

## **THE POTENTIAL OF BRAZILIAN BEEF PRODUCTION FROM THE PERSPECTIVE OF EFFECTIVENESS AND EFFICIENCY**

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### **Abstract**

The general objective of the research is to analyze the national bovine protein market in order to compare the Brazilian production and productivity in relation to the main world producers of bovine livestock, in order to discuss, under the prism of effectiveness and efficiency in the perspective of rural administration. For the analysis procedure of this work, the SWOT Matrix tool was applied, focusing on the criteria of "strength", "weakness", "threat" and "opportunity". Based on the results found in the research, it was possible to conclude that Brazil has significant chances of growth for this sector of the economy, but it will only be able to sustain itself in this market when efficiency is also part of the decision-making process. Based on the SWOT Matrix, it was observed that the "strength" of the country in this segment is concentrated, in general, in the significant available agricultural production areas and in the hegemonic technologies existing at the national level. In the field of "weakness", it was observed that the concentration of technologies in a certain group of rural producers reduces the diversification of production technologies, which may represent a loss of competitiveness in certain market niches, mainly in those more demanding sectors. In addition, high production costs were also perceived as a "weakness" that impacts the country's competitive power. The "opportunities", on the other hand, are more linked to the growing global demand for food, placing Brazil at the forefront of food on the planet. The "threats", in turn, observed in this study are linked to food safety and more demanding production criteria in competitive markets, which impose, in the Brazilian reality, the need to adopt a strategic vision and greater investments in science and technology, aiming to improve the

development, in the national territory, of technologies more adapted to the realities of different biomes, such as the Amazonian biome.

**Keywords:** Effectiveness, Efficiency, Livestock, Cattle, Brazil.

## Resumo

O objetivo geral da pesquisa é analisar o mercado nacional de proteína bovina a fim de comparar a produção e produtividade brasileira em relação aos principais produtores mundiais de pecuária bovina, a fim de discutir, sob o prisma da eficácia e eficiência na perspectiva da administração rural. Para o procedimento de análise deste trabalho, foi aplicada a ferramenta Matriz SWOT, com foco nos critérios de “força”, “fraqueza”, “ameaça” e “oportunidade”. Com base nos resultados encontrados na pesquisa, foi possível concluir que o Brasil tem chances significativas de crescimento para este setor da economia, mas só conseguirá se sustentar neste mercado quando a eficiência também fizer parte da tomada de decisão. Com base na Matriz SWOT, observou-se que a “força” do país nesse segmento concentra-se, em geral, nas expressivas áreas de produção agrícola disponíveis e nas tecnologias hegemônicas existentes em nível nacional. No campo das “fraquezas”, observou-se que a concentração de tecnologias em determinado grupo de produtores rurais reduz a diversificação das tecnologias de produção, o que pode representar perda de competitividade em determinados nichos de mercado, principalmente naqueles setores mais exigentes. Além disso, os altos custos de produção também foram percebidos como uma “fraqueza” que impacta o poder competitivo do país. Já as “oportunidades” estão mais ligadas à crescente demanda mundial por alimentos, colocando o Brasil na vanguarda da alimentação do planeta. As “ameaças”, por sua vez, observadas neste estudo estão ligadas à segurança alimentar e aos critérios de produção mais exigentes em mercados competitivos, que impõem, na realidade brasileira, a necessidade de adoção de visão estratégica e maiores investimentos em ciência e tecnologia, visando aprimorar o desenvolvimento, no território nacional, de tecnologias mais adaptadas às realidades de diferentes biomas, como o bioma amazônico.

**Palavras-Chave:** Eficácia, Eficiência, Pecuária, Bovino, Brasil.

## 1. INTRODUCTION

The history of Brazil has always been linked to agricultural production, such as sugar cane, at the beginning of the colonization of Brazil by the Portuguese, and coffee growing in the Southeast region of Brazil, which impacted the national economy and gave rise to the industrialization of the country in mid-twentieth century. However, from the process called "Green Revolution", in the 1960s, the country began to experience a boom in the production of primary products of the economy from the rural sector, allowing it to reach a prominent place in the international scenario, in a concept that became known as "modernization" of national agriculture.

This modernization symbolized the appropriation, by industry, of the agricultural production process, where the productive system increasingly developed ties of dependence with the industrial sector, whether in the petrochemical field, such as chemical fertilizers, pesticides, or in the mechanical sector, such as tractors and agricultural implements. Such factors help to explain, currently, Brazil's prominent position as world leader in the production and export of some commodities, such as soybeans, oranges, coffee and sugar (EMBRAPA, 2022a; EMBRAPA, 2022b).

Likewise, the livestock sector has established itself as one of the foundations of the Brazilian economy. According to the analysis by the Association of Pig Breeders of the State of Rio Grande do Sul on the report published by the Associação Brasileira das Indústrias Exportadoras de Meat, on July 1, 2022, Brazilian beef cattle raising today represents a significant branch of our economy, where in 2021, this sector moved R\$913.14 billion.

However, analyzing the Brazilian scenario in terms of livestock production and productivity, in comparison with some producing countries in the same branch of economic activity, what to say about the competitive future of the national market, considering the hegemonic model of agricultural and livestock production practiced in the country? Would Brazil be experiencing a trajectory of economic stagnation in the bovine protein production model, in relation to other countries? Is there a perspective for growth and an increase in

Brazil's importance in the international market? What are the strengths and weaknesses of the country's internal environment that can influence this scenario? And what external factors, such as threats and opportunities, can equally influence the domestic market?

Thus, it was defined as a general objective to analyze the bovine protein market in order to compare the Brazilian production and productivity in relation to the main world producers of bovine livestock, in order to discuss, from the perspective of effectiveness and efficiency, the perspective of the market, and, in general, Brazil's competitive strength.

## **2. THE CONSTRUCTION OF THE HEGEMONIC AGRICULTURE AND LIVESTOCK PRODUCTION MODEL IN BRAZIL**

To approach the subject, it was necessary to start with the process of "modernization" of agriculture in the country, still in the 20th century, and discuss the concept of "technological package".

