UNIVERSIDADE ESTADUAL DO OESTE DO PARANÁ
PROGRAMA DE PÓS-GRADUAÇÃO EM ADMINISTRAÇÃO
MESTRADO PROFISSIONAL

WESTERN PARANÁ STATE UNIVERSITY
PROFESSIONAL MASTER'S IN ADMINISTRATION

COMPETITIVIDADE DAS EXPORTAÇÕES DE PROTEÍNA ANIMAL DO BRASIL E SUA RELAÇÃO COM A SUSTENTABILIDADE

COMPETITIVENESS OF ANIMAL PROTEIN EXPORTS FROM BRAZIL AND ITS RELATIONSHIP TO SUSTAINABILITY

[TRADUÇÃO INGLESA]

FRANCIELI BINOTTI

CASCAVEL

2022

Francieli Binotti

COMPETITIVIDADE DAS EXPORTAÇÕES DE PROTEÍNA ANIMAL DO BRASIL E SUA RELAÇÃO COM A SUSTENTABILIDADE

COMPETITIVENESS OF ANIMAL PROTEIN EXPORTS FROM BRAZIL AND ITS RELATIONSHIP TO SUSTAINABILITY

[TRADUÇÃO INGLESA]

Dissertation presented in partial fulfilment of the requirements for the degree of **Master of Science in Administration** in the Department of Administration, Western Paraná State University.
Adivisor: Professor Ph.D. Geysler Rogis Flor Bertolini
Co-advisor: Professora Ph.D. Loreni Brandalise

Dissertação apresentada ao Programa de Pós-Graduação em Administração (PPGAdm) – Mestrado Profissional, da Universidade Estadual do Oeste do Paraná, como requisito parcial para obtenção do grau de **Mestre em Administração**.
Orientador: Professor Dr. Geysler Rogis Flor Bertolini
Coorientadora: Professora Dra. Loreni Brandalise

CASCAVEL

2022

FRANCIELI BINOTTI

Competitividade das exportações de proteína animal do Brasil e sua relação com a sustentabilidade

Dissertação apresentada ao Programa de Pós-Graduação em Administração em cumprimento parcial aos requisitos para obtenção do título de Mestra em Administração, área de concentração Competitividade e Sustentabilidade, linha de pesquisa Sustentabilidade, APROVADO(A) pela seguinte banca examinadora:

Orientador(a) - Geysler Rogis Flor Bertolini
Universidade Estadual do Oeste do Paraná (UNIOESTE)

Ivano Ribeiro
Universidade Estadual do Oeste do Paraná (UNIOESTE)

Ítalo Emanuel Rolemberg dos Santos
INSTITUTO FEDERAL DE EDUCAÇÃO, CIÊNCIA E TECNOLOGIA DO CEARÁ - CAMPUS ACARAÚ (IFCE)

Cascavel, 29 de junho de 2022

ACKNOWLEDGMENT

RESUMO

O mercado brasileiro de proteína animal destaca-se nas exportações por apresentar vantagens competitivas no mercado internacional e a sua relação com a sustentabilidade passou a ser um ponto imprescindível para a manter a competitividade do setor. Por isso, o objetivo geral desta pesquisa foi analisar o impacto da sustentabilidade na competitividade das exportações do mercado brasileiro de proteína animal (frango, boi e suíno), no período de 2000 a 2021. Para verificar a competitividade do Brasil nesse período, utilizou-se o método *Constant Market Share* (CMS), dividindo a análise em subperíodos. A sustentabilidade do país foi avaliada pelo desempenho social, com a utilização do índice de Desenvolvimento Humano (IDH) e pelo Desempenho ambiental, avaliado a partir da Poupança Líquida Genuína (ANS). A coleta de dados foi realizada por meio de documentos disponíveis em instituições públicas, como Ministério do Desenvolvimento, Indústria e Comércio Exterior (MDIC), Secretaria de Comércio Exterior (SECEX), Organização Mundial do Comércio (OMC) e também na base de dados World dataBank do Banco mundial e a UNdata da ONU. Os resultados apontam que o Brasil é competitivo no mercado internacional de proteína animal e vem aumentando sua participação ao longo dos anos, destacando-se como importante fornecedor de alimentos para o mundo. Com a chegada da pandemia em 2020, previa-se uma redução das exportações brasileiras, devido ao aumento das restrições para o combate ao Coronavírus, mas as exportações de carne bovina e suína não forma afetadas, somente a carne de frango teve uma redução, em 2020, no valor exportado e que foi superado no ano seguinte. As dimensões ambiental e social não apresentaram grande influência no desempenho competitivo; os fatores, como o crescimento mundial, destinos das exportações e barreiras comerciais, exerceram maior influência no desempenho exportador do país. As barreiras tarifárias e não tarifárias agem como uma trava na expansão do setor, por isso, há uma necessidade de acordos de flexibilização para a melhoria das políticas de incentivo à competitividade.

Palavras-chave: Mercado de Carnes. Desempenho Sustentável. Barreiras comerciais. Comércio Exterior.

