Dairy farming dynamics in the state of São Paulo

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ABSTRACT

Dairy farming is one of the most relevant sectors of Brazilian agribusiness and it has high socioeconomic importance to the nutrition and food safety of the population. In 2019, Brazil was ranked as the sixth largest milk producer in worldwide. However, the state of São Paulo has been particularly showing a gradual decrease in the country's prominence regarding milk production, as it was downgraded from the second largest producer in 1990 to the sixth one in 2019. In this context, the general objective of this research is to analyze the dynamics of the dairy farming system in the state from Sao Paulo. For such a purpose, this work was developed through an exploratory research of a quantitative nature. Moreover, a literature review on the subject and documental research allowed analyzing the explanatory factors of productivity changes in dairy farming activities, and it was found that the state of São Paulo presented a significant reduction in its cattle herd and milked cows during the period of analysis (1990-2019), thus leading to lower milk production. Despite managing to increase its milk productivity rates, the state has not followed the nation's growth trend for the sector. A combination of these factors explains such a reduction in São Paulo's prominence nationwide. Its productive structure does not seem to be an influencing factor in such dynamics, since the features of production in small farms and Family Farming are similar among its main producing states and the country as a whole.

KEYWORDS: Milk. Dairy farming. Agribusiness. Agro-industrial System.

1 INTRODUCTION

Brazilian agribusiness has a prominent role in its economy, given its standing regarding the Gross Domestic Product (GDP), as well as the national trade balance. In addition to its economic importance, the social relevance and development capacity of this sector for the country must also be explained.

Rodrigues (2001) attempted to understand the range of factors and sectors influenced by agribusiness and reaffirmed its capacity to be one of the main means of promoting development in the country, and solve serious and chronic problems. The author believes that agribusiness allowed achieving good economic results and ensuring job creation.

Given that agribusiness is regarded as a productive chain, this field of analysis is defined as a chain of activities originating in the agricultural sector (production of raw material of animal origin, or vegetable source in such a case) with upstream (segments of agricultural inputs) and downstream elements (processing of agricultural products and transport to the end consumer) (BATALHA, 2021; BARROS; SILVA; FACHINELLO, 2014).

Grynszpan (2012) defines the concept of agribusiness as a social entity which is sized and perceptible in its area, having its own institutions and interests. As it is undergoing constant transformation, agribusiness has been perfected and developed through relationships and disputes of interests with other institutions influenced by public policies and social dynamics carried out by its national and international agencies (GRYNSZPAN, 2012; RODRIGUES, 2001).

As regards Brazilian agribusiness, the Agroindustrial System of Milk stands out. This production chain plays an important role in supplying food to the Brazilian population, and generates jobs in the countryside and income for thousands of rural producers (PEROBELLI et al., 2018). In 2019, Brazil was accountable for the production of 34.8 billion liters of milk, resulting in a 2.7% increase if compared to the previous year (IBGE, 2021). This production ranks the country as the sixth largest milk producer in the international scenario, and it is only outranked by the European Union and United States, India, China and Russia (USDA, 2019). Even though there was a reduction in the total number of milked cows compared to previous years,

milk production in 2019 represented the second largest amount of milk production nationwide, revealing higher milk productivity at a rate of 2,141 liters of milk/cow yearly (IBGE, 2021).

Although it is scattered throughout the country's territory, it was verified that milk production was concentrated mainly in its southeastern region in the 1990s, with the states of Minas Gerais and São Paulo being its major producers, or 43% of the country's overall production. (IBGE, 2021). From the 2000s, however, there has been an increase in milk production in its southern states (Paraná, Santa Catarina and Rio Grande do Sul) and Goiás.

The state of São Paulo, which once occupied an upstanding position in the national dairy scenario, has been gradually losing its prominence. This fact indicates a restructuring of productive activities in the country (BÁNKUTI et al., 2017).

Given the above, it is scientifically worth understanding such a change in dairy farming in Brazil, particularly in the state of São Paulo. In this sense, the general aim of this research is to analyze the dairy farming system in the state of São Paulo and identify the explanatory factors of its dynamics.

