prepare the HDI, this article considers, in addition to the dimensions present in HDI, other scales of economic development (demographic and environmental). Stiglitz, Sen and Fitoussi (2009); Barbier (2015); Jackson (2017); and Fernández Domínguez and Gómez Hernández (2019), consider these extra dimensions crucial elements to estimate indexes that intend to measure, with the greatest possible completeness, the degree of economic development of geographical areas.

In practice, Brazilian authors such as Melo and Parré (2007); Stege and Parré (2011); Melo and Silva (2014); and Vidigal, Amaral, and Silveira (2012), performed factor analysis (principal component) using variables that were intended to measure, approximately, the participation of those dimensions, or part of them, to elaborate rural or economic development indexes. There are also international references, such as Prieto-Lara and Ocaña-Riola (2010); Michalek and Zarnekow (2012); and Pagliacci (2017) that carried out similar analyzes, each in their geographic space, using the concept of rurality to assess the level of rural development and, therefore, measure the positive influence of these particularities for the economic development of the regions.

Within this logic, the works mentioned above guided the objective of this article. Because the particularities present in the rural environment, which have gained emphasis, are probably directly related to the economic development process of the municipalities, which, according to Alves et al. (2007); Rosa and Ferreira (2010); and Pagliacci (2017) runs through a rural-urban *continuum*.

Considering that such process occurs through the *continuum*, mentioned previously, the present article aims to produce a new index of local economic development (LEDI), capable of capturing the characteristics of the new rural development paradigm, which overlap and interconnect local specificities to measure the level of economic development of 5560 Brazilian municipalities[1]. To

[1] In agricultural and rural development, the quantitative aspect refers to the increase in wealth, income level, and goods or services availability. The qualitative aspect includes the achievement of social well-being, creation of employment opportunities, sustainable development, and improvement of the quality of life (BALDANOV; KIMINAMI; FURUZAWA, 2020; OECD, 2016).

achieve this objective, factor analysis (principal component) was chosen, based on data from the IBGE Agricultural (2006) and Demographic (2010) Census, DATASUS (2010), the Atlas of Human Development in Brazil (2013), and IPEADATA (2010)[2].

In summary, the LEDI innovates by being, firstly, a pioneer in evaluating based on a wide range of variables (55), and, secondly, for allowing the classification and comparison of all Brazilian municipalities (5560) in 2006/10. It is based on their intrinsic characteristics, listed through factor analysis, emphasizing rural particularities combined with local aspects to capture municipal performance regarding the level of economic development and, therefore, in complementarity with the indexes HDI-M and IFDM-G, providing a measurement instrument with greater explanatory power to analyze inequalities between Brazilian regions.

Finally, in addition to this brief introduction, the article contains four more sections, a theoretical framework, the methodology used to build the index, the discussion of the obtained results, and main conclusions.

2 – THEORETICAL REFERENCE

Santos (2014) considered urbanization one of the main transforming phenomena in the relationship between countryside and city, highlighting the degree of intensity by which this phenomenon has occurred over the last century. Given its accelerated degree, urbanization has been absorbing and transforming new rural plots using new technologies and by the growing demand for natural resources to produce various goods of origin, mainly foodstuff (SPOSITO, 2010). This observation allows us to infer that, as Santos (2014) observed, urbanization can be considered both a result and a condition of the capital diffusion process. Therefore, the interaction between economic activities, social and cultural relations, and their results, regarding socio-environmental impacts, are more often combined in urban areas.

At the same time that the rapid urbanization process took place, which started in the 19th century and was engendered by the Industrial Revolution, the need to differentiate the countryside and the city was transformed. In this context, two aspects have been configured to differentiate the rural and urban spheres, namely: the urban-rural dichotomy and the urban-rural *continuum*. The urban-rural dichotomy sought to establish the rural and the urban as autonomous and opposite poles, in addition to being well-demarcated and excluding each other. Such division, originated by social transmutations, produced two conceptions within this approach; one, considered anti-urban, idealized rural life and criticized the transformations resulting from the dissipation process; the second, called pro-urban, observed the urbanization process as an engine for society's innovation, modernization, and progress (LAURENTI 2014; CARNEIRO; SANDRONI, 2019; NAVARRO, 2019).

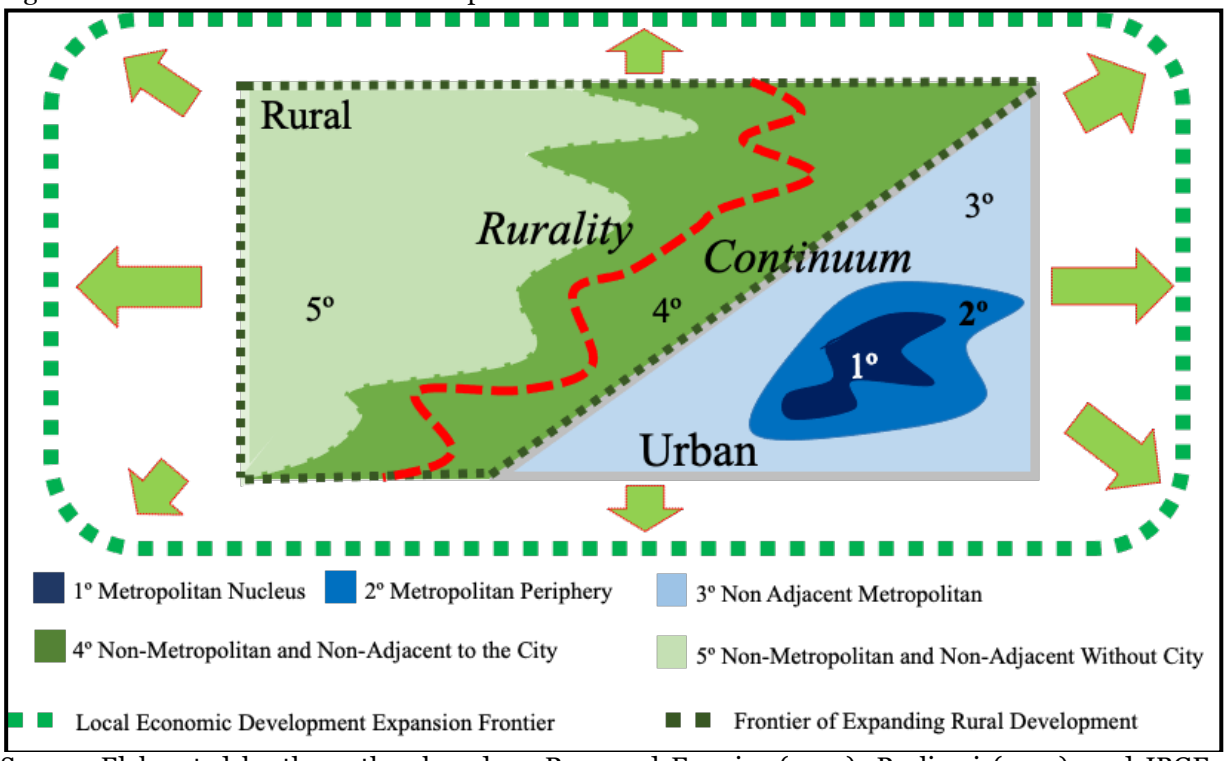
The other approach, called the economic development process takes place through a rural-urban *continuum*, refers to the idea that there is certain contiguity between rural and urban settlements, and there are difficulties in clearly demarcating these places. Thus, it is plausible to consider that rural and urban

[2] At the time of construction, an outdated database was chosen because there was no provision for publication of the new Population Census of 2020. Thus, as two Censuses are necessary for analysis, it was decided to use the data from the Agricultural and Livestock Census of 2006 and the 2010 Population Census.

spaces are, in most cases, intricate and overlapping (ROSA; FERREIRA, 2010; PAGLIACCI, 2017). Accordingly, Alves et al. (2007) argue that the regional *continuum* is defined by employing a locational pattern in which the spatial process of uninterrupted economic development occurs; in other words, this process occurs contiguously and gradually. Therefore, this *continuum* is characterized by a related grouping in which the positions of productive activities change due to transformations in localities and the effects of centripetal and centrifugal forces on local spatial economic performance.