ABSTRACT

Binotti, F (2022). ***Competitiveness of animal protein exports from Brazil and its relationship with sustainability***. Master's dissertation, State University of West Paraná, Cascavel, PR, Brazil.

The Brazilian market for animal protein stands out in exports for presenting competitive advantages in the international market and its relationship with sustainability has become an essential point to maintain the competitiveness of the sector. Therefore, the general objective of this research was to analyze the impact of sustainability on the competitiveness of exports of the Brazilian animal protein market (chicken, beef, and pork), in the period from 2000 to 2021. if the Constant Market Share (CMS) method, dividing the analysis into sub-periods. The country's sustainability was assessed by social performance, using the Human Development Index (HDI) and by Environmental Performance, assessed from the Genuine Net Savings (ANS). Data collection was carried out through documents available in public institutions, such as the Ministry of Development, Industry and Foreign Trade (MDIC), Secretariat of Foreign Trade (SECEX), World Trade Organization (WTO) and also in the World database. dataBank from the World Bank and UNdata from the UN. The results show that Brazil is competitive in the international animal protein market and has been increasing its share over the years, standing out as an important food supplier to the world. With the arrival of the pandemic in 2020, a reduction in Brazilian exports was expected, due to increased restrictions to combat the Coronavirus, but exports of beef and pork were not affected, only chicken meat had a reduction, in 2020, in the value exported and which was surpassed in the following year. The environmental and social dimensions did not show great influence on competitive performance; factors such as world growth, export destinations and trade barriers exerted greater influence on the country's export performance. Tariff and non-tariff barriers act as a barrier to the expansion of the sector, therefore, there is a need for flexibility agreements to improve policies to encourage competitiveness.

Keywords: Meat Market. Sustainable Performance. Commercial barrier. Foreign trade

FIGURE LIST

CHART LIST

LIST OF ABBREVIATIONS AND ACRONYMS

ABIEC	Associação Brasileira das Indústrias exportadoras de Carnes
ABPA	Associação Brasileira de Proteína Animal
ANS	Poupança Líquida Genuína
ApexBrasil	Agencia Brasileira de promoção de expostações e Investimentos
BPF	Boas Práticas de Fabricação
BPH	Boas Práticas de Higiene
CMS	*Constant Market Share*
CNA	Confederação da Agricultura e Pecuária do Brasil
CTE	*Committee on Trade and Environment*
FAO	*Food and Agriculture Organization of the United Nations*
GATT	Acordo Geral de Tarifas de comercio
HACCP	*Hazard Analysis and Critical Control Point*
IBGE	Instituto Brasileiro de Geografia e Estatística
IDH	Índice de Desenvolvimento Humano
IDS	Indicadores de Desenvolvimento Sustentável
Ipeadata	(Instituto De Pesquisa Econômica Aplicada
IPG	Índice de Progresso Genuíno
ITC	*International Trade Centre*
IVCR	Índice de Vantagem Comparativa Revelada
LOSAN	Lei Orgânica da Segurança Alimentar e Nutricional
MAPA	Ministério da Agricultura, Pecuária e Abastecimento
NRCA	Índice de Vantagem Comparativa Revelada Normalizada
OECD	*Organization for Economic Co-Operation and Development*
OMC	Organização Mundial do Comércio
ONU	Organização das Nações Unidas
PNUD	Programa das Nações Unidas para o Desenvolvimento
PSA	Peste Suína Africana
SAN	Política de Segurança Alimentar e Nutricional
SECEX	Secretaria de Comércio Exterior
SISAN	Sistema Nacional de Segurança Alimentar e Nutricional
TBL	Triple Bottom Line
TBT	*Agreement on Technical Barriers to Trade*
WCED	*World Commission on Environmet and Development*
WTO	*World Trade Organization*

SUMMARY

1   INTRODUCTION

It was in the 1960s that Brazil stopped being a food importer and became an exporter. This fact occurred due to the combination of natural resources with knowledge and technology, with rural entrepreneurship and with the coordination of value chains (*Associação Brasileira de Proteína Animal* [ABPA], 2021). Therefore, in addition to adequately feeding the national population, the country is strengthening itself as an important supplier of food to the world.

According to the *Ministério da Agricultura, Pecuária e Abastecimento* (MAPA), Brazilian agro exports grew from US$20.6 billion to US$120.5 billion between 2000 and 2021, especially soybeans, representing 40% of 2021 revenue and meats representing 16%. The Brazilian sector of animal protein stands out in exports for presenting competitive advantages in the international market. The country's participation has been increasing significantly, as a result of efforts by national organizations in the development of behavioral models and investments in the market (Stal, Sereia & Silva, 2010; Souza, Souza, Marques, Gazzola & Marra, 2011; Aparicio, González-Esteban, Pinilla, & Serrano, 2018).

Accompanied by this great growth in exports in recent years, there have been the imbalances caused by productive activities to the environment and society. According to the Food and Agriculture Organization of the United Nations (FAO) (2020), Agriculture is the sector responsible for consuming the largest amount of water in the world, using an average of 70% of all water consumed. Cattle ranching is the main reason for soil degradation and deforestation, due to the need for large areas of pasture, and emission of methane gas, which contributed to the greenhouse effect, as it is produced naturally by ruminants (Oliveira, 2021).

