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Soybeans production and its influence on the socioeconomic variables o the Matopiba Region

A produção da soja e sua influência nas variáveis socioeconômicas da região do Matopiba

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Abstract

The article focused on analyzing the evolution of soybean`s agribusiness in the municipalities of Matopiba and its correlation with the socioeconomic indicators of the region. This is an explanatory research, with a quantitative approach, having as a sample the annual data from 160 municipalities in this region from 2004 to 2018. In order to analyze, it was applied a multiple linear regression, using the grain production data and the socioeconomic data of the municipalities of the selected regions. Based on the chosen variables, the results indicated a significant correction for the four dependent variables of the study: Firjan Index of Municipal Health Development; Employment and Income; Education; General, indicating an explanatory power of around 30% of the grain production on the socioeconomic indicators of the municipalities of the micro-regions of Matopiba studied.

Keywords: Agrobusiness. Socioeconomic indicators. Regional development

Resumo

O artigo centrou-se em analisar a evolução do agronegócio da soja nos municípios do Matopiba e sua correlação com os indicadores socioeconômicos da região. Trata-se de uma pesquisa explicativa, de abordagem quantitativa, tendo como amostra dados anuais de 160 municípios da região no período de 2004 a 2018. Por meio da regressão linear múltipla cruzaram-se os dados de produção de grãos e os dados socioeconômicos dos municípios das regiões selecionadas. Com base nas variáveis escolhidas, os resultados indicaram uma correção significante para as quatro variáveis dependentes do estudo: Índice Firjan de Desenvolvimento Municipal Saúde; Emprego e Renda; Educação; Geral, sinalizando um poder explicativo em torno de 30% da produção de grãos sobre os indicadores socioeconômicos dos municípios das microrregiões do Matopiba estudadas.

Palavras-chave: agronegócio; indicadores socioeconômicos; desenvolvimento local.

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1 Introduction

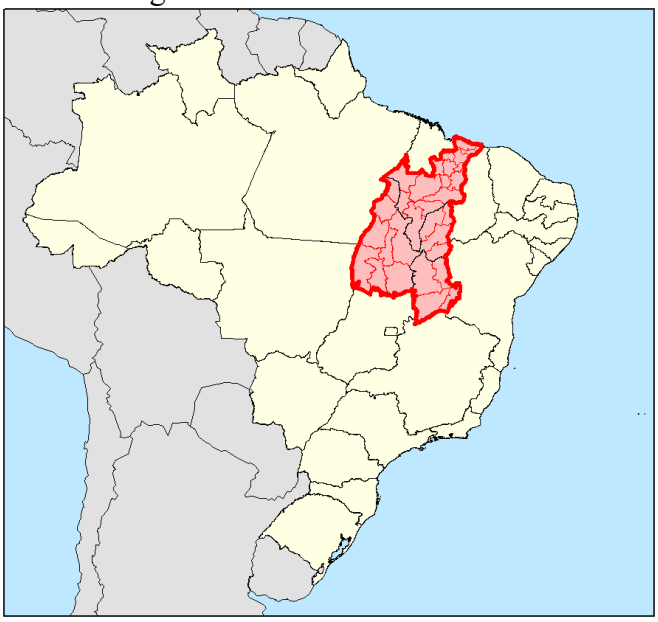
Agribusiness is a set of operations that is not limited only to the internal ambience of rural properties; it is supported by a series of activities, installations of agro-industrial complexes, machinery sales companies, representatives of fertilizer manufacturing companies and biotechnological support, which provides the necessary support to carry out its main activity in the municipality or region in which it operates.

For Rhoden (2017), food production and the various labor markets depend on, and are driven by, agribusiness, and this activity promotes employment, income, good tax returns, promoting growth and local development. In that regard, local development is associated with the improvement of the socioeconomic conditions of a community, municipality or micro-region. It is a type of development linked to the internal productive and social articulation of resources and the opportunities that the place offers, resulting from a partnership between the business sector, the interests of the community and the municipal government (TABOSA et al., 2012), within of the capitalist model of production.

For Oliveira (2015), Brazilian agribusiness has brought significant changes in the places where it operates, standing out in the Brazilian regional economies being responsible for 23.5% of the National GDP (IBGE, 2018), which has led to the emergence of large agricultural frontiers across the country, including the Matopiba region – considered the "last national agricultural frontier", a new economic region, located in the Brazilian Cerrado biome.

The acronym Matopiba derives from the acronyms of the states that make up the region: Maranhão, Tocantins, Piauí and Bahia (Figure 1). In the last two decades, this region has undergone a rapid transformation arising from the expansion of agricultural activity and land occupation, and with that it has presented several socioeconomic impacts from the production of grains, especially soybeans (PORCIONATO; CASTRO; PEREIRA, 2018a).

Figure 1 - Delimitation of MATOPIBA



Source: EMBRAPA (2015) and GITE (2015).