Figure 1 is a theoretical representation of the level of economic development evolution, of a hypothetical region, where different rural and urban areas can interact, without demarcated borders, and where the representative economic sectors can be present in one, the other, or in both areas, generating positive effects on the economic development evolution in the region as a whole. Additionally, in agreement with Graziano da Silva (2002), it is worth mentioning that the "new rural" does not result from an unfolding of the urban areas adjacent to them; the transformations co-occur in areas previously defined as agricultural and in medium and small municipalities. Furthermore, the studies carried out on the demographic density and its respective location have not yet captured the progressive heterogeneity of contemporary population patterns. Therefore, the choice of municipalities as a geographical unit seems to be the most appropriate way to identify the concept of a "rural-urban *continuum*." Such perspective influences the set of data to be selected and, consequently, on the rigor of the analysis to be performed.

Figure 1 - Influence on economic development: rural-urban *continuum* interaction



Source: Elaborated by the author based on Rosa and Ferreira (2013); Pagliacci (2017); and IBGE (2017).

Thus, instead of seeking to delimit spaces in rural or urban areas, given the complex task of occupational and territorial dissociation, we seek to capture

aspects of rurality and how such aspects can affect the level of local economic development in geographical areas. Some attempts in this regard have been made.

In Brazil, Graziano da Silva (2002) characterized the new rurality through the sectoral composition of economic activities. He described them as: 1st) Modern agriculture based on commodities and closely connected to agroindustry. This connection tends to make rural development more dynamic, in complement to the argument of Pedroso and Navarro (2020) when discussing the transition process from a "rural agrarian Brazil," from the past, to a "rural agricultural Brazil" directed, progressively, by strictly economic-financial forces; 2nd) A range of agricultural activities related to new specific market niches; 3rd) A range of non-agricultural occupational activities associated with leisure, housing, various industrial activities, and the provision of services; and 4th) A set of subsistence activities, in general, through primitive agriculture and small animal breeding to maintain a relative overpopulation in rural areas, and an army of landless workers, without fixed employment, and without qualification, the "*sem-sem*" (without-without), that is, those excluded from the process generated by agribusiness.

This new Brazilian rurality's characterization brings up new elements to compose the idea of rural development, making it more complex and dynamic. In this direction, the OECD (2016), and Baldanov, Kiminami and Furuzawa (2020) present the new rural development paradigm in which women's participation and governance capacity are crucial. In this new conception, rural areas are interconnected with cities and regions through multisectoral economic relations (agriculture, agribusiness, services, rural tourism, information and communication technology, biofuels), and multi-agent (public and private). Moreover, the rural development process is adapted to each region's specific contexts (economic, social, environmental, demographic, and institutional) and local and national interests, without losing sight of the intention to optimize synergies and promote productive growth.

Therefore, this new paradigm of rural development tends to combine with the designation of the rural-urban *continuum*; the particularities of the new paradigm also do not enable a rigid territorial demarcation between rural and urban, but they collaborate in helping to choose the variables capable of observing, to some degree, the rural characteristics present in the geographical areas. In complementarity, the idea of rurality proposed by Somerville and Bosworth (2014)[3] was integrated, to improve the selection process of the variables representing the rural aspects.

The concept of rurality theory is based on three interrelated aspects. First, the functional aspect acts as detailed identifier of the concept, for example, the environmental qualities, the lifestyle in the rural environment, and the intensive or extensive use of the land factor. Secondly, the political-economic aspect related to the structural particularities that affect the rural areas' inhabitants, such as attractive tourist elements. And thirdly, rurality is a social construction in which cultural and moral values gain emphasis and importance when assessing life in rural environments. Thus, based on these aspects, it is possible to use a statistical perspective to measure the relevance of the economic, environmental, social, and spatial dimensions as precisely as possible to produce an interpretation of the relevant aspects within the geographic areas (TORRE; WALLET, 2016).

[3] The article's objective is not to elaborate criteria or to demarcate rural areas; the theoretical framework was used only to select the variables and, through them, observe the importance of rural characteristics on the level of economic development of the localities. For a more precise analysis on the topic of rural spaces in different countries see Somerville and Bosworth (2014).

In summary, to carry out the analysis of municipal units, and the new rural development paradigm, the concepts of rural-urban *continuum* and rurality, will be used as theoretical references to guide the selection process of variables related to rural characteristics, correlated to local aspects, and capable of capturing the particularities observed to measure the level of local economic development in Brazilian municipalities.

3 – PRACTICAL FRAMEWORK

Some national and international practical work aimed to assess the importance of rurality for rural development. Some of them attribute this importance as influencing the performance of the economic development of geographic areas. Among them, the authors Melo and Parré (2007), using factor analysis, created a rural development index for the municipalities of Paraná.

Then Stege and Parré (2011), using a similar methodology, evaluated the Brazilian micro-regions, and Vidigal, Amaral and Silveira (2012), analyzing the micro-regions of Paraná, concerning the levels of socioeconomic development, hierarchized and grouped them into clusters. Melo and Silva (2014) developed a rural sector development index to rank municipalities in the southeastern region of Paraná.

Following a similar construction to elaborate indexes through factor analysis, the authors Michalek and Zarnekow (2012) developed a composite index based on a set of variables, which captured multidimensional aspects in secondary databases (environmental, demographic, socioeconomic, infrastructural, and administrative) to assess the general level of rural development and quality of life in Poland and Slovakia.

Finally, Pagliacci (2017) used Fuzzy logic to evaluate 27 European regions through a continuous and multidimensional rurality indicator. This indicator comprises factors related to population density, characteristics of land-use, and aspects related to agricultural functionality. According to the results obtained by this author, the degree of rurality in the European regions is a factor to be considered and can help to explain the regional differences in Europe related to the divergent levels of socioeconomic development.

After describing the theoretical and practical references, the next section presents the adopted research strategy, the methodology, and the databases used to achieve the proposed objective, which concerns the production of the local economic development index (LEDI) to categorize Brazilian municipalities.

3 – METHODOLOGY

The adopted research strategy aims to produce an index capable of representing and classifying the level of local economic development (LEDI) of 5560 Brazilian municipalities through a database initially composed of 146 variables, 97 of which come from the IBGE Agricultural Census (2006), and 49 other variables collected from the IBGE Demographic Census (2010), DATASUS (2010), Atlas of Human Development in Brazil (2013) and IPEADATA (2010)[4]. Factor analysis was employed after applying the natural logarithm to all variables. The method chosen

[4] This number of variables was initially selected to test those that best correlate with composing the latent factors and, therefore, participate in categorizing Brazilian municipalities. Only the table with the selected variables will be presented in the article.

was the principal components because this method is considerably robust against violation of normality by the variables (SARSTEDT; MOOI, 2019).

Factor analysis (FA) allows the selection of correlated variables from the obtained factor composition, it constitutes the index (LEDI) and, later, weighted by the participation of these factors, forms the mentioned index and performs the categorization of municipalities. FA is chosen because the economic development, in analysis, presents multidimensional characteristics, and it allows the identification of common variability dimensions existing in a set of phenomena, in which the objective is to verify existing structures, which are not directly observable (FÁVERO; BELFIORE, 2017).

After performing factorial analysis and producing the latent factors, these were tested by Cronbach's alpha (***α***), which assesses the internal consistency of each factor's constitutive variables. This test is important and contributes to the result's reliability. For this analysis, alpha values above 0.7 were considered as a criterion to support the internal consistency of the obtained latent factors, therefore, as factors capable of being used in the categorization and hierarchy of Brazilian municipalities (FÁVERO; BELFIORE, 2017; SARSTEDT; MOOI, 2019).