On the other hand, the revenues generated with this increase in agro exports were relevant to the country's economy. In 2021, chicken meat exports generated a revenue of US$ 6.9 billion, beef, US$ 7.9 billion and pork US$ 2.6 billion (SECEX, 2022). These data show the importance of Brazil in the international market, as it is one of the three largest producers and exporters of these products (Organization for Economic Co-Operation and Development [OECD], 2021). A factor that contributes to these results is the country's competitive cost structure (Ferreira & Vieira, 2019) and also the strategies adopted to increase the productivity of the sectors, mitigate the impacts of barriers that harm exports and enable the integration of the productive sector with the industry (Stal, Sereia & Silva, 2010).

OECD indicators project that Brazil, China, the European Union, and the United States will represent about 60% of world meat production by 2030, with Brazil standing out for its abundance in natural resources, forage, availability of pastures and increased productivity. The data indicate that the country will have increased productivity in beef and poultry, with the latter item accounting for half of all additional meat produced over the next decade (OECD, 2021).

Due to the effects of the African Swine Fever (ASF) outbreak in China, pork production was reduced by 21% in 2019, causing its imports to come mainly from Brazil, Canada, the European Union, and the United States. Estimates indicate that pork production will increase and, in 2025, will reach production levels prior to the outbreak in China, with Brazil being one of the main producers of the protein (OECD, 2021).

Population growth in developing countries combined with rising incomes was responsible for the high global demand for animal protein (Fernandes *et al.,* 2019 e Ferreira & Vieira, 2019). To meet this demand, it was necessary to use technologies that increase productivity in a way that contributes to the economy of scarce resources. In this way, increasing productivity is a central point to minimize the pressure of consumption of natural resources and to preserve the environment in a sustainable way (Vieira, 2016).

With the arrival of the Covid-19 pandemic and the slowdown in the world economy, a threat to food security emerged, raising awareness of food supply and demand. Slow economic growth in developing countries could lead to a gradual decline in demand for value-added products, including meat and fish products, which increased demand for bread and flour (Gadzalo, Sychevskiy, Kovalenko, Deineko & Yashchenko, 2020).

This reduction in consumer demand for foods with basic protein has negative consequences for the global economy, with a significant drop in GDP in developed economies and an increase in prices, which will pose a threat to the entire production chain (Gadzalo *et al*., 2020). However, other factors influence the reduction of meat consumption, such as consumer preference for a vegetarian or vegan lifestyle, climate change, income variation, obesity, and the adoption of environmentally sustainable consumption patterns (OECD, 2021).

It is clear that the animal protein market, especially beef, pork, and chicken, is of paramount importance for the country, since its consumption is affected by the increase in income and population growth. Brazil is a developing country, which has competitive advantages and, for many years, has ensured the success of exports (Stal, Sereia & Silva, 2010). Increasingly, it is necessary to improve the ability to innovate in products, processes and services so that the country remains competitive in a sustainable way in the market.

The sustainability of a market is one of the strategies used to make or maintain a competitive sector. Only with the balance between environmental, social, and economic aspects, at the same time, sustainability is achieved. Therefore, understanding the evolution of the country's competitiveness in the sector, combined with aspects of sustainability, may result in public policies that support and encourage its development, stimulating exports in the country in an even more sustainable way. To fill the existing gap, it is necessary to study the impacts that sustainability has on the competitiveness of exports in the Brazilian meat market. Thus, the survey and understanding of these relationships can collaborate with the identification of strategies, potentials and challenges related to the internal and external market.

1.1   SEARCH ISSUE

Studies point to the growth of agricultural productivity over time (Gasques, Bastos, Valdes & Bacchi, 2012; Fornazier & Vieira, 2013; Vieira, Gasques & Sousa, 2012; Vieira, 2016). Between 2000 and 2021, revenue from agricultural exports grew significantly and currently corresponds to 43% of the country's total exports (Comex Stat, 2022). Like other activities, the meat market has also gained relevance in economic terms.

The estimates for the meat sector carried out by Souza et al. (2011), showed that the production of chicken meat in Brazil would reach 17 million tons (Mt); beef would reach 11 million and pork, 4 million by 2020. Projections made by the United States Department of Agriculture (USDA) in 2020 estimated the production of 13.8 million tons of chicken meat, 10.10 Mt of beef and 4.13 Mt of pork. Both projections pointed to good prospects for growth and strengthening of the Brazilian animal protein market.

According to data from the *Associação Brasileira de Proteína Animal*, production volumes have grown in the last two decades, and confirmed the aforementioned forecasts: Brazilian production of chicken meat increased from 5.6 million tons in 2000 to 13.3 million in 2021, while pork production increased from 1.2 million tons in 2000 to 4, 7 million tons in 2021. Exports of these products, in the same way, also show an increase in quantity; in 2000, chicken meat exports totaled 893 thousand tons and, in 2020, it was 4.6 million tons. Pork exports, in turn, totaled 127,000 tons in 2000, and in 2020, 1.13 million tons were exported (*Confederação da Agricultura e Pecuária do Brasil* [CNA], 2022).