Several studies have been developed on the Matopiba region in recent years, such as those by Miranda and Gomes-Júnior (2017), who analyzed the investment in the technological process of logistics infrastructure and economic modernization in Matopiba; Brugnera and

Dalchiavon (2017), who addressed the current road and rail transport of soy from Matopiba and the potential for expanding rail transport for grain exports, as well as the benefits and obstacles in the soy industry chain in the region. The studies by Araújo et al. (2019) INTENDED to analyze the temporal and spatial dynamics of soy production in the Matopiba area between 1990 to 2015. These studies show, among other things, the accelerated expansion of soy in the region. However, there are few studies on the effective impact of agribusiness on the socioeconomic indicators of the municipalities that make up the Matopiba microregions, requiring research on the topic of socioeconomic and academic relevance for the country.

For this reason, this study proposes the following research question: how has the expansion of soybean agribusiness in Matopiba contributed to the improvement of the socioeconomic indicators of the municipalities in the region? Based on the problem, the hypothesis was raised that, as agribusiness evolves in the Matopiba region, it translates into improvements in the region's socioeconomic indices. Specifically, an attempt was made to describe the development of soy agribusiness in the Matopiba region and to correlate this evolution of the data referring to soy agribusiness with the socioeconomic indicators of the region.

The relevance of the research is due to the fact that it analyzes whether the evolution of agribusiness in the region has contributed to improvements in the socioeconomic indicators of the municipalities that comprise it. From the territorial delimitation obtained and proposed for Matopiba, 13 of the 31 micro-regions are responsible for 76.97% of the total production value (GITE, 2015). For this reason, the study will focus on the micro-regions that most contribute to grain production in the region, which make up 160 of the 337 existing municipalities. Through these micro-regions, the study will make it possible to point out the social advances that have taken place in recent years in the region, thus presenting an overview of the socioeconomic situation based on secondary data.

In addition to the introduction, the article is divided into four sections. The first presents the theoretical foundation, approaching definitions of development and economic growth, the identification and description of the main indicators of socioeconomic development; in the second section, the methodology and procedures used to carry out the research are presented; in the third section, the research results are presented; and the fourth section is dedicated to final considerations and the study's contribution to future researches.

2 Social economic development and brazilian agribusiness

It is common to confuse the concepts of economic growth and development. According to Bresser (2006), this confusion is due to the close connection of these concepts, since, according to the author, economic growth is an indispensable condition for development, as it is a requirement for overcoming poverty and for building a decent standard of living.

In this regard, Oliveira (2002) states that economic growth has a concept focused more on quantitative variables and, for this reason, is strongly linked to the increase in Gross Domestic Product (GDP) per capita. However, development tends to have a broader concept, in addition to the increase in per capita income, including other variables, such as social indicators. As the author points out, development must be seen as a complex process of changes and transformations in the economic, political and even human and social order.

2.1 Socioeconomic development indicators

Measuring development is not an easy task, as it involves economic, social and value judgments. “It is impossible to know the exact measure of development or any other phenomenon applied to the social sciences, however, the same can be measured, and one of the mechanisms that helps in this measurement is the indicators” (PROCÓPIO; OLIVEIRA JÚNIOR; AMÂNCIO, 2009). , p. 116). Remember, in these terms, that “indicators are a method

of evaluating the most extensive aspects of society; therefore, they are presented mainly in the form of metrics and later in the form of information" (RODRIGUES, 2010, p. 18).

To measure the phenomena studied by the social sciences, Trzesniak (1998) states that social or socioeconomic indicators are used. Those ones belong to the genre of quantitative indicators, which cover all forms of phenomena studied by the various sciences that measure human practice. This tool emerged with the natural sciences, and in these sciences, due to the determinism of the models, the construction of the models and their measurement methods and indicators can provide the best results. In the social sciences, relationships are expressed randomly, that is, there is no direct relationship between cause and effect. The emergence of such a relationship will only increase the possibility of this happening.

Social indicators, on the other hand, refer to both objective (quantitative) and subjective (qualitative) data that consistently explain aspects of a certain social reality. For the author, indicators are created from statistical data, including demographic censuses. Due to their scope and possibilities of spatial disaggregation, these statistics become the main source of information for the construction of these indicators at the municipal, state and federal levels (MATIAS-PEREIRA, 2012).

The construction of an indicator depends on the choice of aspect to be treated in that reality, and, with regard to social phenomena, the most used socioeconomic indicators according to Schlindwein, Cardoso and Shikida (2014), are: the Human Development Index (HDI)) and the Firjan Municipal Development Index (IFMD).

2.2 Human Development Index

The HDI is a comprehensive index that focuses on three basic aspects of human development: a long and healthy life expectancy measured by life expectancy at birth; the ability to acquire knowledge, which is based on average years of education and expected years of education; and the ability to achieve a decent standard of living measured by gross national income per capita (UNDP, 2015).