This article used a classification methodology similar to the one used by Melo and Parré (2007); Stege and Parré (2011); and Melo and Silva (2014). It uses the value of each factor, each is weighted by its variance. Thus, the LEDI for the i-th municipality is presented by equation 1,

$$LEDI_i = \frac{\sum^{\rho}_{=1} \theta_i F_i}{\sum \theta_i} \qquad (1),$$

where, $\boldsymbol{LEDI_i}$ refers to the local economic development index of municipality i; θ_i are the proportions of the variance explained by each factor (*Fi*) of LEDI; ρ is the number of factors used in the analysis of the i-th municipality; and $\Sigma\theta_i$ represents the sum of the proportions of the explained variances referring to the ρ factors extracted from the set of LEDI component variables.

After the constitution of LEDI, it was submitted to an interpolation process and, thus, it allowed the classification of municipalities, which started to vary between 0 and 1, and were organized hierarchically according to the methodology described (**Chart 1**).

Chart 1 - Brazilian Municipalities Classification In Relation To The Rural Economic Development Index (LEDI)

1	Extremely High (EH)	Greater than 2.5 standard deviations above average
2	Very High (VH)	Between 1.5 and 2.5 standard deviations above the average
3	High (H)	Between 1 and 1.5 standard deviations above the average
4	Reasonably High (RH)	Between the mean and 1 standard deviation above the mean
5	Reasonably Low (RL)	Between the mean and 1 standard deviation below the mean
6	Low (L)	Between 1 and 1.5 standard deviations below the average
7	Very Low (VL)	Less than 1.5 standard deviations below average

Source: Prepared by the author based on Melo and Parré (2007) Melo and Silva (2014)[5].

[5] The asymmetry performed on the first two levels is purposeful to more accurately assess the municipalities that presented the best levels of rural economic development (REDI). Only the two levels greater than 1.5 standard deviation were shared in two categories.

In summary, the factor analysis was chosen as a method to select the correlated variables and, through the latent factors obtained and representative of the composition of the variables and dimensions of the economic development constituted therein, compose the index (LEDI) and, later, by an interpolation process allow the classification of municipalities between 0 and 1, and the resulting hierarchy of municipalities according to the methodology described (**Chart 1**). Finally, based on this categorization, the results obtained for the Brazilian states and regions will be discussed[6].

4 – DISCUSSION OF RESULTS

The factor analysis showed an adequate result since the Kaiser, Meyer, and Olkin test (KMO) was 0.941, and, mainly, the Bartlett test (*p-value* = 0.00) was significant (see **Erro! Fonte de referência não encontrada.**)[7] (FÁVERO; BELFIORE, 2017).

Table 1 - Kaiser, Meyer, and Olkin (KMO) test and Bartlett test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.941
Bartlett's Sphericity Test	Approx.χ 2	349,881.94
	df	1485
	Sig.	0.000

Source: Own elaboration using SPSS software.

Another aspect to be highlighted to confirm the model's adequate adherence is observed through the correlation reproduction matrix in which 6% (91) of the non-redundant residues show absolute values above 0.05%; the criterion for selecting a good model is that it has values below 50% (SARSTEDT; MOOI, 2019).

Table 2 - Variance explained and accumulated by factors with normal characteristic and rotated roots for the 10 established factors

LATENT FACTORS	INITIAL EIGENVALUES			VARIMAX ROTATION		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1st	17.825	32.409	32.409	11.995	21.809	21.809
2nd	5.649	10.270	42.679	6.012	10.930	32.739
3rd	4.093	7.442	50.121	5.832	10.604	43.343
4th	3.163	5.751	55.873	3.411	6.202	49.545
5th	2.831	5.148	61.020	3.277	5.959	55.504
6th	2.596	4.720	65.740	2.911	5.293	60.796
7th	2.166	3.938	69.678	2.874	5.225	66.021
8th	1.907	3.468	73.146	2.264	4.116	70.137
9th	1.315	2.391	75.537	2.225	4.046	74.183
10th	1.147	2.086	77.622	1.891	3.439	77.622

Source: Own elaboration using SPSS software.

[6] Geoda free software was used to construct the map and, therefore, expose the categorization of municipalities according to LEDI.

[7] It is worth highlighting the Bartlett test's superiority to the KMO statistic to decide on the factor analysis's global adequacy.

Table 2 shows the ten latent factors, representing 77.62% of the total accumulated variance, that is, the set of factors express more than 77.62% of the variance of the 55 indicators of local economic development in Brazilian municipalities[8].

The first column in **Chart 2**, below, shows the codes of the selected variables; in the second column are the factor loads which represent Pearson's correlations between the initial variables and each of the latent factors produced. The factorial loads of the generated ten latent factors bring the correlations between each factor and the indicators (HAIR et al., 2009)[9].

Chart 2 - Latent factors, factor loads, used indicators and their respective dimensions of local economic development in Brazilian municipalities, after varimax rotation

CODE	FACTORIAL LOAD[10]	COMMUNITY	NAME OF VARIABLE
FACTOR 1: VULNERABILITY TO POVERTY, EDUCATION, AND BASIC SANITATION (α = 0.719)			
SL134	-0.882	**0.912**	Percentage of children vulnerable to poverty.
SL133	-0.880	**0,909**	Participation (%) of children in a household earning below 1/2 minimum wage (MW).
SL110	-0.846	**0.852**	Illiteracy rate - 15 years or more.
SL131	-0.854	**0.842**	Participation (%) of residents in permanent private households earning up to1 minimum wage.
SL130	-0.823	**0.838**	Participation (%) of the sum of people who receive some type of aid (Bolsa Família[11]; Benefício de Prestação Continuada[12]; Renda Mensal Vitalícia[13]) in the population.
SL129	-0.833	**0.819**	Percentage of people aged 15 to 24 who do not study or work and are vulnerable to poverty.
SL115	0.726	0.795	Percentage of 25 years old or more with a high school degree.
SL117	-0.815	0,762	Percentage of children in households where nobody has full primary education.
SL116	0.725	0.757	Percentage of 25 years old or older with a college degree.
SL137	-0.778	0.746	Percentage of people in households who are vulnerable to poverty and dependent on the elderly.
SL144	-0.783	0.724	Mortality up to 5 years of age.
SL114	0.763	0.719	College attendance net rate.

[8] The present factor analysis employed the varimax rotation method to maximize factor variance and provide a more simplified structure, with greater conclusive power, allowing higher interpretive capacity (FÁVERO; BELFIORE, 2017).

[9] Factor loads greater than ± 0.5 are considered significant for sample sizes greater than 120 elements, that is, n≥ 120. In the present analysis, n = 5560 was used and, therefore, factor loads with values greater than ± 0.3 can be considered significant.

[10] The factorial loads highlighted in red have a negative correlation, and in green have a positive correlation.

[11] Bolsa Família is a cash transfer program with conditionalities, focused on poor families registered in each municipality in the country. It was instituted by law in 2004. The amount of the benefit, adjustable by decree, varies according to the family's per capita household income, the number and age of the children. This series presents the number of families benefited by the program in December each year.

[12] The Continued Benefit and Social Assistance Benefit is a monthly transfer of a minimum wage to a disabled or elderly person (65 years of age or older) who, in both cases, has a per capita family income less than 1/4 of the minimum salary.

[13] Monthly Lifetime Income, created in 1974, is the monthly transfer of a minimum wage to needy elderly or disabled people with at least 12 months of social security contributions.