In relation to beef, the production volume in the year 2000 was 3.8 Mt and, in 2021, it became 7.4 Mt. Exports, on the other hand, totaled 357 thousand tons in the year 2000 and, in

2021, totaled 1.8 million tons. Brazil is the second largest producer of this protein and, analyzing the export revenue of the product, which was US$ 835 million, in 2000, and US$ 9.2 billion, in 2021, its great importance can be observed in the market (*Instituto De Pesquisa Econômica Aplicada* [Ipeadata], 2022 and *Associação Brasileira das Indústrias exportadoras de Carnes* [ABIEC], 2022).

The current production and export figures, presented by CNA, Ipeadata and ABIEC, show the evolution that Brazil has had in the animal protein sector and its contribution to the generation of wealth for the country is visible. On the other hand, meat production brings some concerns and challenges; one of these great challenges is the constant growth of the population's perception of environmental sustainability, causing the debate on an increasingly sustainable production and with less impact on the environment (Claudino & Talamini, 2013).

The emergence of the concept of sustainable development, in 1987, through the report Our Commun Future, proposes a relationship between economy, technology, society and politics. In its definition, it presents that sustainable development must meet the needs of today's society in harmony with social and environmental issues, without compromising the future of the next generations (World Commission on Environmet and Development [WCED], 1987). Since then, the world has adopted an ethical stance, based on social responsibility and consistent with the ideals of sustainable development (Flores & Gavronski, 2016).

Brazil is known for its natural biodiversity, so the agribusiness has the challenge of associating this image with the quality of agricultural products and the preservation of nature. However, the integration of environmentally sustainable practices into the production process requires significant investments and does not bring an immediate incremental return (Carneiro, 2019). In this way, government strategies and incentives are important for the development of a production chain with sustainable performance, reducing its environmental impact.

With the perspective of analyzing the sustainability of a region of the country, sustainability indicators emerge, which are used as a tool to help monitor the operationalization of sustainable development. This need to consolidate indicators was expressed at the United Nations International Conference on Environment and Development, held in Rio de Janeiro, with the adoption of Agenda 21. The main objective was to create a range of factors related to sustainability, such as ecological, economic, social, cultural, institutional factors, that serve as a reference to measure society's progress towards a sustainable future (Veiga, 2010).

In addition, it is clear that competitiveness in the international meat trade is influenced by other factors, such as the production capacity of a given location compared to its competitors,

production cost, product quality, export logistics and dependence on cooperation between countries in trade negotiations. This dependence has led to the imposition of trade barriers, which aim to restrict the access of foreign goods and services to a market, whether in importation or commercialization.

These barriers can be both tariff and non-tariff, the former arising from import taxes, import tariffs and customs fees; the second, on the other hand, can be used as an instrument to control access to markets. Non-tariff barriers have the power to restrict the entry of imported goods, which do not follow the technical, sanitary, environmental, labor requirements, customs valuation policies of minimum prices and price bands (Cardoso, 2019; Cruz, 2019).

In addition, constant changes in politics, society and the economy over the years affect the market and competitiveness of a country. With the Covid-19 pandemic, global economic growth is expected to be 2.4% in 2021, the lowest level since the 2008 financial crisis (OECD, 2022). This pandemic and unexpected scenario has led some countries to impose even more restrictions on imports in order to protect their consumers (World Trade Organization [WTO], 2020). Despite the impacts on the economy caused by the pandemic, Brazilian agribusiness exports were not negatively affected (Malafaia & Biscola, 2020). But, even with the good performance, it is important to analyze how the country's competitiveness behaved in the face of the uncertainties of the lived environment, which generate tensions and imbalances in the market.

The sustainable development of a country encompasses aspects of a consumption system concerned with the preservation of the ecosystem, while meeting current needs. In this way, sustainability is the balance between what nature has to offer, its consumption limit, providing quality of life and economic development. Thus, in this research, aspects related to the sustainability of the meat market are highlighted, involving the environmental, social, and economic dimension.

With the increase in Brazil's participation in the meat market, between the years 2000 to 2021, together with the growing concern about the country's sustainability without leaving aside the competitiveness in the sector, the research gap that covers this study arises. Therefore, it is proposed to evaluate the country's competitiveness in the beef, pork and chicken meat market, its performance related to sustainability indicators and the main tariff and non-tariff barriers. In view of the aspects presented in the research problem, the question that guides this study is: **What is the relationship between sustainability and competitiveness of exports of**

the Brazilian animal protein market (chicken, beef, and pork) in the period from 2000 to 2021? Item 1.2 presents the objectives that were prepared in order to answer this question.

1.2 OBJECTIVES

1.2.1 General

To analyze the relationship between sustainability and competitiveness of exports from the Brazilian market of animal protein (chicken, beef, and pork) in the period from 2000 to 2021.