The HDI was created to antagonize another widely used indicator, the Gross Domestic Product (GDP) per capita. This indicator only considers the economic aspects of development. Conceived by Mahbud ul Haq, in collaboration with Indian economist Amartya Sen, the Human Development Index is a comprehensive indicator of human development (UNDP, 2018).

Using these same pillars and with the objective of evaluating the development of Brazilian municipalities and metropolitan regions, in 2012 UNDP Brazil, Ipea and Fundação João Pinheiro accepted the challenge of adapting the global HDI method in order to calculate the HDI of cities (MHDI), in the case of the 5,565 municipalities in the country. The calculation is based on information from the last 3 IBGE censuses: 1991, 2000 and 2010, and based on the existing municipal network in 2010 (ATLAS BRASIL, 2019).

The HDI varies between 0 and 1, and the closer to 0, the less the development of the local area. Therefore, the closer to 1, the greater the development of the local area. When the HDI is below 0.500, low development occurs; the average development is between 0.500 and 0.799; when the HDI is above 0.800, high development occurs (UNDP, 2018).

The Human Development Index uses the same method to calculate the Global Human Development Index, adjusting the method according to the situation in Brazil and adapting the method used in the Global Human Development Index to the indicators available in the Brazilian Census, to ensure that all have the same data sources and comparability between municipalities.

2.3 Firjan Municipal Development Index

The Firjan Municipal Development Index (FMDI) is an indicator of social and economic development created in 2008 based on the Human Development Index organized by the United Nations (UN). According to data from the Federation of Industries of the State of Rio de Janeiro (2015), it is a comprehensive indicator that comprises three areas and considers them equally: education, health, employment and income. The index combines the level of local socioeconomic development into a single number by simply averaging the results obtained in each of these three fields.

The index provides a more in-depth analysis of municipalities, covering the entire country, including municipal reductions and annual renewals, and assesses various aspects of municipal capacity: primary health care, early childhood education and basic education, maintenance of an income-friendly business ambience of local employment, etc., and for that reason these factors were chosen as a source for the present study. Table 1 shows the variables that make up the FMDI by area of development.

Table 1 - FMDI Components by Development Area

Education	Health	Employment and Income
• Enrollments in Early Childhood Education • Dropout in elementary school • Age-grade distortion in elementary school • Teachers with higher education in elementary school • Average daily class hours in elementary school • IDEB result in elementary education.	• Numbers of prenatal consultations • Deaths from ill-defined causes • Child deaths from preventable causes • Hospitalization sensitive to primary care (ISAB)	• Generation of formal employment • Absorption of local labor • Formal income generation • Average wages for formal employment • Inequality

Source : Firjan (2018).

The FMDI calculation uses mandatory reporting data provided by municipalities and the Ministry of Education, Ministry of Health and Ministry of Labor and Employment and, like the HDI, the FMDI also varies between 0 and 1 and has the same interpretation: Low development, below 0.400; regular development, between 0.400 and 0.599; moderate development, between 0.600 and 0.799; and high, development above 0.800 (FIRJAN, 2018).

The FMDI is an effective social understanding tool because it allows people to understand the municipal development of the region. In addition to being used to correct any undesirable process of actions inconsistent with the expected results, the index can also provide a diagnosis of the local socioeconomic reality and provide data to guide the formulation of public policies based on its results (RIBEIRO, 2018).

3 Agribusiness and regional development

The impact of the agricultural sector on economic and social growth and development is a controversial topic that has generated many discussions, involving the transfer of labor and capital from this sector to industry or the belief that it is essential for income redistribution (CASTRO ; MIRANDA; LIMA, 2015).

According to the World Bank, agriculture has close links with other sectors of the economy, because when agricultural income is used for domestic products and services, it stimulates industries and services. These connections have promoted the vitality and growth of the food processing and marketing sector and the demand for intermediate inputs and services (WORLD BANK, 2008).

Corroborating this, Sarris (2001) states that agricultural growth generated demand for labor, which can directly or indirectly reduce poverty in rural communities through general economic growth. The author points out that people can increase their income in three ways, namely: increase productive assets, such as health and education; increase employment and wage levels and increase the productivity of assets, labor or land.

When considering the main works on the subject, agriculture is a way to promote growth and social development. However, the definitions of development and well-being also generated discussions about the measurement of these variables by income and other more abstract factors. There are two main methods in the literature. The first is the classical or utilitarian approach, which is based on income as a source of maximizing personal utility, so development and well-being start with income. The second is based on a multidimensional approach that considers variables other than income, such as education, opportunity and access to goods and services to determine development and measure well-being. In this sense, the author highlights that the multidimensional method is the closest to the regional development process, because it combines other variables with income factors (ROCHA; MIRANDA, 2010).