SL132	0.695	0.641	Participation (%) of residents in permanent private households with per capita household monthly nominal income greater than 5 minimum wages.
SL112	0.690	0.567	High School attendance net rate.
SL146	-0.662	0.566	Percentage of people in households with inadequate water supply and sanitation.
SL128	-0.670	0.544	Percentage of head of household mothers without full elementary school and children under 15 years of age.
FACTOR 2: LIVESTOCK, SOIL MANAGEMENT, AND INVESTMENT (α = 0.916)			
ER67	0.895	**0.884**	Average heads of cattle per establishment.
ER56	0.712	**0.806**	Cattle and other livestock participation.
ER63	0.733	0.787	Establishments' animal production average value (R$).
ER17	0.757	0.779	Control of diseases and/or parasites in animals by establishment.
ER79	0.805	0.762	Average value (R$) with cattle revenue per establishment.
ER60	0.588	0.754	Average value (R$) of investments by establishment.
ER69	0.732	0.715	Average number of horses per establishment.
AR10	0.684	0.691	Participation in planted area (ha) of pastures in good conditions.
ER78	0.694	0.677	Average value (R$) of milk produced per establishment.
AR18	0.729	0.613	Pasture rotation per establishment.
FACTOR 3: PHYSICAL CAPITAL (α = 0.939)			
ER39	0.813	**0.923**	Average number of tractors per establishment.
ER45	0.785	**0.857**	Average number of sprayers and/or atomizers per establishment.
ER46	0.850	**0.853**	Average number of fertilizers and/or lime dispensers per establishment.
ER41	0.754	0.785	Average number of harrows and/or rotating hoes per establishment.
ER42	0.718	0.671	Average number of brushcutters per establishment.
ER49	0.767	0.658	Average number of trucks per establishment.
ER50	0.630	0.608	Average number of utility vehicles per establishment.
FACTOR 4: RECEIVED MUNICIPAL REVENUE AND BALANCED BUDGET (α = 0.816)			
EL104	0.876	**0.941**	Current transfers of state taxes to municipalities per capita.
EL105	0.945	**0.938**	Share of the municipal participation fund per capita.
EL102	0.945	**0.935**	Municipal budget revenue minus expenditure per capita.
EL103	0.806	**0.896**	Municipal tax revenue per capita.
FACTOR 5: SOIL AND SOYBEAN MANAGEMENT (α = 0.816)			
ER32	0.849	0.794	Participation (%) of establishments that use no-till in straw agriculture.
ER54	0.601	0.694	Participation (%) of the area for production of temporary crops.
ER82	0.681	0.654	Average value of soybean production (R$) by all establishments.
AR27	0.735	0.637	Crop rotation by establishment.
FACTOR 6: RURAL EDUCATION AND DEMOGRAPHY (α = 0.856)			
DR24	0.909	**0.880**	Participation (%) of the number of people who run an establishment residing in the municipality's

			urban area itself or another in the rural population.
SR121	0.841	**0.865**	Participation (%) of people with high school degree in the rural population.
SR120	0.744	**0.803**	Participation (%) of people with a college degree in the rural population.
ER98	0.647	0.728	Participation (%) of employed personnel in establishments with ties to the producer (including the producer) in the rural population.
FACTOR 7: PRIMARY PRODUCTION AND ECONOMIC RESULT (α = 0.910)			
ER64	0.799	**0.901**	Establishments' vegetable production yearly average value (R$).
ER85	0.793	**0.839**	Establishments' average value (R$) of primary production.
ER66	0.728	0.728	Average balance (R$) per establishment (Income and Other Income - Expense).
FACTOR 8: HOSPITAL INFRASTRUCTURE (α = 0.929)			
SL139	0.904	**0.856**	Value of hospital procedures (R$) by municipality and year per capita.
SL140	0.882	**0.804**	Hospitalization Authorization (HA) approved by municipality per capita.
FACTOR 9: PRODUCTION OF GOATS, SHEEP, AND DONKEYS (α = 0.777)			
ER72	0.838	**0.814**	Average number of goats per establishment.
ER73	0.753	0.717	Average number of sheep per establishment.
ER70	0.703	0.712	Average number of donkeys per establishment.
FACTOR 10: Agroindustrial PRODUCTION (α = 0.875)			
ER86	0.905	**0.871**	Average value (R$) of agroindustrial production per establishment.
ER65	0.916	**0.868**	Average added value (R$) of agribusiness by establishment.

Source: Own elaboration using SPSS software and with data collected from IBGE (2006), DATASUS (2010), UNDP (2013), IPEADATA (IPEA, 2010) and Atlas of Human Development in Brazil (2013).

Still in **Chart 2**, the third column represents the commonality which is used to express the variance of each indicator. In detail, the greater the value of commonality, the greater the association between the variable and the latent factor. Therefore, when considering only eigenvalues greater than the unit, the commonality corresponds to the total shared variance of each variable in all common factors extracted. In this analysis, commonality values greater than 0.6 were used as a criterion for the selection of variables (HAIR et al. 2009; FÁVERO; BELFIORE, 2017).

When proceeding with the analysis of **Chart 2**, it shows that the results obtained for the ten factors' alphas (α) exhibited values greater than 0.7 and, thus, demonstrate a considerable degree of reliability. Additionally, the 55 indicators presented positive or negative factor loads which proved to be consistent with the expected direction, in theory, with respect to the dimensions belonging to the concept of economic development. Among these 55 indicators, 25 have extremely high values of commonality, that is, greater than 0.8 and, therefore, the variables that have the greatest influence over the factors in which they are contained are considered. Thus, the next step is to describe the variables present in the latent factors, and inserted in at least one of the dimensions of economic development, to compose the index of local economic development (LEDI).

The **Factor *Vulnerability to Poverty, Education, and Basic Sanitation*** ($\mathbf{F_1}$) represents 21.81% of the total accumulated variance. It is composed

of 16 variables, ordered by the importance of commonality in **Erro! Fonte de referência não encontrada.**. This factor managed to capture the relevance of the social dimension, interconnected with the economic dimension, through the individuals' socioeconomic condition represented in the listed variables. As a result, through the signal of the factor loads, how each of these variables correlates with the Brazilian municipalities' economic development.

Still on **Factor 1** (**Chart 2**), as pointed out by Currie (2009), Cunha, Heckman, e Schennach (2010), Raiher (2016) and Renzi et al. (2022), the variables related to education have direct effects, in some proportion, with the economic development of the analyzed geographical space. This theoretical argument supports the results found in this study, since the variables ***Illiteracy rate - 15 years or more*** (SL110), ***Percentage of children in households where nobody has full primary education*** (SL117), and ***Percentage of head of household mothers without full elementary school and children under 15 years of age*** (SL128), contained in the education subdimension, capture the harmful interference of the illiteracy rate, and the influence of the environment over resident children, where there are no people with complete primary education.

Also, variable (SL128) includes an adverse and specific condition of the household, namely: the negative influence on the categorization of Brazilian municipalities due to the socio-educational condition of female heads of household. These results are corroborated by the study carried out by Currie (2009), in which the author discusses the argument that more years of study tend to result in a higher family income and, therefore, children in families with higher income levels tend to receive more education, in terms of quality and quantity, compared to other children. Thus, the variables SL117, SL133, SL137, and mainly SL128 allow the diagnosis of this correlation between the level of education of residents concerning the level of income and the determination of the children's future educational level.

Another point to be highlighted that helps to explain the results achieved for variable SL128, indicated by the latent factor 1 of LEDI, stems from the work of Staduto, Nascimento, and Souza (2017), concerning the occupation and income of women in rural areas of the Northeast, in the period between 2002 and 2007. These authors demonstrate that the reduction in agricultural occupations produces more intense effects on women and, given the social peculiarities in force in rural areas, favor women's migratory process to urban areas. Thus, non-agricultural occupations are becoming an employment option for women to earn income living in rural areas. These authors also emphasize that government transfers (retirements and pensions) are the primary income sources for these women.

Factor 1 also includes variables related to the health subdimension: ***Mortality up to 5 years of age*** (SL144), and the ***Percentage of people in households with inadequate water supply and sanitation*** (SL146). These variables, also as anticipated in theory, in agreement the results of Paixão and Ferreira (2014), presented negative factor loads (see **Chart 2**). It means that the lack of sanitary conditions and infant mortality, directly interrelated variables, contribute negatively to categorizing the municipalities involved in this research. As pointed out by Camarano (2014), better health conditions tend to reduce the mortality rates of lactating women and children susceptible to diseases.