1.2.2 Specific

a) To analyze the competitiveness of Brazilian exports of animal protein (chicken, beef, and pork) using the Constant Market Share (CMS) method.
b) Identify the main destinations of Brazilian animal protein and their trade barriers.
c) Verify the relationship between Brazil's sustainable performance and export performance and its competitiveness in the face of the pandemic scenario.

1.3 JUSTIFICATION AND CONTRIBUTION OF THIS TECHNICAL PRODUCTION

The representativeness of Brazil in the animal protein market and its competitiveness is pointed out in research, such as that of Thomé, Reis & Paiva (2013); Florindo, Medeiros, Costa & Ruivano (2014); Fernandes *et. al.,* (2019) and Ferreira & Vieira (2019). A limitation of the results is seen when the analysis is performed on a single aspect or a specific product, but when the sector is analyzed in general, as in the publication by Alves, Gazzola & Marra (2008) and Souza et al. (2011), the results are the identification of market strategies.

Many countries have productive capacity, but few are able to meet their domestic demand and become competitive in the foreign market. The large meat production capacity that Brazil has is due to some particular advantages of the country; one of them is grain production, which is very rich and has a high growth indicator (Ferreira & Vieira, 2019). But to maintain this advantage, investments that increase the quality of the exported product are needed,

increasing competitiveness from the advance of the import market (Rodrigues & Marta-Costa, 2021).

Another factor is that, with the Covid-19 Pandemic, concern for animal health has increased, leaving even greater demands on surveillance systems. In view of this, Brazil gains a great opportunity to show the transparency of the production chain, which has reliable production processes in the field and industry (Malafaia, Biscola, & Dias, 2020).

A challenge faced, not only by Brazil, but by all exporting countries in order to remain competitive and conquer new markets is the adaptation to international standards with the imposition of tariff and non-tariff barriers. Due importance must be given to the negotiation of trade agreements that offer conditions for growth with access to new markets, so that the competitive advantages acquired are not blurred by trade barriers (Cruz, 2019; Medeiros & Bender, 2019).

Regarding the sustainability variable, a series of studies seek to relate it to agribusiness (Akabane, Lopes & Silva, 2010; Silva, 2012; Reis & Gonçalves, 2014; Carneiro, 2019), associating economic aspects, but leaving social and environmental aspects in the background. Despite the importance of exports for the economic development of countries, the literature on the subject has paid little attention to the relationship between sustainability and export performance (Galdeano-Gómez, 2010; Flores & Gavronski, 2016).

Since John Elkington sought to balance economic, social, and environmental objectives, known as the sustainability tripod, in 1997, the environmental variable has gained relevance. The term sustainability is quite evident in agribusiness, as it is an activity recognized as causing environmental impacts (Giordano, 2005). Despite the great challenge of becoming an environmentally responsible activity, with the imposition of regulations, policies and sanctions aimed at production practices that meet environmental criteria, this vision is being changed.

Therefore, this research contributes to broadening the understanding of the relationship between the use of sustainability strategies for Brazil's competitiveness, and the theoretical subsidies will allow the country and meat exporting companies to adapt their sustainability strategies for a more competitive performance. By demonstrating the relationship between the variable sustainability and exports more clearly, it is possible to better target public policies for the promotion of the Brazilian market. Regarding the theoretical contribution, this work collaborates with the development of studies on Brazilian agribusiness in general, and also with those related to the competitiveness of the meat sector.

1.4   THESIS STRUCTURE

This dissertation is divided into three chapters, according to Figure 1.

Figure 1. Structure of the report

INTRODUCTION		1.1 Search Issue

INTRODUCTION
The introduction of the theme, the problem, the objectives, and the justification are presented.
→
- 1.1 Search Issue
- 1.2 Objectives
- 1.3 Justification
- 1.4 Thesis structure

THEORETICAL REFERENCES
The important theories and studies related to the theme of work are characterized.
→
- 2.1 Global Animal Protein Markets
- 2.2 World Trade Organization
- 2.3 Competitiveness of Brazilian exports
- 2.4 Sustainability Indicators
- 2.5 Related Studies

METHODS AND TECHNIQUES OF RESEARCH
Explains the procedures used in the study and the databases.
→
- 3.1 Research design
- 3.2 Universe
- 3.3 Data Gathering
- 3.4 Data analysis procedure

ANALYSIS AND DISCUSSION OF RESULTS
The results of the data analysis and a discussion about them are presented.
→
- 4.1 Characterization of exports from the Brazilian Market
- 4.2 Constant Market Share analysis (CMS)
- 4.3 Animal protein exports and sustainable performance
- 4.4 Covid-19 pandemic and Brazilian exports of animal protein

FINAL REMARKS
The main results of the survey are reported.

REFERENCES

Source: Made by the author (2022)

2   THEORETICAL AND PRACTICAL REFERENCES

This Chapter presents theoretical arguments that supported and contextualize the objectives of this study, showing the main highlights of global animal protein markets, the role that the World Trade Organization plays in the market, issues related to food safety and tariff and non-tariff barriers, as well as the competitiveness that the country has in the foreign market, sustainable performance, and its indicators. And, finally, the related studies of the scope of this research and considerations.