With regard to regional development, from the colonial period to the present day the agricultural sector has played an important role in the economic base of Brazil. This agricultural production model is based on monoculture, on the export of products and the use of large estates. In the North and Northeast regions, where the Matopiba region is located, agriculture, based on agribusiness, is the protagonist of the region's development process (CASTRO, 2012). In a sense, agricultural production has always been a strategic economic activity in Brazil, because it played a counter-cyclical role – that is, countermeasures during periods of declining economic vitality (BUAINAIN; GARCIA, 2013; GARCIA; VIEIRA FILHO, 2014). Another striking aspect of Brazilian agriculture is the use of technological components in its systems and production chains, which help to increase productivity (GASQUES et al., 2011).

In recent decades, especially in soybean production, Brazil has shown great growth due to the increase in the planted area and the application of advanced management techniques, which increases productivity (PORCIONATO; CASTRO; PEREIRA, 2018a).

The implementation of a soybean breeding program in Brazil (a technology package developed by a research organization) made it possible to extend the crop to low latitude regions. Factors that have spurred participation in the growth of agricultural production in central Brazil include the construction of Brasília and the increase in regional infrastructure that did not exist in the region previously, as well as the construction of transport, communication and energy infrastructure. Therefore, in this period, agro-industrial was established due to the tax incentives granted for the expansion of agricultural limits (FREITAS, 2011).

Due to the increase in productivity and the expansion of arable land, Brazil has great capacity to expand current production. In recent decades, the agricultural sector of the Brazilian Cerrado has made important contributions to this growth. In the Midwest, the state of Mato Grosso stands out in the country's soybean production, with 13 of the 20 largest grain producing cities located in the state. Currently, the new agricultural frontier of soybeans is becoming promising, placing the North and Northeast in Brazilian agribusiness: Matopiba (BRASIL, 2017).

Agricultural development and grain production have significantly impacted the occupation and economic development of the Midwest, North and Northeast regions. The tax exemption policy and income tax reduction adopted at the time (during the military dictatorship,

starting in 1975) contributed to increasing the concentration of Brazilian lands. According to the study by Schallenberger and Schneider (2010), agribusiness provides directions for the development of these areas. For the authors, livestock and modern agriculture for export have promoted the development of trade and the regional economy and laid the foundations for the implementation of the industry. This process has triggered an expressive flow of capital, services and people, which is reflected in the accelerated process of urbanization in these areas.

Another influence of Brazilian agricultural activity is the occupation of the national territory from the opening of new production areas or territory (GARCIA; VIEIRA FILHO, 2014; MIRANDA, 2012).

> In this way, these areas are welcomed by immigrants due to their enormous exploitation potential, mainly due to public finances and financial incentive schemes for agricultural production, road construction and/or private initiative projects (PORTIONATO; CASTRO; PEREIRA; FIGUEIREDO NETO, 2018b, p. 15).

It is in this situation that the expansion of the agricultural model over Matopiba in the Midwest region was developed, such as the use of hybrids and cultivars adapted to soil and climate conditions, and the effective use of fertilizers, correctives and pesticides and protection management systems, such as no-tillage and crop-livestock-forest integration. In the last ten to fifteen years, this became known as the Cerrado do Nordeste, which is characterized by strong ecological, social and economic restrictions on the development of agricultural capitalism and is being used as a new agricultural frontier in Brazil (CARNEIRO SOBRINHO; COELHO, 2006; MIRANDA , 2012).

Cerrado do Nordeste occupies an area of 645,000 square kilometers (64.5 million hectares), which corresponds to 7.6% of the Brazilian territory and 31.7% of the Cerrado biome. In the last IBGE census (2010), the population of the Cerrado do Nordeste was approximately 8.26 million people, corresponding to 4.3% of the Brazilian population. The population density is 12.8 inhab./km², which is much lower than the national one, of 22.4 inhab./km². The rural population is 2.9 million and the urbanization rate is 65%; is much lower than the 84% of the country (IBGE, 2018).

Thus, it can be observed that the population dynamics of the Cerrados region has promoted its expansion as a frontier, but Buainain et al. (2014) pointed out that other factors affected this process, which the authors call “multiplier effects” – such as the recently established commercial institutions. According to this survey, the productive structure is concentrated in a few cities, and the complexity of the activities is low, in addition to having economic sectors of the agricultural sector.

With that in mind, this research aims to analyze how the expansion of soybean agribusiness in Matopiba, described above, contributed to the improvement of socioeconomic indicators in the region's municipalities.

4 Material and method

The present research fits, in terms of objectives, as explanatory, as it sought to connect the identified variables in order to analyze the causes and effects of these on the phenomenon addressed, that is, the hypothesis: that as the soy agribusiness developed in the Matopiba region, this translated into improvements in the region's socioeconomic indices.

As for the procedure, a bibliographic study was used, through which a series of references on the research topic was proposed, based on scientific publications from the Scientific Periodicals Electronic Library (SPELL), from Capes Periodicals and international bases Science Direct and Google Scholar, between 2009 and 2020.