### **2.1 The "Green Revolution" in Brazil**

In Brazil, the so-called "Green Revolution" began in the 1960s (BARROS, 2010; MATOS, 2010). This period influenced and guided the research and development of modern agricultural production systems in the country for the incorporation of technologies in the productive system, known as "technological packages", aiming to establish a certain standard, a model of practice of universal use, with the purpose of maximizing crop yields in different ecological situations by maximizing the potential capacity of crops, in order to generate ideal ecological conditions, keeping away natural predators, via the use of pesticides, and thus contributing, on the other hand, to crop nutrition through the use of synthetic chemical fertilizers. The intensive use of pesticides and fertilizers, combined with the genetic development of seeds, contributed to the "Green Revolution", that is, a broad program to increase agricultural production worldwide (BARROS, 2010; MATOS, 2010).

The modernization of Brazilian agriculture was induced by the country's industrialization process, that is, by the government's economic policy between 1950 and 1970, which favored industry to the detriment of agriculture, which reinforced the power of the cities and accelerated the rural exodus. The urban population in the country increased from 31.2% in 1940 to 44.7% in 1960, and from 67.6% in 1980 to 81.2% in 2000 (ALVES, 1999; ALVES, CONTINI, GASQUES, 2008). According to the 2010 demographic census, Brazil had, in that year, 84.3% of the total population living in urban areas (IBGE, 2022a; 2022b and 2022c).

According to Alves (2001) and Alves, Contini and Gasques (2008), the increase in purchasing power, combined with the strong demographic growth between 1950 and 1990, stimulated the demand for food products at annual rates of up to 6%, which created an environment support the growth and modernization of agriculture. According to Alves (2001), with the increase in the opportunity cost of labor, from the 1970s onwards, agriculture (of soy, corn, wheat and cotton) was driven to intensify and mechanize. In addition, industrialization and urbanization established the paradigms for the transformation of agriculture, based on science and technology. In the political sphere, these transformations shifted the center of power to cities.

The period known as the "Green Revolution" was not exclusive to Brazil, although it found fertile ground for its consolidation here. It comes from an international movement linked to scientific and technological advances applied to the rural sector, led by the industrial sector, which began to appropriate the productive system based on its technologies. According to Goodman, Sorj and Wilkinson (1990) the "Green Revolution" period was one of the main efforts to internationalize the process of appropriation. This term can be understood exactly as the act of executing tasks, previously carried out in a humanized way, manually or handcrafted, with the use of industrial technologies in the production process, so that the specialization of production is increasingly high, making the production system dependent on industrial inputs, mainly in large and medium-sized rural properties focused on the competitive market, although its influence is observed, to a greater or lesser extent, in areas that are not very competitive and focused on small family production, where, even so, part of these industrial inputs end up somehow being incorporated into the small rural property.

According to Oliveira e Souza (2008), the process of modernization of Brazilian agriculture, understood as the importation of machines and inputs, resulted in its industrialization, that is, in the use of machines and inputs produced in the country itself, in the 1960s, allowing to observe great transformations in the national territory that, allied to the changes in the labor relations, resulted in the constitution of the agroindustrial complex in the 1970s. About this aspect, the authors also reveal that this restructuring in the field will be called by Lipietz (1989) peripheral Fordism, and will characterize a whole reorganization of work in the rural environment, affecting from the land structure and the social relations of work, in addition to the means of production and the flow of goods. It is an authentic Fordism, with a true mechanization and an association of

intensive accumulation and the growth of markets in terms of durable consumer goods. However, it continues to be peripheral, first of all in the sense that, in the world circuits of the productive branches, jobs and production corresponding to the levels of qualified manufacturing and, above all, engineering remain largely outside these countries" (LIPIETZ, 1989).

The period of the "Green Revolution" allowed for a strong economic projection of Brazil, which went on to experience a golden period in its economy in the 1960s and 1970s. About this period:

As far as raising the total output of agriculture is concerned, the Green Revolution was undoubtedly a success. Between 1950 and 1985, world cereal production increased from 700 million to 1.8 billion tons, an annual growth rate of 2.7%. During this period, food production doubled and the availability of food per inhabitant increased by 40%, it seems that the problem of hunger in the world would be overcome by new discoveries (MAROUELLI, 2003, p. 07).

Therefore, the 1960s were considered the beginning of a new profile for the Brazilian socioeconomic model, replacing the so-called import substitution model with the modernization of the agrarian sector and the implementation of the agro-industrial complex (CALIXTO TEIXEIRA, 2005).

## **2.2 The Technological Package: Hegemonic Model of Agricultural and Livestock Production in Brazil**

From the 1960s onwards, aiming to increase agricultural production and, consequently, the accumulation of wealth, Brazil, through an agricultural development model rooted in the ideals of the "Green Revolution", began the process of modernizing its agriculture (CAVALCANTE, 2001). The "Green Revolution" first evidenced in countries like the United States, after the Second World War period, which considerably increased agricultural production through "modern" practices, characterized by the use of mechanical and biochemical technologies. Intensive soil cultivation, monoculture, irrigation, application of inorganic fertilizers, chemical control of pests and diseases and genetic manipulation of cultivated plants form the set of practices employed by "modern" agriculture (GLIESSMAN, 2000; CAVALCANTE, 2001). According to Cavalcante (2001), in order for these objectives to be achieved (increase in production and income), Brazil initiated a policy that encouraged the absorption, by farmers, of these "modern" technologies to replace those considered "obsolete". The main policy used in this context was the credit policy.