2.1   GLOBAL ANIMAL PROTEIN MARKETS

The general increase in the level of global economic openness and the rapid growth of agricultural trade in recent centuries has spurred a more integrated development of trade. As a result, there was an increase in revenue as the costs of sea and land transport declined, providing a trend towards free trade. Agricultural products were the main components for the growth of international trade, with the largest part being food products and agricultural commodities, given the increase in the world demand for food especially caused by the great Asian demand (Aparicio *et al.,* 2018).

The retraction of trade, caused by the First World War, had its recovery gradually, which happened during the 1920s. But with the crisis of 1929, international trade was affected and, again, there was a retraction in volume and value. At the time of the "golden age of capitalism", the acceleration of the world economy brought freedom for international trade, as well as improvements in transport and communications, in addition to rate stability. This stimulus provided to international trade resulted in a growth rate of trade greater than production, favoring the broad integration of markets (Aparicio *et al.,* 2018).

In relation to the meat market, its production has doubled in the last centuries. Economic development and the shift in consumer preferences towards the high value of agricultural products have notably increased meat consumption in many developing countries (Ucak, 2007; Ali & Pappa, 2015). This effective growth in meat consumption was noticed, on a large scale in China, for having one of the highest population growth rates in the last two decades, associated with the increase in income (Ucak, 2007).

With urbanization, there was an increase in families' access to meat sold in stores, which caused occupational and family structural changes, which favored the consumption of food

outside the home. The important change in meat consumption is shown by the case of Japan, the world's largest importer of beef and pork, both in value and in volume. The growth in imports from Japan reflected the rapid increase in meat consumption, which occurred there between 1960 and 1995, when *per capita* consumption increased almost sixfold. This growth in meat consumption has raised the prices of domestically produced meat and, consequently, has increased the possibility of a market for imported meat (Dyck & Kenneth, 2003).

Over time, the global meat industry has experienced several critical events related to food safety, disease outbreaks, and environmental concerns such as global warming. According to Ali & Pappa (2015), during 1980-82, Europe was still the largest producer of meat, with 39% of world production, followed by America with 31%, Asia with 21%, Africa with 5%, and Oceania with 3% of production. However, in 2009-11, Asia became a major meat producer, with 41% of world production.

Red meat accounted for 78% of global meat production in 1980-82 but dropped to 64% in 2009-11. The decline in the share of red meat in total production has been significant in all regions, especially in the Americas. During 1980-2011, global meat production grew by 2.5% annually. White meat (chicken meat) presents 4.6% annual production growth, more than double the growth of red meat, mainly beef, mutton and pork, which totaled 1.8% per year (Ali & Pappa, 2015).

In terms of world meat exports, Europe was the largest exporter with around 64% of the global share in 1980-82 but declined to 50% in 2009-11. In contrast, the Americas' share of total beef exports increased from 16% in 1980-82 to 29% in 2009-11. Even though it has declined significantly, red meat represents the majority of global exports; in 1980-82, its share of exports was 84%; in 2009-11, it was 71%. The global shift in the composition of the meat trade favoring poultry is expected to continue in the future, supported also by lower poultry prices relative to other meats (Ali & Pappa, 2015).

There are big differences in the preference for meat according to the culture of each country. For example, Americans pay more for white chicken meat, but consumers in other countries value dark chicken meat. Some major markets are willing to pay higher prices for meat offal than others, again leading to large trade flows. The ability to ship second-rate cuts to outlets around the world created the opportunity to explore differences between countries in their preferences for specific cuts of meat from the same animal species (Dyck & Kenneth, 2003).

Overall, world meat production is characterized by a positive development trend, but its regional distribution and levels of development are very different and uneven. Most of the world's meat production is concentrated in a relatively small number of countries. That is, they are the 15 largest producing countries and represent more than 62% of the world production of beef and buffalo, about 84% of pork and 72% of poultry, sheep and goat meat (Djorović, Stevanović, & Lazić, 2009).

From the point of view of economic development, developed countries account for most of the world's beef production, while underdeveloped and developing countries have a greater share in world production of pork, poultry, sheep and goat meat. This was also noticed in imports and exports, where developed countries hold a higher share of almost all meats, except for poultry meat imports, compared to developing and underdeveloped countries (Djorović, Stevanović, & Lazić, 2009).

One factor that has strongly influenced the global meat market are trade barriers, both sanitary and protectionist. Protectionist barriers still remain with high tariffs and tariff quotas, which impede or inhibit the potential development of the meat trade. Therefore, with the greater liberalization of protectionist barriers, eradication of animal diseases, economic development and population growth, there was a great perspective of growth for the world meat market (Dyck & Kenneth, 2003).

Although the global meat trade has grown strongly in recent decades, many meat producing and consuming countries are still not linked by trade. In some cases, no trade occurs because neither supply nor demand factors make trade profitable, but in other cases, no trade occurs because countries have erected barriers to import or export (Dyck & Kenneth, 2003). However, with the evolution of the General Agreement on Trade Tariffs (GATT) and its successor, the World Trade Organization (WTO), there was a reduction in protectionist barriers, which made it possible to increase imports and exports of meat and other commodities.