As for the approach, the research is characterized as predominantly quantitative, as it sought to collect information on the socioeconomic data of the Matopiba region and analyze the relationship between the data and the expansion of agribusiness in the region, using secondary data collected on the page web of the Brazilian Institute of Geography and Statistics (IBGE), to obtain information on the social and economic aspects of the municipalities in the Matopiba microregions from 2004 to 2018, given that it was in this period that grain production intensified in the region.

The reason why the IBGE was chosen as the research data source is that it constitutes the main provider of data and information in the country and serves all social strata and municipal, state and federal government agencies (IBGE, 2018) .

Then, the Federation of Industries of Rio de Janeiro was consulted, which publishes the municipal socioeconomic development index. The third step consisted of identifying the reports of soy production in the municipalities of the Matopiba micro-regions from the IBGE's Automatic Recovery System (SIDRA) database, based on data from the National Supply Company (CONAB), of the Ministry of Agriculture, Livestock and Supply and also the reports from Embrapa's Strategic Territorial Intelligence Group (GITE).

In this sense, the sample used for this research is composed of annual observations of 160 (one hundred and sixty) municipalities distributed in 13 (thirteen) micro-regions of Matopiba, responsible for 76.97% of the total value of production (GITE, 2015), being selected due to its great representation in soybean production in the region between the years 2004 to 2018, period of research interest.

Table 2 presents all the variables collected, with their respective sources of information.

Table 2 - Variables considered in the research

Variables	**Period**	**Source**
Dependent Variables		
Populatiom	2000/2010	File with population estimates, available on the I++BGE page.
GDP at current prices	2004 – 2016	GDP file at current prices, available in the database - SIDRA, on the IBGE page.
GDP per capita	2005 – 2016	GDP file at current prices, available in the database - SIDRA, on the IBGE page.
FMDI General	2005 – 2016	Social performance indicator, available on the Firjan page
FMDI Education	2005 – 2016	Social performance indicator, available on the Firjan page
FMDI Health	2005 – 2016	Social performance indicator, available on the Firjan page
FMDI Employment and Income	2005 – 2016	Social performance indicator, available on the Firjan page
Independent Variables		
Quantity produced x 1000 (ton.) of soy	2004 – 2018	File with production value (one thousand reais), available in the Database – SIDRA, on the IBGE website.

Yield (kg/ha) of soybean	2004 – 2018	File with average yield, available in the Database – SIDRA, on the IBGE website.
Soybean harvested area in crops from 2004 to 2018	2004 – 2018	File with harvested area, available in the Database – SIDRA, on the IBGE website.
Total production in tons from the 2004 to 2018 harvests.	2004 – 2018	Produced area file, available in the Database – SIDRA, on the IBGE website.-gm7+7-

Source: The authors.

The study used multiple linear regression as a statistical technique to analyze socioeconomic data from municipalities in the Matopiba microregions and soybean production data in the region. According to Gujarati and Porter (2011), it is the study that proves the dependence of a variable (dependent variable) on one or more variables (explanatory variables) to estimate or predict the average (general) value of the first and last variables. , or a fixed value (in repeated sampling).

Through multiple regression, variance Y (dependent variable) is explained by the behavior of variable X (independent variables) (PEREIRA; FIGUEIREDO NETO, 2018). The explanatory power of the regression is measured by adjusting or explaining the coefficient R^2, where Fávero (2015) explains that the R^2 is as part of the variance of the sample Y explained (or predicted) by the explanatory variable. The sample proportion of changes in the dependent variable explained by the set of explanatory variables is used as a measure of the degree of fit of the proposed model. To assess the general significance of the model and of each parameter, the T test is used. According to Fávero, Belfiore and Silva (2009), the T test tries to determine whether there is a statistical difference between the sample means.

The regression model was carried out by Generalized Least Squares (GLS), according to Gujarati and Porter (2011), due to the need to minimize the variance of the estimator. GLS is used for regression analysis to make it more consistent and reliable.

With the annual reports of the municipalities studied, Pearson's correlation was made between the socioeconomic variables (dependent variables) and the variables related to soybean production in the region (independent variable). The Pearson ® correlation coefficient ranges from -1 to 1.

The sign indicates the positive or negative direction of the relationship and the value, the strength of the relationship between the variables. A perfect correlation (-1 or 1) means that the score of one variable can be accurately determined by knowing the score of another variable. On the other hand, a zero correlation coefficient indicates that there is no linear relationship between the variables (FIGUEIREDO FILHO; SILVA JUNIOR, 2009, p. 119).

For data organization, SPSS 25.0 software was used. Since then, multiple linear regression has been performed and the equation obtained by fitting the model is as follows (1)

$$Y = \alpha + \beta 1.X1 + ... + \beta n.Xn + \varepsilon$$

Where Y is the variable to be explained (socioeconomic development index) and the following factors are considered as explanatory variables: IFDM Health (grade), IFDM General (grade), IFDM Employment and income (grade), IFDM Education (grade). α is a constant. The X's are the explanatory variables to be tested to explain the variable Y. ε is the expected error of the analysis, and β is the coefficient that measures the magnitude of the influence of the corresponding X on Y.