Therefore, this work has been divided into 5 sections. Initially, its context, justification and objective are presented as an introduction. Its methodology is evidenced in the second section. In the third section, a literature review on the economic and nutritional importance of milk is presented, as well as the evolution of the dairy farming sector in Brazil and its normative instruments. In the fourth and fifth sections, its results and final considerations are presented and discussed, respectively.

2 METHODOLOGY

To achieve the proposed objective, this work is an exploratory research of a qualitative nature aiming to acquire familiarity with the problem, either by explaining it or formulating hypotheses. Its main objective is to improve ideas or find intuitions. It has a very flexible planning so as to investigate various aspects of the objective proposed herein (GIL, 2002).

It was adopted a qualitative approach as research methodology which, according to Bogdan and Biklen (1994), focuses on descriptive aspects and individual perceptions in order to identify those involved and exploring the scenario experienced.

A literature review and documentary research were also carried out by selecting the most relevant scientific articles and publications about Brazilian and/or São Paulo dairy farming. As for data collection, it was opted for a document analysis consisting of data with no analytical treatment, or one that can be re-elaborated according to the objectives proposed herein (LAKATOS; MARCONI, 2003). Document analysis generally makes use of diverse and widespread sources, which generates a rich and reliable source of data (GIL, 2002; LAKATOS; MARCONI, 2003).

3 LITERATURE REVIEW

3.1 Economic and nutritional importance of milk

Milk is one of the most important agricultural commodities in the world, in addition to being ranked among the five most commonly traded products in terms of volume and value. It is considered a vital source of nutrition for having macro proteins of high biological value,

essential vitamins and minerals for the development of the human body at different stages of human life (MUNIZ; MADRUGA; ARAUJO, 2013; SIQUEIRA, 2019).

It is considered a rich food and contributes to 5% of daily energy needs, 10% of protein needs per day and 9% of daily fat requirements on average. Therefore, milk and its derivatives are among the most accessible sources of protein, vitamin D, calcium and vitamin A (SIQUEIRA, 2019).

According to the FAO, Food and Agriculture Organization of the United Nations, its physicochemical characteristics allow great versatility in its use, which is why billions of people consume it on a daily basis in its most diverse forms worldwide. In addition to its raw consumption as a main meal (UHT milk), it is also used as input for the production of derivatives and processed products, such as cheese, butter, yogurt and dairy drinks, in addition to being massively used in the food industry (SIQUEIRA, 2019).

In addition to its nutritional importance, milk has a strong socioeconomic relevance, as it is the livelihood of a large amount of rural producers globally, thus playing an essential role in the economic development of well developed countries, mainly in developing countries relying on family farming systems (CONAB, 2016; MATTE; JUNG, 2017).

The global milk production is 816 million tons a year and an average of 116.5 kg of UHT milk are consumed per inhabitant, with prospects to increase by 1.2% on a yearly basis (GDP, 2019). For every actual production rise in the milk agro-industrial system, there is approximately a five-reais increase in the Gross Domestic Product (GDP), which ranks milk agribusinesses ahead of more important sectors such as the steel industry and textile industries in Brazil (CARVALHO et al., 2003). Furthermore, Martins et al. (2016) have analyzed the Brazilian milk and dairy products market, and demonstrated that an increase in Brazilian income reveals that there is a direct growth in the consumption of fresh milk and its derivatives, i.e. for every 1% increase in the population's income, it is estimated a growth in expenditure on dairy products of 0.339%.

The versatility of milk also shows great potential for growth in demand and generation of wealth. In addition to fluid (raw, pasteurized, pasteurized type A, UHT) and powdered milk, flavored milk, milk drinks, milk compounds, infant formulas (for infants, early childhood children, newborns, and children with special needs), dairy supplements and supplements, fermented milk products (such as yoghurt, curd and kefir), cheese (cured by bacteria or fungi, i.e. processed), butters, creams, cream, fats, milk jam, condensed milk, desserts, ice cream, whey, concentrated protein peptides (isolated and hydrolyzed) among other milk products or by-products are marketed (REGO et al, 2020).