Agriculture, in this modernization process, became, under the stimulus of the government's subsidized credit policy, a major buyer of industrial inputs (CAVALCANTE, 2001). Silva (1981) states that economic policies aimed at the agricultural sector in Brazil represented a specific way of promoting the subordination of agriculture to capital. This fact was observed both in large monoculture properties and in small family properties (CAVALCANTE, 2001). The Green Revolution, therefore, influenced the creation of special lines of agricultural credit. These lines were linked to the purchase of agricultural inputs, that is, only those who bought the set of inputs in the technological package could borrow money (EHLERS, 2009). As Cavalcante (2001) clarifies, the credit policy "pushed" to farmers a true technological framework that became known as the "Technological Package". According to the aforementioned author, the set of agronomic techniques, practices and procedures that characterized this model was incorporated into the production process without, however, taking into account the Brazilian socioeconomic and environmental reality. For Cavalcante (2001), agriculture, in this modernization process, became, under the stimulus of the government's subsidized credit policy, a major buyer of industrial inputs.

According to Moreira (1999) criticisms of the Green Revolution, originating from ecological movements and the like, are centered on criticism of industrial production. In this sense, the author clarifies that in rural areas, industrial production emerged in the form of technological packages in the "Green Revolution", assuming in Brazil, markedly in the 1960s and 1970s – the priority of subsidy agricultural credits to stimulate large agricultural production, agroindustry, industrial input machinery companies for agricultural use – such as tractors, herbicides and chemical fertilizers –, export agriculture, production of processed products for export and differentiation – such as cheese and yogurt.

According to Oliveira (2007), agriculture developed in two directions: on the one hand, agriculture based on the specificities of capitalist molds, taking into account salaried work and leases, on the other hand, agriculture linked to forms of non-capitalist production. In this case, it can be said that the first is more oriented to the influences of the green revolution and the modernization of agriculture, and the second is more linked to the context of extractive production that normally proves to be devoid of the modern use of technology or industrial inputs.

Faced with the complexity and variety of scenarios that the country presents in terms of rural areas, it became necessary to build a logic of analysis that would allow such an initiative to be possible, based on the

assumption of understanding the Brazilian rural scenario from the perspective of the “technological packages”, that is, models of rural properties that seek, in their production process, to internalize mechanical and chemical technologies derived from industrial inputs, configuring a hegemonic model of production.

### **2.3 Effectiveness and Efficiency in the Context of Agricultural and Livestock Production**

In administrative theory, effectiveness and efficiency are considered fundamental to any public or private organization (ALCANTARA, 2009). According to the same author, both are vital for planning, that is, it serves to determine the right goals and then choose the right means of achieving these goals. However, according to Phelan (2005), it is noted that the terms efficiency and effectiveness are still little explored in the literature with regard to differentiating, defining, measuring and associating these two terms. It is worth noting that effectiveness has its emergence in the theory of Administration at a later time than efficiency, because the concern, in the early years of the structuring of administrative science, was to focus on the means and organization of work. The focus on results and objectives has been highlighted in more recent theoretical approaches, such as, for example, the Contingency Approach, which sought more effective organizational models (WITT, 1998; MATOS; PIRES, 2006; PINTO and CORONEL, 2017).

Mariano (2007) when addressing efficiency in the context of the productive system, revealed that this has always been a highly valued attribute in society, which emerged after the industrial revolution, which in recent decades has grown dramatically in importance, because in this period the process known as globalization, whose main feature was the opening of the market between countries, which generated a significant increase in competitiveness between companies. According to the same author, because of this, this approach has become essential for the survival of an organization, since inefficiency generates a great risk of closing the company, since it would be using many inputs to produce few outputs, with a direct impact on the production costs, negatively affecting the company's competitiveness and earnings. In a complementary way, Mariano (2007) also reveals that it is extremely important for a company to know, as far in advance as possible, its level of efficiency in relation to its competitors, since this will enable, in case of inefficiency, that the company reacts and can reverse the situation before being crushed by its competitors. Thus, Efficiency can be understood as a characteristic of the planning process related to the scope of actions programmed in the universe of planning actions (SIQUEIRA, 2006).

On the other hand, when talking about organizational effectiveness, there is generally a tendency to equate the issue in the context of business. Therefore, the effectiveness criteria are based on and derive from economic considerations such as productivity, service quality and delivery service (FERNANDES, 2008). According to Siqueira (2006), Effectiveness is a characteristic of the planning process related to the adherence of the executed actions, in relation to the universe of planning actions. The concepts of effectiveness and efficiency are not clearly understood by many, as previously revealed and, therefore, need to be better understood. In this sense, Figueiredo and Mello (2009) reveal that it is possible for a person or a process to be efficient, but not be effective. And this relationship is reciprocal as well. According to these authors, Efficiency is a relative concept, whose evaluation depends on knowing the results achieved by all production units, which translates the relationship between the resources that should be consumed and the resources actually consumed, that is, it compares what was produced with the resources actually used and what could have been produced with them. Effectiveness, according to the same authors, is the relationship between the results obtained and the desired or expected results, without taking into account the resources used. To be effective is to make a work fully reach the expected results (FIGUEIREDO and MELLO, 2009).

In the same direction, Matias-Pereira (2014) states that Effectiveness is a normative measure of the achievement of results, while efficiency is a normative measure of the use of resources in this process. Matias-Pereira (2014) also reveals that in the economic field, the effectiveness of a company refers to its ability to meet the needs of society through the supply of its products (goods or services), while efficiency is a technical relationship between inputs and outputs. Therefore, according to him, Efficiency is a relationship between costs and benefits, that is, it represents the relationship between the resources applied and the final product obtained, that is, the ratio between effort and result, between expense and income, between the cost and the resulting benefit. Thus, according to the same author, efficiency is concerned with correctly carrying out the proposed activities, and in the best possible way. Hence the emphasis on internal methods and procedures. Effectiveness, in turn, is concerned with correctly carrying out the actions and/or activities proposed to meet the needs of the company and the surrounding environment (MATIAS-PEREIRA, 2014).

Based on this perspective, Efficiency would be linked to the process and Effectiveness to the result, goals, objectives and final deliverables. Ideally, both go hand in hand and not separate, because, according to Pradella (2013), the current scenario makes organizations seek more agility, efficiency and also a more responsive attitude towards contemporary society, which is more complex, diversified and dynamic.