In the present work, the X variables are: Area planted or destined for harvest (percentage of the general total), Total area harvested (ha), Area harvested (percentage of the general total), Quantity produced (ton.), Productivity (Kg/ha) , Production (R$1,000), Total Production (R$1,000) and Production (R$1,000) percentage of the grand total.

5 Results and discussions

Based on the analysis of the research data, the study evaluated whether the variables considered contributed to the model, applying the regression significance test called F and t statistics, considering in this study the α=10%, that is, if the p value calculated from the F and t test is less than 0.1, the acceptance test variable explains the hypothesis of the response variable. Generally the statistic, R^2 is used to evaluate the fit of the model. The higher the value, the better the fit.

Based on this assumption, using multiple regression, 4 indicators (or response variables) were evaluated in order to verify the impact of soybean production variables on the related socioeconomic development indices as shown in Table 1.

Table 1 - Adjustment statistics of the modeling of the evaluated variables

Response variables	R	R^2	R^2 adjusted	Standard error of the estimate	N of predictors[(a)]	Valor F	P- test value F
FMDI HEALTH Grade	0,57	0,32	0,27	0,11	10	7,10	<0,001
FMDI General Grade	0,57	0,32	0,28	0,06	10	7,16	<0,001
FMDI EMPPLOYEMENT & INCOME Grade	0,48	0,23	0,17	0,05	10	4,41	<0,001
FMDI EDUCATION Grade	0,59	0,35	0,30	0,08	10	8,01	<0,001

Source: The authors

[(a)] Predictors in the Model: (Constant), Area planted or destined for harvest - general total percentage, Harvested area (ha), Harvested area (ha) percentage of the general total, Amount produced (ton.), Productivity (kg/ha), Production (R$1,000), Production - percentage of the grand total.
*: Gray values are significant.

As can be seen in Table 1, there was significance for the dependent variables by the F test: FMDI Health (grade), FMDI General (grade), FMDI Employment and Income (grade), FMDI Education (grade). Such significance can be seen by p-values smaller than 0.10, that is, these dependent variables are related to agricultural production variables (area, tons and/or productivity).

It is noteworthy that the F test is a general significance test that assesses whether the group of independent variables, when used together, reliably predicts the dependent variable and does not address the ability of any particular independent variable to predict the dependent variables. The ability of each individual independent variable to predict the dependent variable is performed by the t test (UCLA, 2016).Um fato a ser notado é que tanto o R^2 como o R^2 ajustado para as variáveis significativas foram menores do que 0,5 ou 50%.

This shows that more than 50% of the variability of FMDI Health, FMDI General, FMDI Employment and Income, FMDI Education is not explained only by the area and quantity of soybeans produced, but by other factors such as, for example, public policies aimed at region in the period.

The analysis of the significance of the relationship between the independent and dependent variables and whether the contribution is positive or negative with regard to the indicators tested as response variables are shown in Table 2.

Table 2 - Estimates of the Standardized coefficients of the Predictor Variables (β) and p-values of the t test to verify if the β are significant

Predictor	FMDI HEALTH Grade	FMDI General Grade	FMDI EMPPLOYEMENT & INCOME Grade	FMDI EDUCATION Grade

	β	P-value	B	P-value	β	P-value	β	P-value
(Constant)	5,2E-01	0,000	4,3E-01	0,000	3,9E-01	0,000	4,7E-01	0,000
Area planted or intended for harvest % of the total	5,8E-04	0,934	2,0E-03	0,584	1,4E-03	0,656	2,5E-03	0,640
Total Area Harvested	-3,0E-07	0,314	-1,2E-07	0,450	9,5E-08	0,486	-2,6E-07	0,250
Harvested area (ha)	2,3E-08	0,953	6,8E-08	0,746	-7,1E-08	0,700	6,9E-08	0,820
Harvested area% of total	-1,2E-03	0,869	-2,3E-03	0,541	-6,8E-04	0,834	-8,7E-04	0,872
Quantity produced (ton)	-2,0E-07	0,035	-1,5E-07	0,003	8,4E-09	0,848	-1,8E-07	0,015
Productivity (Kg/ha)	-4,5E-06	0,875	2,1E-05	0,173	3,2E-05	0,017	4,1E-06	0,851
Total Production x R$ 1,000	1,3E-07	0,020	8,2E-08	0,006	3,8E-08	0,148	1,3E-07	0,002
Production x R$ 1,000	9,7E-08	0,373	3,5E-08	0,545	-1,2E-07	0,016	5,6E-08	0,505
Production x R$ 1.000% of total	2,7E-03	0,079	1,6E-03	0,059	-1,2E-03	0,096	9,0E-04	0,448

Source: The authors.

*Values marked in gray are significant by the t test with a significance of 10%.