According to data from the International Monetary Fund (IMF), about 1 billion people depend on milk to survive and 600 million live in 133 million dairy farms around the world. Therefore, about 10% of the world's population directly depends on dairy farming activities (SIQUEIRA, 2019).

3.2 Evolution of the Brazilian dairy sector

In Brazil, the history of cattle farming dates back to the 16th century. In 1534, the Portuguese donator Martim Afonso de Souza landed the first 32 European Caracu and Dutch Belted cattle in the settlement of São Vicente. Initially, the animals were used as a means of transport, traction, food and leather production, and served as a high-value exchange currency (MOUTINHO, 2018).

However, cattle were sold at high prices, costing 12,000 réis per head, in addition to having low survival rates due to random crossing between breeds associated with the nation's tropical climate and existing forage (MOUTINHO, 2018).

It was only from the 19th century onwards that the activity gained significance as a result of a decline in coffee production. In the settlement contracts of coffee farms, the creation of up to three dairy cows was authorized so that the colonist could meet the needs of his family (MOUTINHO, 2018).

The geographical area of livestock was interconnected with the economic interests of metropolises and mainly located in areas where export items were produced, thus generating violent conflicts between breeders and planters of cassava, wheat and sugar cane (MOUTINHO, 2018).

Due to the perishability of milk and obstacles to transporting it, the product was restricted to marketing only around properties. Therefore, production in Brazil was a complementary activity in agricultural establishments for quite some time, maintaining characteristics of subsistence production to serve a large number of people living in rural areas (BACCARIN; ALEIXO, 2013).

In the 20th century, the Brazilian political scenario started to increasingly favor agrarian activities and allowed a modernization of farms and dairy farming development, albeit with some delay. This occurred after the end of the second Brazilian industrial revolution, with the emergence of more stringent state regulation regarding the quality of milk production and marketing (VILELA et al., 2017).

In the meantime, there was a transformation in dairy farming through successive legal, technological and logistical changes providing ways for the creation of a dairy circuit, supported by improvements in transport and studies aimed to reduce the perishability of these products (MILINSKI; VENTURA, 2010).

According to Vilela et al. (2017), the factors leading to such transformations in the dairy chain occurred while President Getúlio Vargas was in office, who signed Decree No. 30.691 approving the Regulation of Industrial and Sanitary Inspection and Control over Animal Products (RIISPOA).

The RIISPOA governed establishments carrying out interstate or international trade and made the following items mandatory: milk pasteurization; inspection and stamp of the Fiscal Inspection Service (SIF) and classification of milk into types (A, B and C) according to milking sanitary conditions and the way of processing, treatment and marketing milk (BNDES, 2013; VILELA et al., 2017).

The decree was in force until the end of the 1990s and underwent several modifications, among which the most important was introduced when Brazil became a member of the Southern Common Market (MERCOSUR). As multinational companies were introduced into Brazil, there was a considerable increase in the amount of dairy companies and the share of UHT milk in the nation's fluid milk market, in addition to offering a positive incentive for an intense reorganization of dairy farming with increased competitiveness so as to face foreign competition. (SANTOS; BARROS, 2006).

Martins et al. (2004) pointed out that, from the 1990s onwards, profound changes occurred in the milk agribusiness. Among the main drivers of such transformations, it is worth mentioning the end of the milk price regulations, increased consumption boosted by the Real

Plan, greater milk production in the Midwest, market opening and a consequent increase in imports, in addition to mergers and acquisitions of bulk trucking companies, compelling businesses to become more competitive and efficient so as to adapt to the new requirements of the domestic market.

The end of price regulation allowed the dairy market to no longer be under government control after 46 years. The previous period was characterized by many losses to the dairy activity, as it was more specifically aimed at controlling inflation than with the intent of modernizing the sector (GOMES, 2001).