According to the same author, this moment is related to the quest for sustainability, which requires alignment between organizational objectives and market objectives. This situation highlights that change processes are inevitable for organizations that intend to continue existing (PRADELLA, 2013). Using this line of thought, that is, sustainability, although it is not the object of this research, it helps to illustrate the importance of this work in the sense that this approach draws attention to aspects of production and productivity. Thus, the focus on producing with a view only to achieving numerical gains from increases in production in quantitative terms would be focused on the idea of Effectiveness. On the other hand, the idea of sustainability, of more attractive production systems in terms of cost-benefit, for example, would be linked to the context of Efficiency.

On this aspect, Drucker (1987) reveals that effective cost control requires a similar concentration of work and effort in those few areas where an improvement in cost performance will have a significant impact on the company's performance and results, i.e. , the areas where a relatively small increase in efficiency will produce a large increase in economic effectiveness. Thus, the evaluation of effectiveness is essential to the extent that the project may be achieving its objectives (effectiveness) and resources may be being properly applied (efficiency), without the project responding to needs or causing real changes in the target audience. Hence the need to create mechanisms that make it possible to assess the impact of the projects developed (FRASSON, 2001). For Siqueira (2006), Effectiveness is the characteristic of the planning process related to the coherence between the actions performed and the action plan, in the universe of planning actions. Therefore, to lose effectiveness is to lose identity, the *raison d'être* of the business. Efficiency is any product or service that makes sense in the marketplace. The existence of a demand for a certain product or service is the guarantee of efficiency of these same products or services offered. Efficiency requires being in tune with market trends, knowing how to interpret demand signals, seeing in the competitive scenario the opportunities for change and improvement necessary to stay alive and with good growth prospects. But, for that, being efficient and effective is the key to the secret of any successful enterprise.

### **3. METHOD**

#### **3.1 SWOT Matrix Tool**

The SWOT Matrix is an analysis tool commonly used in various segments for decision-making in relation to the management and business of companies, which, based on all available information to be evaluated about their reality, is part of strategic planning, functioning as a tool very accurate in judging the application of future actions in relation to business, market positioning, behavior towards competitors, partnerships, etc., evaluating all the important points for the continuity and expansion of activities (FILHO, ARAUJO and QUINTAIROS, 2014).

Created by Kenneth Andrews and Roland Cristensen, professors at the Harvard Business School, and later applied by numerous academics, the SWOT analysis studies the competitiveness of an organization according to four variables: Strengths, Weaknesses, Opportunities and Threats. Through these four variables, it will be possible to inventory the strengths and weaknesses of the company, the opportunities and threats of the environment in which the company operates" (SILVA, SILVA, BARBOSA, HENRIQUE and BAPTISTA, 2011).

A company's strengths and weaknesses are made up of its resources, which include human resources (experiences, capabilities, knowledge, skills); organizational resources (company systems and processes such as strategies, structure, culture, etc.); and physical resources (facilities, equipment, technology, channels, etc.). Opportunities, on the other hand, are current or future external and non-controllable situations that, if properly taken advantage of by the company, can positively influence it. As for the threats, they are external situations and not controllable by the company, current or future that, if not eliminated, minimized or avoided by the company, can negatively affect it"(ANDREWS, 1980).

The perception that to elaborate a good strategy requires a lot of knowledge and understanding of the business, of the internal and external environments in which the organization is inserted, is reason enough for the use of the SWOT matrix, which was structured sometime in the 1950s and 1960, contributing greatly to the dissemination of the use of strategic planning. The intrinsic characteristics of the organization, its strengths (Strengths) and weaknesses (Weaknesses), and its extrinsic characteristics, opportunities (Opportunities) and threats (Threats) of the external environment of the organization, form the basis of the matrix and which ultimately represents the result of perceptions about the environments in which the organization is inserted (FERNANDES, 2012).

### **4. DATA ANALYSIS AND DISCUSSION**

The data below seek to shed light on the process of analysis and discussion on the topic of cattle raising,

focusing on production and productivity in the Brazilian reality and, in this way, contribute to the scientific debate by adding a vision of efficiency and effectiveness of the productive process of the national bovine livestock. First, however, it is necessary to demonstrate, in general lines, the basic process of livestock production. In this sense, three steps are essential for the livestock system to find its effective functioning. The first of them concerns the stage of creation itself, that is, called "Create".

In "Create", which involves the cow's pregnancy, the period during which the cow is pregnant, going through the birth of the calf and extending until approximately the eighth month of birth, it is an important part of the process, as it feeds back the entire system with the arrival of new animals to be inserted in the production process. Thus, in beef cattle, the "Creating" phase comprises the reproduction and growth of the calf until weaning, which occurs between six and eight months of age. Beef cattle herds must have defined seasons for mating, calving and weaning, as demonstrated by the Scenario for the Amazon Beef Cattle.

In this way, after the "Create" comes the recreation that can vary depending on the production system, and the Associação Sul Mato-grossense de Novilho Precoce removes this part of the process and proceeds to fattening in confinement, with the objective of slaughtering the bovines aged 15 months, as stated by Nedson Rodrigues, president of the association, in 2022. However, in the traditional method, this process of rearing beef cattle usually lasts, on average, two years and it is during this period that the handling and development of the bones and muscles of the animal occurs. During this time, management also occurs so that females enter the reproductive period earlier.

In "Recreates", therefore, the concern is with the perfect structural development of the bovine, where the feeding and phytosanitary control are important for the health of the animal. This period extends until the animal reaches, on average, the weight of 12 arrobas of live weight. Each arroba is equivalent to 15 kg. Therefore, this can vary greatly, reaching a period of 2 to 3 years. After the "Recreate" phase, the "Fattening" phase begins. In fattening, the animal is prepared more vigorously so that it can acquire the maximum possible live weight, since it will generally be sent to slaughterhouses for marketing purposes.