It can be seen from Table 2 that the variable quantity produced (ton.) had a negative and significant impact by the t test at 10% probability for IFDM Health (score). The variables Total Production (R$ 1,000) and Production (R$ 1,000) as a percentage of the total had a positive impact on the IFDM Health (grade).

However, the β values were very low, a result that indicates that, even if the values of quantity produced (ton.) Total Production (R$ 1,000) and Production (R$ 1,000) percentage of the total present a large variation, the values of IFDM Health (grade) tend to vary relatively little.

The variable quantity produced (ton.) had a negative and significant impact by the t test at 10% probability for General IFDM (grade), while the variables Total Production (R$ 1,000) and Production (R$ 1,000) percentage of the total had positive impacts on the said index. However, the β values, as well as the Health IFDM (score) were relatively low.

The Productivity variable (kg/ha), in turn, had a positive and significant impact by the t test at 10% probability for FMDI Employment and Income (grade). However, the variables Production (R$ 1,000) and Production (R$ 1,000) as a percentage of the total had negative impacts on FMDI Employment and Income (grade). Nevertheless, the β values, as well as the Health FMDI (score) and General FMDI (score) were very low.

It can be seen, in the same table, that the variable quantity produced (ton.) had a negative and significant impact by the t test at 10% of probability for IFDM Education (grade), while the variables Total Production (R$ 1,000) and Production (R$ 1,000) as a percentage of the total had positive impacts on the aforementioned index. But, again, the β values, as well as IFDM Health (grade), IFDM General (grade), IFDM Employment and Income (grade) were very low.

In general, it can be seen that the variables of soybean production in Matopiba have a positive and significant impact on the socioeconomic variables of the region, and it is in the variable Total Production (R$ 1,000) that this influence is most noticeable in the region, also reflected in the socioeconomic indices studied, FMDI Education (grade), FMDI Health (grade) and a little more expressively in the General FMDI (grade).

Regarding the FMDI Employment and Income (note), although the production variables also have a positive impact, the productivity variable (kg/ha) was the one that most significantly influenced this index, presenting a $\beta = 3.2$.

These results partially confirm the research hypothesis that tests the claim that, as agribusiness evolves in the Matopiba region, it translates into improvements in the region's

socioeconomic indices, given that, as indicated by the multivariate statistical analysis, there are a positive influence of the soy agribusiness on the region's socioeconomic indicators.

However, this influence, even if positive, indicates an explanatory power of only 30% on the socioeconomic indicators of the municipalities in the Matopiba microregions studied. Such findings are in line with the results of research by Oliveira (2015) and Buainain, Garcia and Vieira Filho (2017), who claim that this situation is due to the vitality of Brazilian agribusiness, given that the new productive organization is responsible for the energy, economic and territorial expansion and the increase in total factor productivity, allowing agriculture and agro-industries to become an important engine of the economy and development of these regions, despite the intensity and socioeconomic impact between each pole and the new open borders from the 1970s are different.

However, in many parts of the country, the dynamism of agriculture is not enough to boost the sector and lead to a more complex economic structure, a greater absorption capacity of the local population and generate independent employment and income opportunities. In this sense, Buainain, Garcia and Vieira Filho (2017) state that, driven by the vitality of agriculture in the Cerrado region, the economic and effective structures of Matopiba still rarely reflect the most recent changes in this region.

In this sense, it is possible that income generation in some cities is more intense and concentrated, leading to increased inequality in the region. However, with the growth of investments and economic activity in the local region, cities tend to start a more intense tax collection process and depend less on government transfers, thus enabling the improvement of the region's human development indices.

Despite this, according to what the research results suggest, the Matopiba region is still highly dependent on the implementation of public policies, which can be carried out through different agents. Such institutions are extremely relevant for its implementation, as they tend to integrate the federal administration, especially with regard to the implementation of public policies, plans, programs and projects, as they consider the sustainability of agribusiness as objectives and tasks. and also for having experienced technicians to solve the problems and "bottlenecks" of Brazilian agriculture.

In view of this, although Brazilian agriculture currently stands out in the world for its high productive efficiency and wide participation in international trade, the pressure for responses to improve social and environmental aspects continues. Under these pressures, agricultural policies emerged at a historic moment in new areas of this sector in the country. One of them is the Matopiba region, and the federal government approved in Decree n. 8,447 in May 2015, whose purpose is based on agriculture and livestock to promote and coordinate public policies aimed at sustainable economic development, improving the quality of life of the population of this region. region.

This governmental action is basically carried out with the provision of infrastructure, such as schools and health centers; in agricultural production, with access to sources of credit for investments in machinery, equipment and crop financing, which are important government measures to stimulate production in areas of expansion such as Matopiba.

As for the environmental issue, theoretically, it is one of the pillars of Brazilian agricultural policy. In 2016, the "Projeto Matopiba 2020 ", initiated by the Brazilian Rural Society (BRS), covered the region. It established a partnership with Conservation International Brazil (CI-Brasil) and the Brazilian Foundation for Sustainable Development (BFSD).