As a result, the potential for maximizing gains from investments in human capital is compromised by the flawed Brazilian health system. Because, as argued by Currie (2009); and Heckman(2012), the representative variables of health in childhood constitute a crucial factor for the constitution of human capital; in other

words, the lack of adequate health in childhood can be an essential mechanism to help explain the intergenerational transmission of education and economic status.

Still on **Factor 1**, also as predicted in theory (CUNHA et. al., 2010; RENZI et al., 2022), the variables: ***Percentage of 25 years old or more with a high school degree*** (SL115) and ***Percentage of 25 years old or older with a college degree*** (SL116); ***College attendance net rate*** (SL114); ***Participation (%) of residents in permanent private households with per capita household monthly nominal income greater than 5 minimum wages*** (SL132); ***High School attendance net rate*** (SL112), showed positive factor loads and, as a result, positively affect the categorization of Brazilian municipalities. It is worth mentioning that the variable SL132, linked to the economic dimension, is closely related to the other variables (SL115, SL116, SL114, and SL 112), which are also members of the social dimension, appropriately in the education subdimension, which regarding human capital theory, relates positively, and bidirectionally, higher educational levels to higher levels of income.

The ***Livestock, Soil Management, and Investment Factor*** **(F_2)** represents 10.93% of the total accumulated variance and is composed of ten indicators, arranged considering the greatest commonality (**Chart 2**). As previously expected, the variable components presented positive factor loads, the first two ***Average heads of cattle per establishment*** (ER67) and ***Cattle and other livestock participation*** (ER56), with a strong influence over this factor. The analysis is composed of variables inserted in the economic and environmental dimensions. The variables ***Establishments' animal production average value (R$)*** (ER63); ***Control of diseases and/or parasites in animals by establishment*** (ER17); ***Average value (R$) with cattle revenue per establishment*** (ER79); ***Average value (R$) of investments by establishment*** (ER60); ***Average value (R$) of milk produced per establishment*** (ER78); and ***Average number of horses per establishment*** (ER69) are inserted in the economic dimension. This results support partially the work of Mendes et al. (2018), when verifying the importance of the agricultural sector for the human development of the municipalities, and by Santos et al. (2014) They discuss the importance of the beef cattle sector for food security and describe it as a relevant element to assess the level of economic development in the regions.

The environmental dimension, related to the ***Participation in planted area (ha) of pastures in good conditions*** (AR10), and ***Pasture rotation per establishment*** (AR18), both indicate acceptable practices in soil management to guarantee productivity and to preserve soil sustainability. This argument is supported by Macedo (2009), for whom there is a direct relationship between those variables (AR10 and AR18) and livestock productivity because an increase in pasture degradation negatively affects the level of livestock productivity and also produces adverse environmental effects by raising the emission of greenhouse gases (GHG) and generate predatory results on water resources.

The ***Physical Capital Factor*** (**F_3**) corresponds to 10.60% of the total accumulated variance and integrates the correlation of seven variables (**Chart 2**). In this factor, there is a positive relationship between local economic development and the use of physical capital, a relationship already mentioned by several authors, such as Freitas, Bacha and Fossatt (2007) and Gasques et al. (2014). As in the previous analysis, again, the first three variables had a high degree of influence on this factor: average quantities of tractors, sprayers and/or atomizers and fertilizers and/or lime dispensers.

The ***Municipal Revenue Received and Balanced Budget Factor*** **(F_4)** explains 6.20% of the total accumulated variance. In **Chart 2** this factor is composed of four (4) variables which presented extremely high commonality (greater than 0.8), as expected from theory, ***Current transfers of state taxes to municipalities per capita*** (EL104), ***Share of the municipal participation fund per capita*** (EL105), ***Municipal budget revenue minus expenditure per capita*** (EL102), and ***Municipal tax revenue per capita*** (EL103) are positively influencing factors in the economic dimension and, therefore, have direct effects on raising the level of local economic development in the municipalities.

Baião, Cunha and Souza (2017); and Mendes et al. (2018) support the results presented by ***Factor 4*** **(F_4)**. These authors obtained positive results regarding the formation of public revenue, in which intergovernmental transfers have a fundamental role due to their participation in the composition of the financial volume, and, therefore, of the economic capacity of the municipalities on their level of economic development. Also, for Baião, Cunha and Souza (2017), the Bolsa Família Program mitigates generated distortions, playing a crucial role in fiscal equalization, and serving as an instrument to counterbalance the limitations of intergovernmental transfers.

The ***Soil and Soybean Management Factor*** **(F_5)** represents 5.96% of the total accumulated variance, being composed of four indicators (**Chart 2**). In this factor, the variables are contained in the economic and environmental dimensions, which are interconnected. The variables related to the ***Participation (%) of the area for production of temporary crops*** (ER54), and ***Average value of soybean production (R$) by all establishments*** (ER82), are directly linked to the economic dimension. In contrast, the variables ***Participation (%) of establishments that use no-till in straw agriculture*** (ER32) and ***Crop rotation by establishment*** (AR27) are related to the economic and environmental dimensions. Because they concern the maintenance of soil fertility properties and, as a result, the sustainability of the land production factor and, also, economic, since it guarantees the maintenance of future productivity (Franchini et al., 2007; Macedo, 2009; and Hirakuri et al., 2014).

The Rural Education and ***Demography Factor*** (**F_6**) constitutes 5.26% of the total accumulated variance and comprises four indicators (**Erro! Fonte de referência não encontrada.**). This factor highlights the relevance of the social dimension, represented by the ***Participation (%) of people with high school degree in the rural population*** (SR121) and ***Participation (%) of people with a college degree in the rural population*** (SR120). As emphasized by Freitas, Bacha and Fossatt (2007); and Cunha, Heckman and Schennach (2010), the variables related to the formal education process are proven to be directly correlated to the level of economic development in a region and represent one of the most relevant sources of information to explain inequalities between regions.

Regarding the demographic dimension, represented by the characteristics of the people involved in rural activities, the importance of the DR24 variable (***Participation (%) of the number of people who run an establishment residing in the municipality's urban area itself or another in the rural population***), in commonality, gives the economic development of rurality a demographic particularity, in detail, the relevance of the leaders of rural establishments living in the urban area, a fact that, ratifying Kageyama (2008) and Laurenti (2014), appears to confer a distinctive aspect of the contemporary Brazilian rural economic development process. Furthermore, as Laurenti (2014), and Navarro (2019), indicate, the traditional configuration of the characteristics of the

establishments' employees still has an essential influence on the conduct of rural establishments; that is, these establishments still employ people with some family ties (ER98).

The ***Primary Production and Economic Result Factor*** ($\mathbf{F_7}$) represents 5.23% of the total accumulated variance and is composed of three indicators (**Erro! Fonte de referência não encontrada.**). This factor captures, in addition to the influence of the variable ***Establishments' vegetable production yearly average value (R$)*** (ER64), the direct relationship between the ***Establishments' average value (R$) of primary production*** (ER85) and the ***Average balance (R$) per establishment (Income and Other Income - Expense)*** (ER66). In other words, it expresses the positive aspect of these variables through the direct relationship between productivity in primary production and financial results in the categorization of municipalities' local economic development. In this context, the work of Staduto, Orlandi and Chioveto (2018), regarding rural development in the municipalities of Mato Grosso, and Mendes et al. (2018) corroborate the agricultural sector's importance as a factor positively correlated with the municipalities' human development, mainly the small ones. Additionally, Stege and Parré (2011) found a positive influence of variables related to agricultural, vegetable, and animal productivity on the categorization of Brazilian micro-regions.