2.2 WORLD TRADE ORGANIZATION (WTO)

The World Trade Organization (WTO) emerged in 1995, replacing the General Agreement on Tariff Trade (GATT), with the aim of creating an organization to regulate trade, which had a great capacity to adapt to the world economy order and that would enable countries to develop their trade in an equitable manner. The WTO revolutionized the international

economy, as it began to manage goods and services through the import and export activities of countries in international trade (Bizawu, Paiva Toledo & Lopes, 2017).

The objective of this organization is to make each member country assume the same political principle of free trade, preventing the imposition of unjustified trade barriers. Among its four main functions, one is to constitute a forum for negotiations on trade relations between the members with the aim of creating or modifying multilateral trade agreements and, also managing the Trade Policy Review Mechanism, which in turn, conducts regular reviews of the Foreign Trade Policies of all WTO members (Thorstensen, 1998).

The general principle of the WTO stipulates that the world trading system must be rules-based, not results-based, and focuses on the design, implementation, updating and enforcement of procedures, rules, and guidelines. Thus, within the general principle, there are five specific principles, which are: non-discrimination, transparency, reciprocity, flexibility, and decision-making by consensus (Baldwin, 2016).

In addition to providing a free trade scenario, the WTO works with issues related to the preservation of the environment, turning to more sustainable trade policies. Environmental issues, associated with trade agreements, develop aspects of sustainability encouraging the preservation and conservation of natural resources. With this, a balance is sought in trade relations, in which the WTO agreements attest to the right of countries to protect the environment, respecting its conditions and even including deliberations related to environmental concerns (Bizawu *et al.*, 2017).

With the aim of integrating trade and the environment, the WTO Committee on Trade and Environment (CTE) was created. The Committee was established by the WTO General Council in January 1995 to promote the link between trade and environmental measures (Thorstensen, 1998). CTE manages all sectors of the trade system, including goods, services, and intellectual property. Its attributions range from identifying the relationship between trade measures and environmental measures, to making appropriate recommendations on the need for modifications to the provisions of the multilateral trading system (WTO, 2021a).

The 2001 Doha Ministerial Declaration instructed the CTE to pay special attention to environmental requirements imposed for market access by developing countries. The committee should assess the consistency between the rules of the WTO agreements and the environmental standards applied by some countries, in order to mitigate inadequate standards that may harm exports. These impositions can generate unjustified economic and social costs for others, especially developing countries (WTO, 2021a).

The multilateral system is a valuable tool for the sustainable development of international trade. Thus, the balance between market access and environmental protection is essential for free trade. The environmental measures imposed in the agreements must consistently comply with WTO rules, consider the capabilities of developing countries, and meet the legitimate objectives of the importing country. The involvement of developing countries in the design and development of environmental measures makes the multilateral system open with equality, so that these measures do not unnecessarily impede trade (WTO, 2021b).

The WTO plays a relevant governance role with regard to trade barriers, including those related to sanitary measures (Thorstensen, 1998). Sanitary and phytosanitary barriers are inspection mechanisms to control the entry of agricultural products into importing countries with the purpose of offering quality products to consumers, both tariff and non-tariff. However, some countries have increasingly used trade barriers for protectionist purposes (a practice prohibited by the WTO), which aim to restrict or prohibit imports of certain goods to protect the internal market from external competition (Bonnomi, 2020).

Thus, in item 2.2.1, the rules of international trade ensured by the WTO are highlighted, which are tariff and non-tariff barriers.

2.2.1   Tariff and non-tariff barriers

There are several types of tariff barriers, ranging from simple tariffs to more complex mechanisms of environmental and labor safeguards. In tariff barriers, all forms of protection that use tariffs as the main instrument are included. Non-tariff barriers, on the other hand, are restrictions on quantities, composition and destination of products in international trade, including quotas, contingencies, import licenses, sanitary and phytosanitary measures, among others (Nassar, 2004; Viegas, Jank & Miranda, 2007).

The imposition of barriers by countries is a way of guaranteeing quality, safety, health and environmental protection standards. Import tariffs are imposed through discriminatory taxes on products from other countries, whose main objective is to contain their incorporation into the import market (Lopez & Gama, 2011). There are four types of tariff barriers: the import tax, the export tax, the import tariff quota and the export tariff quota.

According to the Manual on Trade Barriers and Investments, prepared by the Brazilian Agency for the Promotion of Exhibitions and Investments (ApexBrasil), the import tax is

applicable when the product enters the country and is levied on its value. As it is applied only at entry, the tariff is an additional charge to the exported product and is not applicable to the same goods produced in the importing country. This tax is limited by commitments that the importing country has entered into in the WTO or other trade agreements This tax is limited by commitments that the importing country has entered into in the WTO or other trade agreements (ApexBrasil, 2017).