As early as 1994, the Minister of Finance, Fernando Henrique Cardoso, enacted the Real Plan, which has brought moments of stability to the Brazilian economy due to a generalized drop in inflation. This factor strongly stimulated the sector, since an increase in consumer income also led to greater demand for dairy products. On the other hand, from the perspective of production, economic stability together with trade liberalization reduced the price of milk and the profit margins of producers, placing the dairy segment at risk and urging less efficient production systems even further (GOMES, 2001).

With the Real plan, dairy imports rose sharply, i.e. from 9% to 18% of domestic production. There was also an important change in the profile of importers, which was previously carried out only by the government to regularize domestic supply and meet social programs, which then started covering the dairy industry and businessmen in the area (GOMES, 2001).

3.3 Normative instruments for dairy activities in Brazil

Given the need to reformulate and update government measures adopted for the milk production chain, particularly concerning the RIISPOA and DIPOA (Department of Inspection of Animal Origin Products), the Ministry of Agriculture, Livestock and Supply (MAPA) issued normative instruction No. 51/2002. The regulation gave rise to the National Milk Quality Improvement Program (PNMQL), a strategic public policy for Brazilian agribusiness implemented to leverage the country's competitiveness (MILINSKI; VENTURA, 2010).

This program was set up by a council board made up of government technicians and major representatives of the milk production chain aimed at the supply of milk and dairy products by aligning national standards to international ones through the insertion of reference parameters towards the search for quality. The program also proposed health and quality standards for bulk transport of refrigerated milk, and it reflected a significant change in the modernization process of dairy agro-industrial systems (MILINSKI; VENTURA, 2010).

Due to an increasingly fierce competition in the international market, the quality of dairy products, especially milk, became a priority in all links of the production chain. Among initiatives, there was the need for refrigerators on properties and the collection of milk in bulk quantities, which in turn urged producers who could not afford the investments required for bulkink of milk (GOMES, 2001).

Milk logistics also underwent significant changes in this period (mainly in the second half of the 1990s). Meanwhile, the collection of milk in bulk quantities using trucks having isothermal tanks was intensified, leading to profound and significant changes in the logistics system of dairy production. This fact led Brazil to having one of the fastest milk collection logistics chains in the world (MARTINS et al., 2004).

In addition to a modernization of the logistics system, the introduction of the concept of transport logistics into the dairy production system has led to a significantly reduction in transport costs and quality gains, since it allowed the closing of cooling stations, fewer collection routes (without necessarily prioritizing large producers) and increased quantities transported by trucks (MARTINS et al., 2004; MARTINS et al., 1999)

These initiatives have substantially increased milk production in the country, and thus challenges of increasing domestic consumption and exploring new markets were posed to industries. From this point onwards, a sector dynamics was introduced into the country, which is characterized by significant growth rates in domestic production resulting from an increase in cattle herd, intensification of imports and, mainly increased productivity through the adoption of new technologies, increased labor and expansion of cultivated areas (ALVES; SOUZA; ROCHA, 2012; VILELA et al., 2017).

However, such changes triggered a series of imbalances, reactions and adaptations in the institutional environment of the milk production chain, thus affecting commercial, structural and organizational contexts of the Brazilian dairy farming sector (OLIVEIRA; SILVA, 2012; MOUTINHO, 2018).

4 RESULTS AND DISCUSSION

4.1 The milk production chain in Brazil

The milk production chain plays a very important social and economic role in Brazil. Dairy farming is governed by several national public policies carried out in a standardized and homogeneous manner aimed to safeguard the interests of rural producers and protect the Brazilian industry against foreign competition (SALGADO, 2013; VILELA, 2016).

According to the Census of Agriculture of 2017, 955,160 (81.2%) out of 1,176,295 establishments producing cow's milk in Brazil are governed by Decree Nº. 9.064. (IBGE, 2020a,d).

This is important, mainly on account of the fact that dairy activities are the livelihood of rural producers, since it is one of the main activities developed by family farmers countrywide. As it is an instrument of social development, it provides a quick return to small-scale producers, assists in supplying food and generating jobs and income, in addition to being an additional source of income at times, or even their main means to make a living, thus reducing rural exodus (CYRNE et al., 2015; MATTE JÚNIOR; JUNG, 2017; PIRES et al., 2018).