Thus, in order to achieve greater profit, it is interesting for ranchers that the calves gain a lot of weight in the shortest possible period of time. If this phase is not well managed, it may end up harming the fattening period of the animals. Thus, the last stage of the beef cattle raising process is fattening, which has the minimum objective of making the cattle reach an average weight of 450 kilograms (live weight). However, the use of feedlots has increasingly shortened this process, as in the cases of precocious steers mentioned above. In the traditional method, in turn, consists of raising cattle in pasture areas, usually in medium and large areas, although this tendency is also observed in family properties. In the dry seasons of the year when there is a shortage of forage, a mineral supplement with urea is used".

In terms of technology in the beef cattle production system, according to the Brazilian association of meat export industries, there are six production models, namely: extractive, low technology, medium technology, adequate technology, high technology and intensive. Therefore, it starts from a reality that practically demonstrates the absence of technology, as in the extractive case, to significantly specialized production models, as in the intensive system. In this way, one can have an understanding that the modernization of agriculture or the rural sector, in Brazil, did not uniformly affect the entire system, but part of it. The fact that some models have more strength and support for the increment of technologies in their production processes shows that access to technological packages is not used by everyone, that is, access to credit is differentiated as is the volume of contracted resources and , consequently, the breadth or reach of the technologies to be acquired by the rural producer. Thus, the concentration of high technology in a few hands, denote, from a more sociological perspective, an established power relationship, which involves, among other aspects, alignment of thought, sector organization, trust and unity in collective decisions, as well as, the hegemonic model of production among its members.

It is clear, therefore, that although practically devoid of technology, the extractive model has a higher operating cost compared to other models. This fact may be related to the strength of manual labor, craftsmanship and with even rudimentary technology that the model in theory prioritizes, either due to the difficulty of accessing the sources of resources that guarantee the acquisition of more technological specialties for the productive process or even due to other factors that somehow allow this group of producers not to advance to more dynamic forms.

Table 1: Full cycle production costs.

Ciclo Completo - R\$/@ COMPOSIÇÃO DE RESULTADOS	Extrativista 1-3 @/ha	Baixa tec. 3-6@/ha	Média tec. 6-12@/ha	Adequada 12-18@/ha	Alta tec. 18-26@/ha	Intensivo 26-38@/ha
Nutrição	18,62	22,08	35,37	61,90	66,76	75,54
Programa sanitário	3,87	3,78	4,02	3,79	3,84	3,43
Corretivos e fertilizantes	0,00	6,79	36,83	39,92	55,32	52,55
Defensivos agrícolas	0,00	10,83	6,47	4,50	2,46	1,37
Combustíveis e Lubrificantes	18,14	10,47	8,43	7,07	8,49	7,75
Reprodução	0,00	2,23	7,85	14,53	14,90	13,35
Funcionários	26,01	22,25	15,55	11,19	9,95	7,86
Manutenções	28,30	14,19	9,79	9,02	8,28	6,53
Administrativos	2,60	2,22	1,55	1,12	1,00	0,79
Energia elétrica	0,91	0,52	9,42	0,35	0,42	0,39
Depreciações	128,90	68,49	42,20	23,64	17,54	12,42
<b>Custos operacionais totais</b>	<b>227,35</b>	<b>163,86</b>	<b>168,48</b>	<b>177,03</b>	<b>188,96</b>	<b>181,98</b>

Source: abiec.com.br, 2022.

Based on tables 1 and 2, it is possible to verify that the “Create” phase of the extractive model had the second lowest operating cost, with the highest verified in the “intensive” model.

Table 2: Production costs in the “Create” phase.

Cria - R\$/@ COMPOSIÇÃO DE RESULTADOS	Extrativista 1-3 @/ha	Baixa tec. 3-6@/ha	Média tec. 6-12@/ha	Adequada 12-18@/ha	Alta tec. 18-26@/ha	Intensivo 26-38@/ha
Nutrição	15,68	16,62	62,38	85,82	109,10	127,68
Programa sanitário	3,32	3,66	4,65	4,65	4,59	4,41
Corretivos e fertilizantes	0,00	6,68	33,45	38,55	51,95	53,74
Defensivos agrícolas	0,00	10,65	7,23	5,11	2,34	1,46
Combustíveis e Lubrificantes	12,79	9,71	10,55	9,25	8,62	8,58
Reprodução	0,00	3,98	13,42	24,29	22,74	21,87
Funcionários	17,76	21,89	18,74	13,58	10,90	9,15
Manutenções	20,71	12,83	10,41	9,01	7,06	6,10
Administrativos	1,78	2,19	1,87	1,36	1,09	0,92
Energia elétrica	0,64	0,49	0,53	0,46	0,43	0,43
Depreciações	63,42	37,13	23,59	17,97	12,85	10,62
<b>Custos operacionais totais</b>	<b>136,09</b>	<b>125,83</b>	<b>186,81</b>	<b>210,05</b>	<b>231,66</b>	<b>244,96</b>

Source: abiec.com.br, 2022.

However, in table 3, which illustrates the “Recreate and Fatten” phase, the highest operating cost is in the “extractive” model.

Thus, it is interesting that the rural producer has a sense of administration and economics when investing in or embracing a productive system. Ignoring this aspect can put the business at risk. That is, what such data reveal is that the small rural producer or even extractivist, when entering the bovine livestock market, is actually competing with models that have lower operating costs and, therefore, with greater economic gains. Thus, what is evident is that the decision of this group of rural producers to enter this market does not occur in a technical way, since when entering this market, it ends up competing with other models that are even more effective and efficient, but for multiple other reasons that this work did not intend to analyze and that makes it necessary to investigate this aspect better.

Table 3: Production costs in the "Recreate and "Fatten" phases.