Concerning the ***Hospital Infrastructure Factor*** ($\mathbf{F_8}$) that represents 4.12% of the total accumulated variance and consists of the variables ***Value of hospital procedures (R$) by municipality and year per capita*** (SL139), ***and Hospitalization Authorization (HA) approved by municipality per capita*** (SL140). These two variables showed positive factor loads, which demonstrate that the municipalities with higher expenses with health and with approvals of hospital procedures per inhabitant tend to have greater access to health infrastructure and, therefore, better living conditions. This fact is corroborated by the results obtained by Bloom and Canning (2003), as they argued that financial expenditures on health tend to cause, in some proportion, positive effects on the individual's well-being, happiness, and, possibly, on labor productivity. Additionally, supported by the work of Currie (2009); and Cunha, Heckman and Schennac (2010), this result indicates the importance of good conditions and access to health services as a foundation to boost children and young people school performance, and the work productivity, therefore, these relationships tend to have direct effects on the level of local economic development.

The ***Factor Production of Goats, Sheep and Donkeys*** ($\mathbf{F_9}$) corresponds to three variables, which represent 4.05% of the total accumulated variance. The importance of ***Average number of goats per establishment*** (ER72) stands out for its commonality being greater than 0.8, followed by the ***Average number of sheep per establishment*** (ER73), and ***Average number of donkeys*** per establishment (ER70). These variables are inserted in the economic dimension and the results obtained are corroborated by those found by Ramos and Garagorry (2019). These authors proved that the productive breeding of goats, sheep, and donkeys, inserted in the set of livestock products, contribute to explain changes in agricultural production and, consequently, the reflexes for the regions present in MATOPIBA[14]. Also, Graziano da Silva (2002) argues, in turn, that the production of small animals can be an important strategy to keep a portion of the people living in

[14] The acronym MATOPIBA corresponds to the first two letters of the states of Maranhão, Tocantins, Piauí, and Bahia.

rural areas in subsistence conditions and, therefore, excluded from the production process of the agricultural sector.

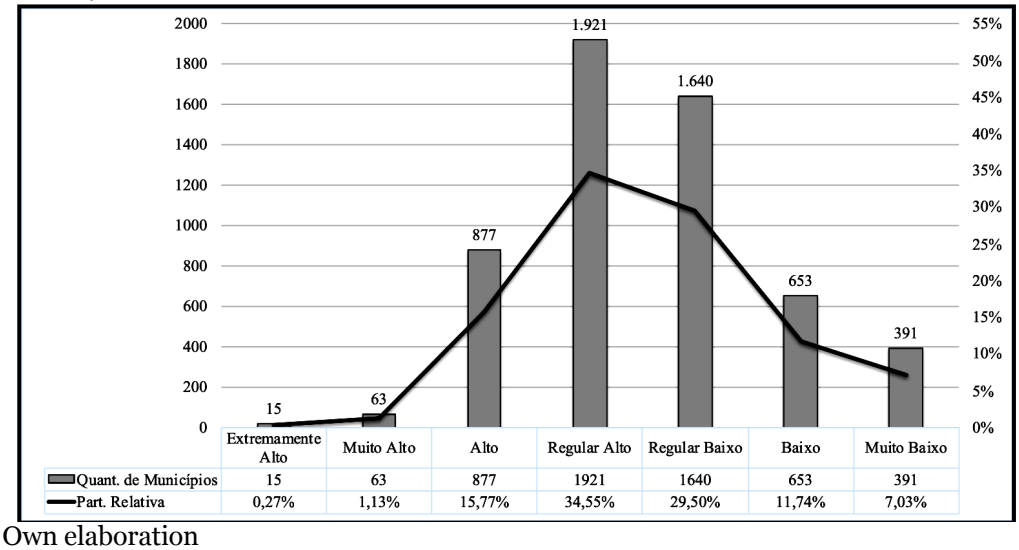
The ***Agroindustrial Production Factor*** (F_{10}) represents 3.44% of the total accumulated variance. This factor consists of two indicators (**Erro! Fonte de referência não encontrada.**) and allows addressing the positive influence for local economic development resulting from the greatest productivity in the agro-industry, ***Average value (R$) of agroindustrial production per establishment*** (ER86) and the process of ***Average added value (R$) of agribusiness by establishment*** (ER65). The two variables mentioned belong to the economic dimension and establish a positive correlation between productivity, added value in the agro-industry, and the level of local economic development. The importance of these variables was highlighted by Graziano da Silva (2002); and Pedroso and Navarro (2020) as extremely relevant and characteristic elements of the new rural. Besides, as alluded to by Brandão (2012), the local economic development process tends to be more dynamic as the greater agroindustrial integration provides greater drag effects (backward linkages) and propulsion (forward linkages), which tend to positively affect the economic development of geographical areas.

In summary, it can be said that the factorial analysis performed produced ten latent factors from 55 variables that could represent, even partially, the dimensions of economic development for the composition of the local economic development index (LEDI). The latent factors found showed reliability, internal consistency, and theoretical support to categorize the 5560 Brazilian municipalities.

4.1 - CATEGORIZATION OF BRAZILIAN MUNICIPALITIES: LEDI

Based on the seven categories of local economic development, presented in the previous section, in **Chart 1**, the results shown in **Figure 2** were obtained, with the classification and distribution of Brazilian municipalities by category of local economic development (IDEL).

Figure 2 - Classification of Brazilian Municipalities through the Local Economic Development Index (LEDI) in 2006/2010



Source: Own elaboration

After the index interpolation process, the average value of 0.5156 of LEDI was obtained, which, with a brief regional analysis, makes it possible to highlight the

presence of 51.73% (2876) municipalities with LEDI greater than or equal to the national average. Furthermore, the LEDI results show a standard error of 0.002, extremely low, indicating a low dispersion among the municipalities regarding local economic development. Also, with a standard deviation of 0.14803, it approaches a normal distribution with 96.92% of the municipalities inserted in the range of two standard deviations regarding the mean. The variation coefficient shows a value of 28.71%, indicating that the average is a good measure of data representation. As this value is lower than 30%, it is inferred that the data are reasonably homogeneous. Regarding shape measurements, the distribution was negative asymmetric (Fischer asymmetry coefficient of -0.0624), and Fischer kurtosis coefficient of -0.5528; that is, the curve is platicurtic (FÁVERO; BELFIORE, 2017).