Such activity has been consolidated as part of the income of small farmers, therefore affecting regional development, mainly due to factors as workforce absorption, social reach and adding value to the property, and even enabling the use of lower quality land towards its development (MATTE JÚNIOR; JUNG, 2017).

According to the United States Department of Agriculture (USDA), Brazil was responsible for an average of 6.5% of the global milk production in 2019, and it was ranked as sixth largest producer (Table 1). The five main producers in the period were the European Union (30.7%), the United States (19.6%), India (18.2%), China (7%) and Russia (6.6%) which, together with Brazilian production, account for 88% of worldwide production (FAOSTAT, 2020; USDA, 2019).

Table 1: Rankings of the largest milk producers in the world in 2019

Country/Community	Thousand liters a year
European Union	145.091
USA	92.417
India	85.865
China	33.114
Russia	31.215
Brazil	**30.967**
New Zealand	19.917
Mexico	11.582
Argentina	10.864

Source: USDA, 2019

Despite the fact that there has been a considerable growth since the 20th century, dairy farming is still irregularly distributed throughout the Brazilian territory. Although milk production is spread across the country, IBGE data (2020b) revealed that its production currently and largely takes place in the states of Minas Gerais (26.42%), Paraná (12.93%), Rio Grande do South (12.54%) and Goiás (9.11%), which are accountable for 61% of the country's overall production (IBGE, 2020b).

The number of cows milked between 1990 and 2019 in Brazil decreased from 19,072,907 to 16,270,691 heads of cattle, i.e. a 15% reduction. Meanwhile, milk production in the country increased from 14,484,414 to 34,844,932 thousand liters, which represents a 241% increase (IBGE, 2020c). This indicates efficiency gains in the production system, i.e. milked cows started producing more milk.

Such data are the result of improvements in the production process. Dairy farming has been innovating and perfecting itself through techniques for improving dairy cattle, such as genetic improvements to seek better offspring, in addition to suitable pastures for each type of soil and climate aimed at animal feeding in the region in order to achieve the highest production yield per head of cattle at the lowest cost (CARLOTTO; FILIPPI; MARCELLO, 2011).

Although the agribusiness sector is growing steadily, the potential of milk is restricted to domestic consumption. According to Vilela (2016), without the respective increase in exports, such a rise in production results in price reduction which is enough to hinder technology dissemination, especially concerning small-scale producers.

The problem takes on greater proportions for these producers, as they sell milk at lower prices than larger producers, but otherwise acquire their inputs at higher prices, thus making modern technology unfeasible for small properties (VILELA, 2016).

Therefore, multiple producers are unable to adopt new technologies and concepts on their own, thus leaving the dairy industry often in charge of imparting new technologies to milk suppliers (VILELA, 2016).

One of the widely used alternatives in Brazil to overcome such technological and economic differences was the formation of cooperatives. As it is guided by democratic participation, this business model promotes economic growth and social inclusion based on haggling for better prices, the possibility of adding value to products, providing access to new markets and adopting innovative technologies (VILELA, 2016).

Cooperative associations arose from the need to group production from different properties around an industrial plant with a view to acquiring raw milk and manufacturing dairy products. In most cases, they were created with the aim of offering better remuneration to

producers, but they were developed and structured so as to meet the increased consumer market demand during the period of urban population growth in Brazil (VILELA, 2016).

Matte Júnior and Jung (2017) affirm that the model was successful due to the fact that its characteristics are prone to the development of dairy activities involving a family farming model, regardless of the technology adopted by the group. In fact, it is mainly on account of varying sources of income provided by other livestock and crops, which in turn support and enable producers to remain in the countryside.

Other reasons contribute to organize production in the form of cooperatives, such as the adaptability of dairy activities to different ecological, climate and socioeconomic conditions, which allow different scales and systems of production. Thus, the producers involved are benefited and input buyers and sellers are provided with greater sales and power of negotiation, i.e. necessary features for cattle herd management (MATTE JÚNIOR; JUNG, 2017).