Recria e Engorda - R\$/@ COMPOSIÇÃO DE RESULTADOS	Extrativista 1-3 @/ha	Baixa tec. 3-6@/ha	Média tec. 6-12@/ha	Adequada 12-18@/ha	Alta tec. 18-26@/ha	Intensivo 26-38@/ha
Nutrição	7,63	16,30	29,47	41,45	46,68	51,33
Programa sanitário	1,58	2,05	2,10	1,52	1,45	1,41
Corretivos e fertilizantes	0,00	4,60	19,77	22,51	30,84	32,96
Defensivos agrícolas	0,00	7,33	4,27	2,98	1,50	0,81
Combustíveis e Lubrificantes	9,97	7,26	6,98	5,33	5,06	4,93
Reposição	158,90	153,01	150,23	147,55	142,46	137,71
Funcionários	10,83	9,83	6,48	4,89	4,74	3,85
Manutenções	15,62	8,41	5,87	4,85	4,27	3,71
Administrativos	1,08	0,98	0,65	0,49	0,47	0,39
Energia elétrica	0,50	0,36	0,35	0,27	0,25	0,25
Depreciações	43,53	27,04	19,19	8,90	5,94	4,70
<b>Custos operacionais totais</b>	<b>249,63</b>	<b>237,16</b>	<b>245,36</b>	<b>240,74</b>	<b>245,67</b>	<b>242,05</b>

Source: abiec.com.br, 2022.

When analyzing the international scenario in terms of livestock production at the international level, new analytical perspectives call attention. It is noted in table 4, therefore, that India and Brazil are the world's largest livestock breeders in terms of head of cattle in the world, with these two countries together accounting for 54.79% of the total head of cattle in 2018, 55.24% in 2019, 55.66% in 2020 and 56.02% in 2021.

There is, therefore, a growing trend in the participation of the two countries together in relation to the number of other countries. However, although with a larger quantity than Brazil, India maintains a stable level around 30% of the world quantity in the analyzed period. Brazil, in turn, which in 2018 represented 23.83% of the world quantity, rose to 24.33% in 2019, then rose to 24.83% in 2020, reaching 25.36% in 2021. Therefore, this scenario indicates that the country's productive force is significant and is in the process of growth, the opposite of India, which, although it is a leader in cattle breeding, demonstrates that it has reached stability in the number of cattle heads.

Based on table 4, it is possible to verify that India, considered the country with the largest herd in the world, is not the same country that leads the ranking of beef quantity, which could lead to several explanatory hypotheses for this fact, for example, the cultural issue that still exists today, the cult of veneration of the ox as a sacred animal. Another hypothesis concerns technology, in particular genetics, which may not yet have been consolidated in the country in a broad enough manner to guarantee an efficient production system. Anyway, it appears in 5th place among the world's largest producers.

Table 4: Quantity of cattle in millions of head and quantity of meat produced in millions of tons

Number of oxen in millions of head	2018	%	2019	%	2020	%	2021	%
<b>Índia</b>	301,9	<b>30,96</b>	302,7	<b>30,92</b>	303,2	<b>30,83</b>	305,5	<b>30,66</b>
<b>Brasil</b>	232,3 5	<b>23,83</b>	238,15	<b>24,33</b>	244,14	<b>24,83</b>	252,7	<b>25,36</b>
<b>EUA</b>	94,29	<b>9,67</b>	94,8	<b>9,68</b>	93,79	<b>9,54</b>	93,59	<b>9,39</b>
<b>China</b>	90,38	<b>9,27</b>	89,15	<b>9,11</b>	91,38	<b>9,29</b>	95,62	<b>9,60</b>
<b>EU</b>	79,01	<b>8,10</b>	77,84	<b>7,95</b>	77,16	<b>7,85</b>	76,46	<b>7,67</b>
<b>Argentina</b>	54,79	<b>5,62</b>	55	<b>5,62</b>	54,46	<b>5,54</b>	53,54	<b>5,37</b>
<b>Austrália</b>	26,17	<b>2,68</b>	25,69	<b>2,62</b>	23,65	<b>2,40</b>	23,02	<b>2,31</b>
<b>Others</b>	96,16	<b>9,86</b>	95,7	<b>9,77</b>	95,64	<b>9,73</b>	96,06	<b>9,64</b>

<b>Total</b>	<b>975,05</b>	<b>100,00</b>	<b>979,03</b>	<b>100,00</b>	<b>983,43</b>	<b>100,00</b>	<b>996,49</b>	<b>100,00</b>
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<b>Amount of meat produced in millions of tons</b>	<b>2018</b>	<b>%</b>	<b>2019</b>	<b>%</b>	<b>2020</b>	<b>%</b>	<b>2021</b>	<b>%</b>
<b>EUA</b>	12,25	<b>21,23</b>	12,38	<b>21,11</b>	12,38	<b>21,47</b>	12,73	<b>22,10</b>
<b>Brasil</b>	9,9	<b>17,15</b>	10,2	<b>17,39</b>	10,1	<b>17,52</b>	9,32	<b>16,18</b>
<b>China</b>	6,44	<b>11,16</b>	6,67	<b>11,37</b>	6,72	<b>11,65</b>	6,83	<b>11,86</b>
<b>EU</b>	7,06	<b>12,23</b>	6,96	<b>11,87</b>	6,88	<b>11,93</b>	6,83	<b>11,86</b>
<b>Índia</b>	4,3	<b>7,45</b>	4,36	<b>7,44</b>	3,76	<b>6,52</b>	4,1	<b>7,12</b>
<b>Argentina</b>	3,05	<b>5,29</b>	3,12	<b>5,32</b>	3,17	<b>5,50</b>	3	<b>5,21</b>
<b>Austrália</b>	2,3	<b>3,99</b>	2,43	<b>4,14</b>	2,12	<b>3,68</b>	1,9	<b>3,30</b>
<b>México</b>	1,98	<b>3,43</b>	2,07	<b>3,53</b>	2,07	<b>3,59</b>	2,12	<b>3,68</b>
<b>Others</b>	10,43	<b>18,07</b>	10,45	<b>17,82</b>	10,46	<b>18,14</b>	10,76	<b>18,68</b>
<b>Total</b>	<b>57,71</b>	<b>100,00</b>	<b>58,64</b>	<b>100,00</b>	<b>57,66</b>	<b>100,00</b>	<b>57,59</b>	<b>100,00</b>

Source: Based on Farmnews (2022).