The project is part of the Global Environment Facility (GEF), the World Bank and the United Nations Development Program (UNDP) "Parceria para o Bom Crescimento", which aims to promote the integration of agricultural production and the conservation of biodiversity, with the aim of taking Brazilian agribusiness to another level and making it the most productive and sustainable in the world (REVISTA GLOBO RURAL, 2016).

As we have seen, there are several government policies that encourage the creation and execution of public policies in agribusiness, following the agricultural policy instruments pre-established by Law n. 8,171/91. These policies are important and help in the development of agribusiness in the country, strengthening the emergence of new frontiers in the sector.

In this logic, it can be said that in Matopiba the agricultural policies that stood out the most were: technological agricultural research, arising from research and projects by Embrapa; vocational training and rural education, both for the local population and for producers who came from other states; public and private investments, mainly for the improvement of the region's infrastructure, such as the recovery of roads; and rural credit, for purchases of machinery and inputs, and thus promote an increase in productivity, which, as indicated by the survey results, is the variable that most impacts the region's employment and income rates.

In this perspective, the study suggests that it is in the integration of agricultural production with public policies, as well as the inclusion of the local population in the productive sector, generating more jobs and improving the level of development of the local population that positive results can be obtained in the future. in all indicators, especially in those that were negatively evaluated, such as the FMDI Health.

By the way, it is worth noting that there are some environmental restrictions for the development of agriculture in Matopiba, such as: agricultural potential; water availability; institutional restrictions, such as the 2012 Forest Code; conservation units; and the creation of new areas of protection. However, along with the restrictions, there are also consequences of social action that affect the performance of agribusiness, processes of desertification, increased deforestation, state of emergency, of public calamity and local climate change (GARCIA; VIEIRA FILHO, 2017).

Agricultural potential is the starting point to discuss environmental restrictions and factors that affect the maintenance and advancement of agricultural activities in Matopiba. This potential can be evaluated based on soil characteristics, whether favorable or unfavorable for agricultural use in relation to natural fertility, physical, chemical and morphological properties (IBGE, 1997). In this sense, the Ministry of the Environment points to a high probability of an increase in the process of desertification in the region, arising from the inappropriate use of the soil by society, which will imply the need for investments in soil management, in order to stop this process. Something around 9.6 million hectares in this region will possibly be affected by this phenomenon, a fact that could have negative consequences for agriculture, such as water scarcity and increased soil acidity (EMBRAPA, 2015). This, then, must be the object of attention in the management of this region, which is so important for Brazilian society.

6 Final considerations

Agribusiness is the fastest growing activity and contributes to Brazil's economy, and for this reason, among others, the country stands out in the production and commercialization of grains worldwide. This evolution is mainly due to the emergence of new agricultural frontiers, such as the Matopiba region.

Due to its representativeness in the sector and its high agricultural expansion, especially in soybean production, this study sought to investigate the relationship of soybean agribusiness on the socioeconomic indicators of the municipalities of Matopiba. For this, the socioeconomic variables and soybean production variables in the region between the years 2004 to 2018 were used.

Analyzes were undertaken to assess the socioeconomic indicators and production of the 160 municipalities that make up the 13 microregions. To investigate the relationship between agribusiness and socioeconomic indicators in Matopiba, a multivariate regression analysis was used, using variables that include socioeconomic and production dimensions, to explain the

behavior of socioeconomic indicators over the years, in relation to agribusiness results of soy in the region.

Based on the selected variables, the results indicated the significance for 4 dependent variables: FMDI Health grade, FMDI Employment and Income grade, FMDI Education grade, FMDI General grade, considered α=10%, where the p-value calculated in the study by the test F and t was less than (0.1). The production variables signaled an explanatory power of around 30% on the socioeconomic indicators of the municipalities in the Matopiba microregions in the period studied, partially confirming the research hypothesis: that as agribusiness evolves in the Matopiba region, this translates into improvements in socioeconomic indices in the region.

The study contributes to the deepening of discussions about agribusiness and its influence on the socioeconomic development of soybean producing regions, given the few published works on the subject. It is believed that the research brought evidence that can serve as a basis for further investigations related to the topic discussed here.

As limitations of this research, we can highlight the unavailability of some data about the municipalities, many of which are incomplete and inconsistent, thus restricting the introduction of other variables, which could add more information about the relationship between agribusiness and of the socioeconomic development of the researched territory.

As a suggestion for future research, we propose the inclusion in the model of the role of public policies on the socioeconomic variables of the Matopiba region, as well as the comparison of the evolution of the reality of this region with other regions of their respective states, seeking to reflect on the role of the agribusiness and public management on Brazilian agricultural borders, considering that, as found, the explanation of the evolution of socioeconomic development indices in these regions is not exclusively clarified by the action of agribusiness, although the latter contributes to its improvement, as indicated in the research .

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