However, even though they have been essential to the dairy sector for several years, cooperatives were strongly impacted by changes in the national market from the 1990s onwards, mainly due to market opening and a reduction in their activities, as they lost business to non-cooperative companies (VILELA , 2016).

It is necessary to adopt strategies based on legal, management, governance and financial health aspects so as to allow cooperatives to regain strength and stimulate innovations in the domestic production chain (VILELA, 2016).

Since the World Health Organization (WHO) announced the COVID-19 pandemic caused by the new coronavirus Sars-Cov 2 on March 11, 2020, practically all sectors have suffered the effects of this health crisis and the measures taken to reduce the spread of the virus. Expectations of an economic downturn, rampant unemployment, negative reviews on the nation's GDP and the dollar exchange rate compared to the Brazilian real were some of the economic indicators emerging at the end of 2020. However, agribusiness and exportations contributed to maintain the country's trade balance positive (ESSADO NETO et al., 2020).

In the dairy market, the inputs needed for dairy farming showed price variations compared to periods prior to the COVID-19 pandemic. According to Piza et al. (2020), producers experienced an increase ranging between 10% and 50% regarding these inputs. However, there was a slight increase in the price of milk during the pandemic, which resulted in a domestic average price of milk of R$ 2.04 in May 2021 (47.7% increase compared to the same period of the previous year). (CEPEA, 2017; ESSADO NETO et al., 2020)

There was an increase in demand for milk (especially UHT and powder), which can be explained by social isolation measures and consumer rush to supermarkets. However, there was a decline in demand for some dairy products with higher added value (such as cheese, yogurt, butter, among others), since these products are more sensitive to the decline in average per capita income (ESSADO NETO et al., 2020; RIBEIRO, 2020).

4.2 Dairy farming dynamics in the state of São Paulo

Although spread out across the Brazilian territory, milk production currently occurs in six states, representing 75% of the country's overall domestic production. Data from 2019 (IBGE, 2021) revealed that the state of Minas Gerais is historically the largest producer in Brazil, as it accounts for 27.11% of the country's overall production, followed by Paraná (12.45%), Rio Grande do Sul (12.26 %), Goiás (9.13%), Santa Catarina (8.72%) and São Paulo (4.74%).

Figure 1 reveals that the state of São Paulo has been gradually losing its prominence in milk production. According to IBGE data (2021), while the state was the country's 2nd largest milk producer in 1990, representing 13.5%; it was ranked 6th in 2019 with only 4.7% of the country's overall production.

Figure 1 - Share (%) of the main milk producing states in Brazil between 1990 and 2019
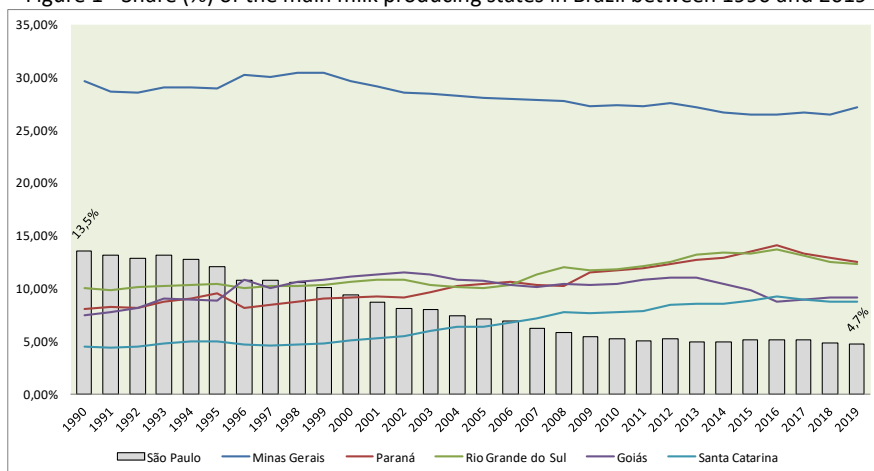
Source: IBGE, 2021

The states located in the southern region of the country (Paraná, Santa Catarina and Rio Grande do Sul), followed by the state of Goiás, showed a significant increase in milk production between 1990 and 2019. Meanwhile, the state of São Paulo showed inverse dynamics in the same period. Table 2 shows the milk production variation in the main Brazilian producing states during this period of analysis.