According to table 4, it appears that the United States leads the world ranking, followed by Brazil, in meat production in millions of tons in relation to the period from 2018 to 2021.

Although the scenario indicates that Brazil is growing in cattle breeding in the same period analyzed, table 4 itself shows that there was one each in 2021 in the quantity in tons of beef in the country. The United States, with the exception of 2019, which showed a reduction compared to 2018, but in the following years it has been showing signs of growth in beef production in 2020 and 2021, that is, consolidating itself as the main producer of beef in the world, even though the United States is the 3rd largest beef producer in the world, behind India and Brazil.

Here, the idea worked on in the theoretical foundations of the work that concerns the effectiveness and efficiency applied to the scenario of bovine livestock production is projected more coherently. In this sense, the idea of raising cattle is not synonymous with quality or performance and differentiated yield. Wanting to produce, without defining how to produce, indicates that the result, in terms of competitiveness, will reach more favorable winds for some and not for others.

In this matter, Brazil, although there have been significant advances in terms of production and productivity over the years in the country, mainly after the green revolution and the incorporation of technological packages in the production process, when compared to the foreign market, it is evident that there is a need to advance much further. From what was presented, although the United States has less head of cattle than Brazil, but in terms of meat production, in millions of tons per year, they manage to project themselves as the largest meat producers in the world.

Even so, the effectiveness of Brazil as one of the world leaders in the production of cattle raising is evident.

As is also evident the advance in productivity since it still manages to remain in second place, both in terms of cattle raising and in terms of meat production. But, on the other hand, when one observes the case of the North Americans, one realizes that working efficiently is a field in which Brazil needs to advance a lot.

Thus, it is not enough to think only in terms of livestock production, there is a need to think in terms of productivity, that is, a more efficient way of using available resources.

In this matter, the United States demonstrates a much more pronounced level of efficiency or productivity than Brazil, although the latter presents a higher production, in terms of head of cattle. Therefore, in comparative terms, effectiveness must go hand in hand with efficiency if the country wishes to become the world leader in this commodity. This is the challenge to be overcome by Brazil.

In terms of the production model, in general, the extensive system predominates in Brazil. In the United States of America, in turn, the use of more efficient technologies and models are reflections of the development of North American industries, which simultaneously conceived a series of transformations in the agrarian sector, mainly with regard to technologies, giving rise to the emergence of machines, implements, inputs and techniques, modernizing the countryside, in addition to the integrated production of agriculture and industry (agroindustry) and finally the rural companies that are properties that function similarly or equal to an urban company, so that these properties become characterized by the technological level and high levels of productivity.

Since pasture is the main way of feeding cattle, Brazil is in an interesting geographical point, as it is a tropical country for the most part, which provides a perfect climate for the production of pastures through temperature, amount of rainfall and the sun exposure. In the southern region, where the subtropical area is located, there is still an ideal climate during periods of higher temperatures. Seeing it this way and comparing the world average, we are well ahead in terms of pasture production, but still far from the ideal production potential, in terms of productivity and efficiency.

In this sense, it is worth mentioning the example of Mr "Joel Pinheiro", who on his YouTube channel shows the day to day of his farm, highlighting the points that led him to intensify production and guide other producers in the process, and during the period rainy season, he treats his herd to pasture and in the dry season he uses a confinement with grass produced and ensiled during the rainy season.

During the rainy season, the producer uses an area with a high productivity grass, the "MG12 Paredão" from the company Matsuda, which according to the company produces between 30 and 35 tons of dry matter per hectare year, in an area divided to support the load animals in exchanges that occur every day, making him get the best result possible from his grass production.

In this same module, he built a cemented resting area, where he confines the animals during the dry season with "BRS Capiçu" elephant grass silage with irrigation. This guarantees an approximate production of 50 tons of dry matter per hectare/year, according to the website <https://matergenetica.com.br/>, where it also collects cattle manure to fertilize or sell per ton produced.

Therefore, the producer intensified his grass production to have a high animal load per hectare in the rainy area. A plantation of elephant grass to have something to serve the cattle in the dry season, built a confinement structure that is used for the animals to rest in the rains and this confinement area generates an extra income with the by-product of the cattle waste.

Mr. "Joel Pinheiro" is a small producer who invested in his property and obtained a significant result, perfectly showing the concept of a compact farm, treating the farm as a rural enterprise. Another example focused more on the intensification and vertical integration of beef cattle is the Carapreta group, which is in the specialty meat niche in Brazil. The group has properties in the state of Minas Gerais, where its main activity is full-cycle beef cattle.

Farm enhancements begin with automatic irrigation systems, meteorological stations, irrigation control evaluation system, pest control system, crop monitoring with drones and satellites, total control system for equipment and systems, fertilization and soil correction, slaughterhouse and own brand of meat, use of slaughter by-products to make feed for the fish farming tanks, in addition to returning water from the fish tanks to the irrigation and fertilization system due to the compounds left by the fish in the tanks, the collection of waste in confinements for energy generation through biogas in its own plant, where the biodigester generates the digestion that turns into fertilizer in the productive areas and franchises of meat houses spread throughout Brazil. To enter the premium meat niche, the group dedicates part of its properties to the production of crops aimed at the entire production chain and to offer a greater variety in the franchises, the group raises beef cattle, fish and sheep.