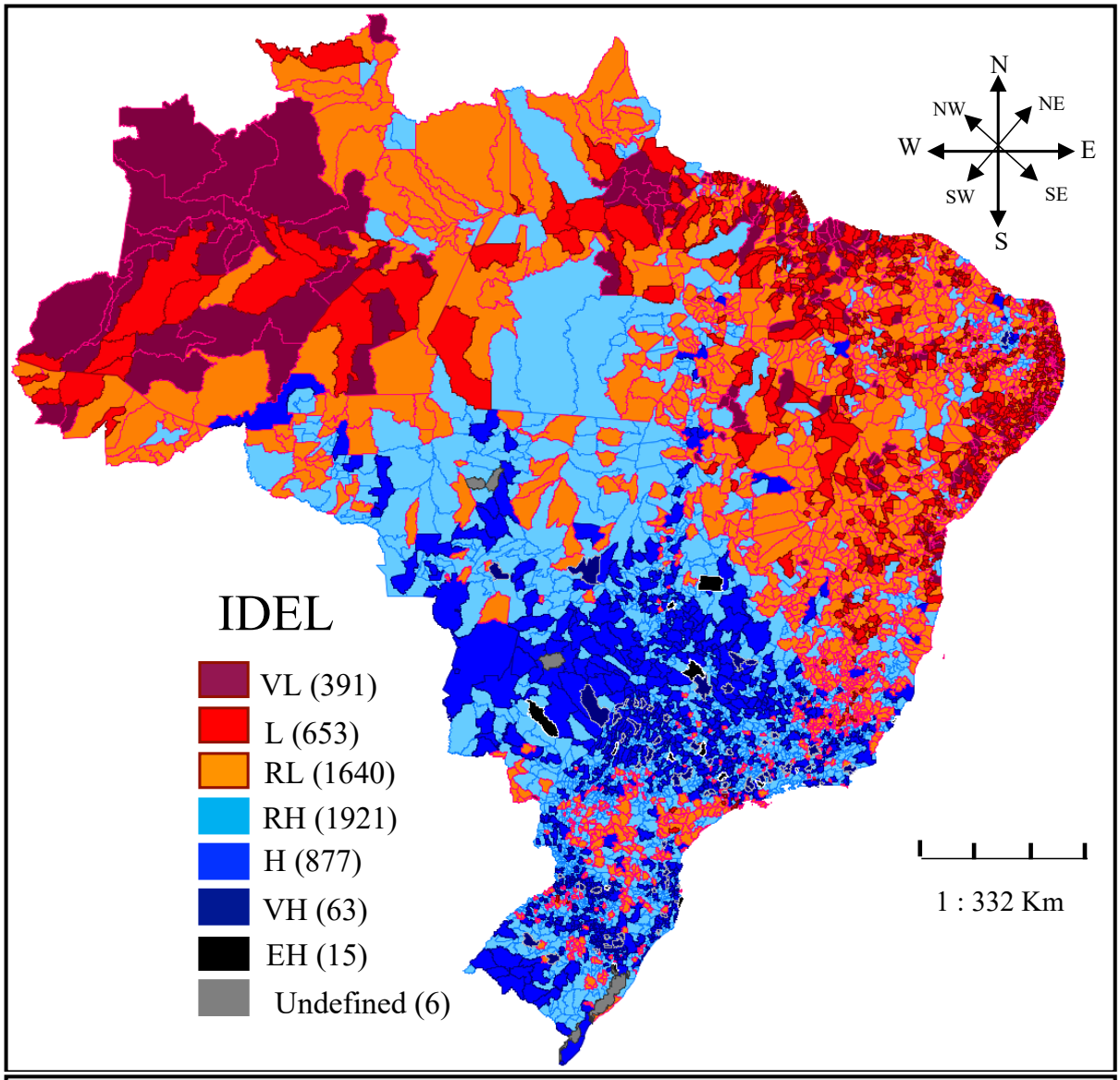
In the analyzed case, when observing **Based on** the seven categories of local economic development, presented in the previous section, in **Chart 1**, the results shown in **Figure 2** were obtained, with the classification and distribution of Brazilian municipalities by category of local economic development (IDEL).

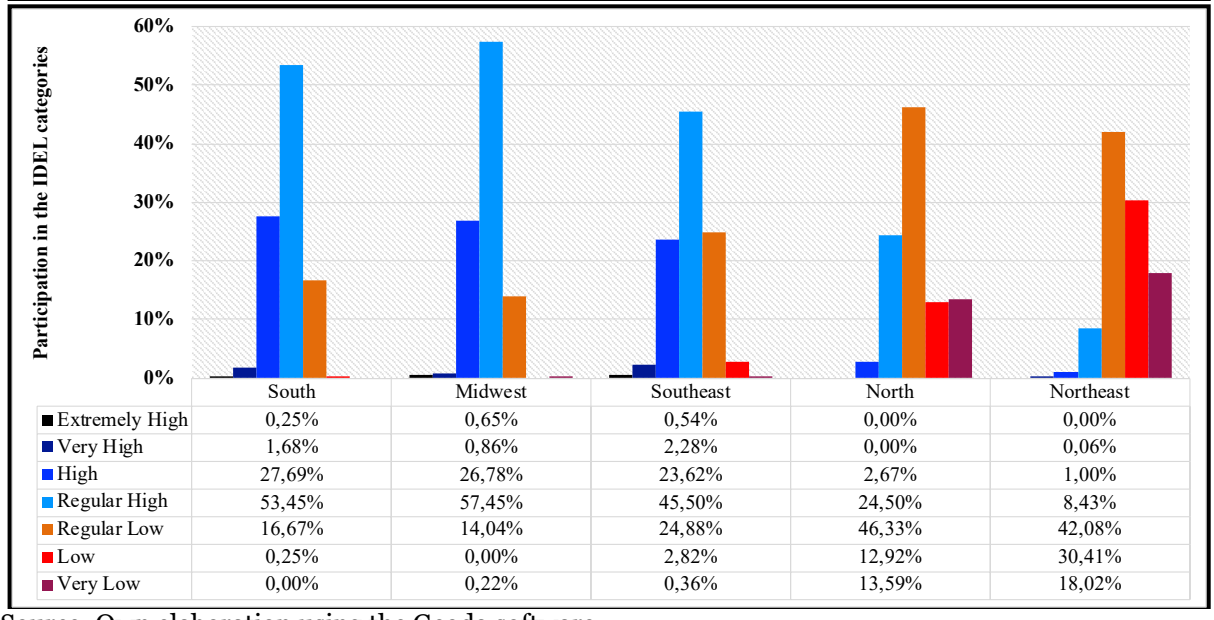
Figure 2 , it appears that the largest portion of the municipalities is concentrated in the categories high regular (HR) and low regular (LR) (64.05%). The ends of the graph show significant differences regarding local economic development, the categories: extremely high (EH), very high (VH), and high (H) correspond to 17.18%, while the categories very low (VL) and low (L) account for another 18.78%. Based on this result, it is inferred that local municipal economic development is characterized by presenting a configuration and concentration of municipalities in extreme opposite situations regarding the degree of economic development. Thus, the analysis will be limited to identifying and examining the extremes mentioned concerning the discrepancies between the Regions and Brazilian states.

When analyzing **Figure 3** below, considering the national LEDI average of 0.51561 as a reference, the Southern Region contains 83.08% of the municipalities with an average higher than the national. Among the municipalities located in this Region, 27.69% (329) had a high level (H); 1.68% (20), very high level (VH); and three municipalities were categorized in the extremely high level (EH) by the index[15]. Then, the Midwest Region presented 85.75 (%) of the municipalities with LEDI above the national average. The Midwest Region concentrates 26.78% (124) at the high level, 0.86% (4) at the very high level (VH), and three (3) municipalities at the extremely high level (0.65%) of LEDI. At the opposite end, it presented only the municipality of Japorã (cod. IBGE: 5004809) with very low-level (VL) and none with low-level (L).

[15] The three municipalities that presented extremely high LEDI (HI) were: 3rd Florianópolis (SC) (cod. IBGE: 4205407); 4th Porto Alegre (RS) (cod. IBGE: 4314902), and 6th Joaçaba (SC) (cod. IBGE 4209003).

Figure 3 - Distribution of LEDI categories by Region in 2006/2010





	South	Midwest	Southeast	North	Northeast
Extremely High	0,25%	0,65%	0,54%	0,00%	0,00%
Very High	1,68%	0,86%	2,28%	0,00%	0,06%
High	27,69%	26,78%	23,62%	2,67%	1,00%
Regular High	53,45%	57,45%	45,50%	24,50%	8,43%
Regular Low	16,67%	14,04%	24,88%	46,33%	42,08%
Low	0,25%	0,00%	2,82%	12,92%	30,41%
Very Low	0,00%	0,22%	0,36%	13,59%	18,02%

Source: Own elaboration using the Geoda software.