Table 2 - Milk production variation (%) of the main producing states between 1990 and 2019

Producing States	Production Variation
Minas Gerais	120%
Paraná	274%
Rio Grande do Sul	194%
Goiás	197%
Santa Catarina	367%
São Paulo	**-16%**

Source: IBGE, 2021

While the main milk producers doubled, tripled or quadrupled their production between 1990 and 2021, the state of São Paulo suffered a drop of 16%.

Since milk productivity is the result of several specific issues, such as the number of milked cows and dairy production, it is worth analyzing each of these indicators with a view to presenting a complete overview of the state of São Paulo in terms of prominence and importance of its production in the national scenario.

In 1990, São Paulo had 12,262,909 heads of cattle, which represented 8.34% of the country's total number of cattle (147,102,314), and it has the 5th largest population in Brazil. The state remained in this position until 1994, i.e. the year with the highest percentage within the analyzed period (1990 to 2019) at 8.20%. Afterwards, it suffered a significant decline, reaching 4.89% of domestic cattle population in 2019 (IBGE, 2021).

As regard milked cows, the state of São Paulo particularly had 2,144,345 cows in 1990,

or 17.5% of the state's overall cattle herd. However, the prominence of its cattle herd showed a gradual decrease, reaching only 9.8% in 2019 (Figure 2).

Figure 2 - Share (%) of milked cows in São Paulo state cattle herd (1990-2019)
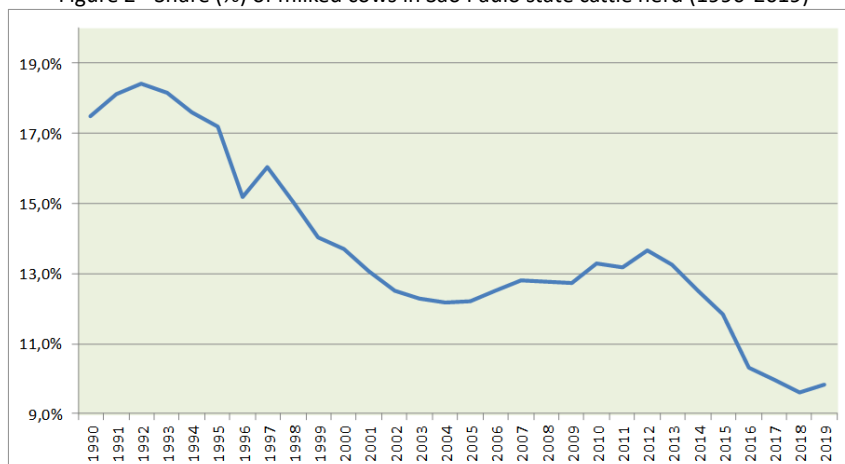
Source: IBGE, 2021

A decline in the number of milked cows reveals that dairy farming is decreasing in the state of São Paulo. According to IBGE data (2021), São Paulo cattle herd experienced a reduction of 1.77 million heads of cattle between 1990 and 2019. The majority of this reduction is related to dairy cattle, since the number of milked cows decreased by 1.11 million heads of cattle, which represents a 52% reduction in the analyzed period.

With respect to dairy farming productivity in Brazil, once again there is a discrepancy in the dynamics of São Paulo in relation to the main producing states. From Table 3, it is possible to observe that the country had significant gains in annual productivity as a whole, i.e. from 0.76 to 2.14 thousand liters of milk per cow, or gains of 182% between 1990 and 2019.