Intensification processes range from small to large rural producers in various ways. However, the fact that

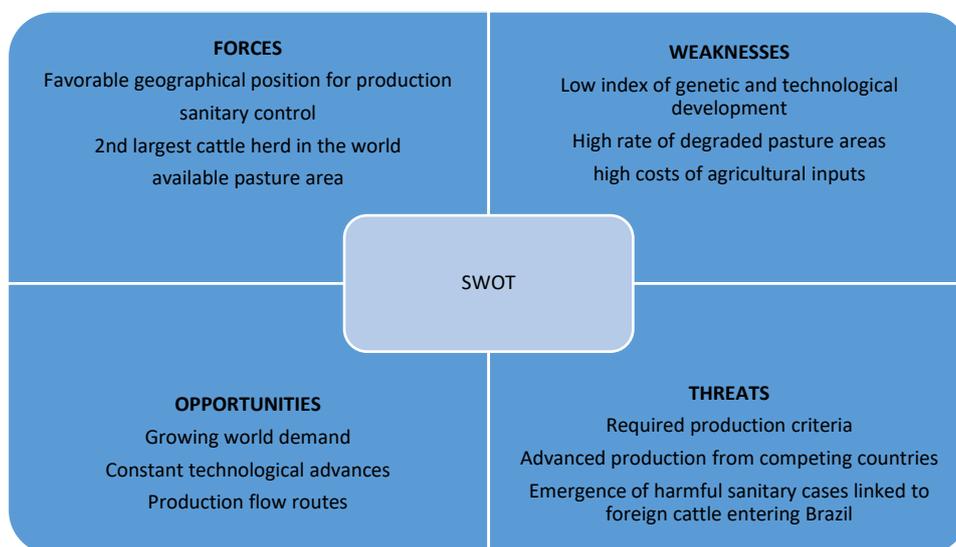
large and medium-sized producers have more access to information, being able to travel to obtain knowledge about the novelties at the source, the small producer is the opposite, he is slower, as it is not uncommon for the novelty to reach him, the it could take years for that to happen. Even with the internet in today's world, the relationship is the same, being more enjoyed by those who are able to acquire internet systems on their properties, that is, large and medium-sized rural producers, with small producers, in general, in situation outside this efficient communication system.

Doing a simple calculation, considering that 60% of the pasture areas could be intensified in Brazil and 40% were destined to elephant grass crops, and also considering an average of 7 animal units per hectare, in an intensive production system, Brazil would have capacity for 840,000,000 animal units of cattle, without considering cattle fed through confinements that do not use grass in the fattening diet.

Pasture evolution grew 39.1% in 36 years. So that, today, there are data that demonstrate concern in relation to these pasture areas. In this sense, EMBRAPA (2022c and 2022d) reveals that of the total 200 million hectares of pasture that Brazil has, 65% of them are somehow compromised as degraded areas, that is, approximately 130 million hectares of pasture would be degraded in the country, which reinforces the country's need to evolve more towards the field of efficiency, productivity and quality as a form of competitive advantage. For this, investing in science and technology is fundamental to this process.

The summary of the SWOT Matrix used in this study will be presented below.

Figure 1: SWOT Matrix



Source: own elaboration

Thus, it is evident that the main strength of beef protein production in Brazil is the immense area available to work, the greatest weakness is the lack of applied technology, the greatest threat is the technological evolution of competing countries and the greatest opportunity is growing demand, as per analysis following the Swot Matrix.

## 5. FINAL CONSIDERATIONS

Based on the results of the research, it was possible to verify that in the productive system of cattle raising in the country, technologies are not uniformly accessible to rural producers, which leads to their concentration and inequality in terms of effectiveness and efficiency in the Brazilian rural sector. Although, in general, there has been an increase, in absolute and relative terms, of livestock in Brazil in recent decades, this increase is more in the sense of productive efficiency, where there is a tendency to value the quantitative increase in meat production. Although there has also been an improvement in the performance of beef production in the country in recent decades in terms of productivity, when comparing the Brazilian scenario with the main world producers of animal protein from livestock, it appears that it is necessary and strategic to the country to advance further in this regard, that is, to improve production efficiency.

In any case, the importance of national cattle production in the international scenario is evident, where it was possible to demonstrate the productive strength of the country in this segment today. However, even though the country is in a position of global importance for cattle raising, this does not mean that there are no risks

in the future. This is the point that this research highlights in strategic terms to ensure the effectiveness of this economic segment in the national and international scenario.

The effectiveness of the economic activity of Brazilian cattle raising will remain strong if production criteria demanded by competitive markets are met. Such criteria end up being placed as conditions in bilateral and multilateral relations involving economic relations and Brazil is at the center of this discussion.

Currently, the world is going through a moment of turbulence, whether due to wars or economic, social and environmental conflicts of interest. The discussion of international economic cooperation agreements involving Brazil, such as the current agreement between MERCOSUR and the EUROPEAN UNION, where the issue of the Amazon and livestock in this biome and the speeches in defense of the environment and sustainable development place the credibility of the Brazil in front of world public opinion. Although part of this discourse is linked to other factors of international interest, which is not the subject of discussion in this study. The fact is that Brazil cannot fail to establish internal strategies aimed at the effective production of beef, including in the Amazon region, the main biome where the feeling of environmental defense emerges in the world. Thus, the present study draws attention to the need for Brazil to urgently strengthen its strategic planning in favor of a more efficient livestock production system in terms of productivity with criteria and quality standards that increase the effectiveness and efficiency of production.

It is evident that there is room for growth in terms of productivity in the country, but there is a limit if you think only in terms of production or efficiency, considering only the scale or exclusive focus on increasing the quantity to be produced. Therefore, it is necessary for efficiency and effectiveness to go hand in hand, in the same way as productivity and production, so that the country can sustain itself in a market that tends to be more demanding, especially in the context of sustainable development when it involves the Amazon. It is not simply an environmentalist discourse, it is a strategic vision to insert Brazil in increasingly competitive and mature markets, which requires technologies, technical capacity, professional training, management, skills and planning skills.

Thus, it is concluded that Brazil has everything to grow, but it will only be able to sustain itself in this market when efficiency is also part of the process, thus making Brazilian cattle production effective in time and space, in order to enjoy sustainably from this activity in the same area for an indefinite period of time. For this to happen, it is necessary to use technologies, strategies and work in a professional manner.

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