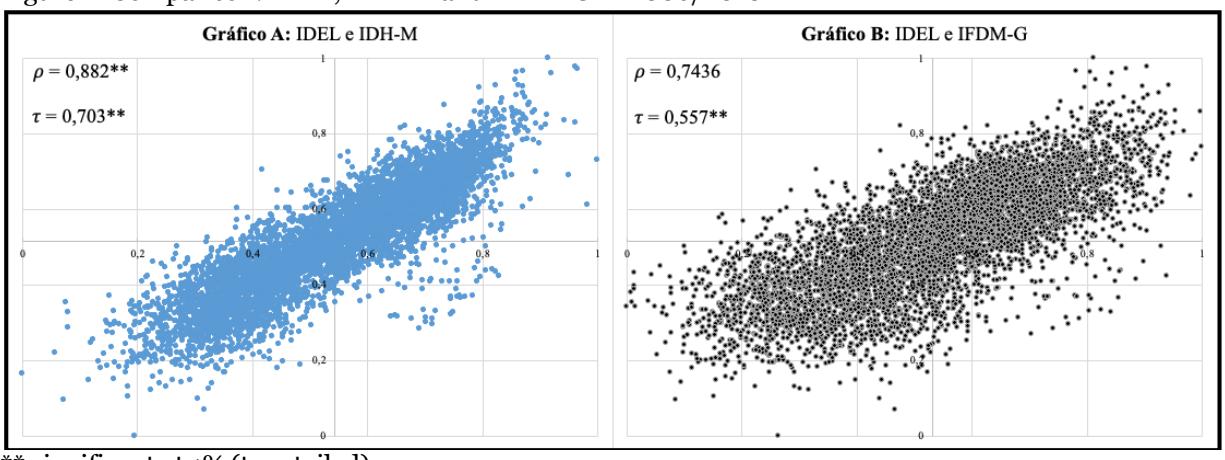
Still on **Figure 3** , the Southeast Region is in an intermediate situation with only 71.94% (1200) of its municipalities with LEDI above the average of Brazilian municipalities. The prevalent categories for the Southeast Region were intermediate (RH and RL) with 70.38% of LEDI. However, when comparing the extremes, there is a greater concentration of municipalities in the upper categories (H, VH, and EH) compared to the categories present at the opposite extreme (L and ML). Because the top three categories (H, VH, and EH) concentrated most municipalities, with 26.44%, of which 23.62% (394) had a high level (H), 2.28% (38) a very high level (VH), and only 0.54% (9) had an extremely high level (EH). At the other extreme, only 3.18% fall into the low (L) and very low (VL) categories, of which 2.82% (47) had a low-level (L), and 0.36% (6), very low-level (VL) of LEDI.

The North and Northeast Regions, in contrast, when observing **Figure 3** , stood out for presenting the highest participation in the low (L) and very low (VL) level of LEDI. With regard to the North Region, it has 27.17% (122) of the municipalities below the national average. Among all the municipalities in this Region, 12.92% (58) were classified as low (L) and 13, 59% (61) at the very low-level (VL). With reference to the other extreme, only 2.67% (12) fall into the high level (H), and no municipality was categorized in the categories very high (VH) or extremely high (EH).

The Northeast Region is the last analyzed in **Figure 3** and presents the worst result of concentration below the national average of LEDI. 90.51% of the municipalities are below the national average, and among these, 30.41% (545) had a low-level (L) and 18.02% (323) a very low-level (VL). At the other extreme, 1% (18) were classified as high (H) and, at the very high level (VH) there is only one (0.06%) (Caicó cod. IBGE: 2402006). Thus, from the results obtained, the Northeast Region was the national territory where the worst performances of local economic development are concentrated.

Spearman and Kendall tau correlation coefficients were used to compare the classification of municipalities, obtained with LEDI, with two indexes (HDI-M and IFDM-G). Similarly, this method was used by Fernández Domínguez and Gómez Hernández (2019). These two indices were used in comparison because they are accepted academically and used to measure and classify the level of economic development in Brazilian municipalities.

Figure1 - Comparison: IDEL, HDI-M and IFDM-G in 2006/2010



** significant at 1% (two-tailed).
Source: Own elaboration.

Thus, based on **Figure1**, when using the index of local economic development (LEDI) in comparison to the HDI-M (Graph A) and the IFDM-G (Graph B), it appears that, in relation to the HDI-M, although divergent, there is a certain similarity due to the strong correlation presented by the Spearman's degree of correlation (ρ = 882 **) and Kendall tau b (τ = 703 **). When comparing LEDI with IFDM-G (Graph B), this index still showed a strong positive correlation, but lower than with HDI-M, both for Spearman (ρ = 760 **) and Kendall's tau (τ = 557 **)[16].

Therefore, as the LEDI presented a degree of strong positive correlation and, consequently, relatively similar to HDI-M and IFDM-G, three main conclusions are mentioned from the comparative results obtained. The first is related to providing a classification with some degree of difference compared to indexes HDI-M and IFDM-G. This difference is explained by the LEDI composition integrating aspects of rurality with other representative variables of the places, providing a classification with some degree of difference compared to indexes HDI-M and IFDM-G, and this difference is explained by the composition of the LEDI integrating aspects of rurality with other representative variables of the place. The second, resulting from the first, indicates that, due to the methodological characteristics of the LEDI composition, given the range of factors representative of the dimensions of economic development involved in its constitution, it has a greater degree of precision and depth to assess the level local economic development of Brazilian municipalities and regions. Finally, the third conclusion, the LEDI can be a complementary instrument to the indexes HDI-M and IFDM-G to measure the level of municipal economic development because the latent factors that constitute it can be essential sources of information for establishing effective public policies to address regional inequalities.

CONCLUSION

Based on the proposed objective, this article presented a new index of local economic development (LEDI) composed of 10 latent factors, produced by factor analysis, which allowed a new and different classification of the 5560 Brazilian municipalities in 2006/10. These factors are composed of variables present in the economic, social, environmental, and demographic dimensions that are part of the concept of economic development.

The characteristics of the new rural have empowered it and made it a phenomenon with a significant degree of complexity, as it expands the ability to articulate with other sectors in formats that are difficult to dissociate methodologically and practically, which, in turn, allows for new occupational, sectoral, and demographics of its participants. As a result of this complexity in demarcating the rural in terms of geographical, occupational, and sectoral limits, this article contributed by addressing the importance of the rural through recent theoretical references, present in the idea of rurality, and in the new paradigm of rural development, which is transposed to mentioned limits and integrates them with the idea of a rural-urban *continuum*.

This article also contributes by integrating different databases and, from them, producing the LEDI, which is capable of performing a new method of measuring the level of economic development, combining aspects of rurality and others related to

[16] Sarstedt and Mooi (2019) suggested, as a general rule, to consider the values of the correlation coefficients by the following classification, considering absolute values: values below 0.3 indicate a weak correlation; between 0.3 and 0.49 indicate a moderate correlation, and higher than 0.49 indicate a strong correlation.

vulnerability to poverty, and public governance, which are particularities adhering to the theoretical framework presented and, in practical terms, are crucial to ensure the development of public policies more adherent to local realities. And therefore, they expand the possibility of producing a more effective result of the most efficient solution to identify bottlenecks and for greater effectiveness in reducing the inequality gap between Brazilian municipalities and Regions.

However, the contribution mentioned above does not overcome three main limitations present in the article. The first one refers to the rural typology because the different typologies may not correspond to the one chosen in this article, since aspects related to rurality were previously established by the selected variables. Consequently, it was considered relevant to designate a theoretical framework capable of allowing a striking analysis. However, selecting the appropriate variables may not be an accessible or plausible task because data sources may not be updated regularly or may not be available at a feasible cost-benefit ratio in due course.

Hence the second limitation, of course, concerns the data used being from secondary and outdated databases (2006 Agricultural Census; 2010 Population Census; DATASUS de 2010; IPEADATA de 2010). This fact is explained by the idea of integrating the databases of the Agricultural and Population Census. Despite the 2017 Agricultural Census being available, at the time of collection and treatment of the database, there was no provision for publication of the 2020 Population Census.

The last limitation arises from the chosen methodology because the factorial analysis performed is unlikely to be comparable with other future periods. This is because the variables to be selected or the results may be different. In addition, although the results obtained allow the comparison only of Brazilian municipalities in 2006/10, they shed light on which variables may be relevant to assess the level of local economic development of the geographic regions and can be used as a reference for other national and international studies.

Finally, as a future research agenda, it is intended to constitute another economic development index with recent data, coming from the Agricultural Census 2017 and Population 2020, and reassess economic development in all Brazilian municipalities. After all, given the evolution of the production process and the social, environmental, and demographic relationships involved, the variables that determine local economic development level may not necessarily be the same as in previous periods.

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