Table 3 - Dairy farming productivity variation (%) (Thousand liters of milk/cow milked) by state between 1990-2019

	1990	2019	Variação
BRASIL	0,76	2,14	182%
Minas Gerais	0,89	3,01	238%
Paraná	1,06	3,32	213%
Rio Grande do Sul	1,24	3,61	191%
Goiás	0,46	1,69	267%
Santa Catarina	1,15	3,82	232%
São Paulo	**0,91**	**1,6**	**76%**

Source: CALCULATED BY THE AUTHOR according to IBGE, 2021

In the main producing states (except for São Paulo), productivity gains were even greater, as there was an average increase of 228%. In the analyzed period, the state of São Paulo also presented productivity gains; however, such gains are only 76%, i.e. well below those of the main producing states, in addition to being notably below the domestic average.

In addition to the number of milked cows and dairy farming productivity, its productive structure should also be analyzed. Table 4 shows the number of agricultural establishments producing cow's milk (Units) by state in 2017 (IBGE, 2021).

Table 4 - Percentage (%) of agricultural establishments producing cow's milk by state in 2017

Hectare	Until 10	From 11 to 100	From 101 to 500	Over 500	* Other	Family farming	
						No	Yes
Brazil	32,6%	57,4%	8,3%	1,3%	0,5%	18,8%	81,2%
Minas Gerais	26,8%	63,0%	9,2%	0,7%	0,3%	23,2%	76,8%
São Paulo	**18,1%**	**69,6%**	**10,9%**	**1,1%**	**0,3%**	**25,1%**	**74,9%**
Paraná	32,7%	61,8%	4,6%	0,5%	0,3%	14,4%	85,6%
Santa Catarina	32,1%	64,9%	2,8%	0,1%	0,2%	11,4%	88,6%
Rio Grande do Sul	42,8%	54,1%	2,6%	0,4%	0,2%	10,6%	89,4%
Goiás	11,6%	65,9%	18,5%	3,8%	0,3%	30,8%	69,2%

* No heads of cattle on the reference date
Source: IBGE, 2021

Table 4 evidences that dairy farming is characteristic of small agricultural establishments in Brazil. About 90% of its properties occupy an area of less than 100 hectares, and 32.6% of which cover up to 10 hectares. In addition, the majority of its milk production (81%) is characteristic of the so-called Family Farming[1] (IBGE, 2021).

Among the main producing states, the southern ones (Paraná, Santa Catarina and Rio Grande do Sul) stand out due to the predominance of small properties and Family Farming. In the other states (Minas Gerais, São Paulo and Goiás), this predominance also occurs, but to a lesser extent than in the southern states and the nation's average. The state of São Paulo (object of study of this research) particularly has 87.7% of properties producing milk covering an area of up to 100 hectares, and 75% of which are Family Farmers.

5 FINAL CONSIDERATIONS

This work aimed to analyze dairy farming in the state of São Paulo. Such an analysis is quite relevant on account of understanding the socioeconomic importance of this agro-industrial system, as well as its transformations in the country. According to official data, the state of São Paulo lost national relevance in dairy production, as it was downgraded from the second largest Brazilian dairy producer in 1990 to the sixth position in 2019.

Based on the results of this research, it was possible to observe that the state of São Paulo presented a significant reduction in its cattle herd and milked cows during the analysis period (1990-2019), thus leading to a reduction in milk production. Despite managing to increase its milk productivity rates, the state has not followed the national growth trend for the sector. A combination of these factors explains a reduction in São Paulo's prominence nationwide. The productive structure does not seem to be an influencing factor in such dynamics, since the features of production in small farms and Family Farming are similar among its main producing states and the country as a whole.

It was also found that productivity gains of São Paulo dairy farming were below the indicators of the main milk producing states in Brazil, including the national average, which reveals the potential for productive improvement in the state, as well as the need for the agents involved to seek strategic, technical and operational measures in order to fill in this

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[1] According Tinoco (2008), the term Family Farming is applied to a rural producer who: (i) has rural activities as his main source of income (above 80% of income); (ii) that the workmanship is performed by direct family members, or that the percentage number of third-party employees hired does not exceed 75% of the total used in the establishment; and (iii) that the area of the property is within the limits established for each region of the country.

technical/technological gap.

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