Export tax is applicable when the product leaves the country of origin. It is used as a form of incentive for the processing of raw materials in the countries, with the future exportation of finished goods. Unlike the import tax, it is not limited by commitments consolidated in the WTO, but its application in a discriminatory manner is prohibited, that is, different rates cannot be applied depending on the country of destination of exports (ApexBrasil, 2017).

Tariff quotas determine a quantity to which a specific tariff is applied, being directed to the quantity that exceeds the quota. Import quotas can become a barrier to trade, as only a certain number of products will have access to the foreign market. Thus, with quotas on exports, a greater amount of the good will be offered to the domestic market, which may result in a reduction in its price, to the detriment of the competitiveness of foreign products, as they end up making exports that are beyond the admitted quantitative limit unfeasible (ApexBrasil, 2017).

Non-tariff barriers are those that discriminate against foreign products without referring to the payment of taxes (Lopez & Gama, 2011). The way in which these barriers are applied is more complex and more difficult to detect and has worried exporting nations, since they do not allow changes in relative costs to influence trade patterns and, also, because they are imposed from one country to the next (Cruz, 2019). These barriers may result from the need to comply with technical requirements established in technical regulations, or administrative requirements, as is the case of limiting exports by pre-fixed quotas (Garrido, 2004).

With the Agreement on Technical Barriers to Trade (TBT), countries began to establish regulations that required quality, safety, composition, production process, among others, for products sold in their territories. These restrictions are part of the non-tariff barriers and are regulated by the TBT, as far as their objectives are considered legitimate. Therefore, the TBT aims to ensure that technical regulations, standards, and conformity assessment procedures are non-discriminatory and do not create unnecessary barriers to trade (WTO, 2021b).

According to ApexBrasil (2017), the main non-tariff barriers that affect Brazilian exports are: quantitative regulations, technical regulations, sanitary and phytosanitary

regulation, private standards/voluntary norms, services, subsidies, intellectual property, government procurement and rules of origin.

Quantitative restrictions can be quotas that limit the volume to be traded and trade bans that prevent a foreign product from having access to the domestic market, or from selling a domestic product to foreign markets. The technical regulations, on the other hand, establish standards that must be met by the products or their production process, and a conformity assessment is conducted to say whether the product meets all the necessary requirements of the technical regulations (ApexBrasil, 2017).

Sanitary and phytosanitary measures are based on scientific standards in a non-discriminatory way, being expressed in law, decree, regulation, or procedure, with the objective of protecting human and animal life and health, as well as plant health (Lopez & Gama, 2011). In addition, Private Standards/Voluntary Norms are standards or norms required by private entities, such as retail groups and NGOs, related to the safety, quality, or sustainability of products (ApexBrasil, 2017).

Barriers to trade in services are related to limitations or prohibitions of market access and, also, to the conditions of unequal competition in relation to national service providers. Subsidies are defined as financial contributions made by the government to specific companies or industries, which may increase the recipients' competitiveness against their foreign competitors (ApexBrasil, 2017).

The rules for the protection of intellectual property impose minimum terms of validity for patents, trademarks, industrial designs, copyrights, topographies of integrated circuits and geographical indications; in addition, there are minimum obligations to protect trade secrets and sanctions against unfair competition practices. And, finally, government procurement refers to the purchase of goods and services by governments through tenders, being a barrier for foreign suppliers and products to compete in this market, since there are preferences for national suppliers (ApexBrasil, 2017).

Rules of origin are criteria used to determine the origin of a product, being uniform, transparent, and administered in a reasonable and non-discriminatory manner (Lopez & Gama, 2011). In relation to the food products market, there is an inherent interest on the part of governments in food safety, as it is what guarantees the quality of food, meeting consumer requirements in terms of food safety, traceability, animal welfare and sanitary control, well-being and health of workers and risk reduction.

Once tariff and non-tariff barriers are known, it is important to emphasize issues involving food security, subject of item 2.2.2 Once tariff and non-tariff barriers are known, it is important to emphasize issues involving food security, subject of item 2.2.2.

2.2.2   Food safety

The concern of governments with the population feeding dates back to colonial times; in Brazil, this concern became public policies from the 20th century onwards. The policies implemented addressed several items, such as agricultural policy, supply systems, price control, food distribution, etc. In 1996, hundreds of countries, including Brazil, began to see this set of policies as part of a general effort to reduce hunger in their territories. So, gathered at the World Food Summit in Rome, comes the commitment to halve the number of hungry people by 2015 (Belik, 2003).

The World Food Summit, held in 1996, had the approval of the Rome Declaration and the Summit Plan of Action, aimed at combating hunger in the world. The participating heads of state and government made a commitment to radically change the situation of malnutrition that affected more than 800 million men, women, and children worldwide. The Action Plan starts from the realization that, in order to improve access to food, it is essential to eradicate poverty, and, for that, the Plan points out support measures, ranging from the development of infrastructure, health, education and rural extension, to attracting investments in the countryside, assisting settlements, encouraging small businesses, and conserving the environment (Alencar, 2001).

Currently, the biggest challenge of food security is access to adequate and healthy food, permanently and sustainably, as stated in the construction of the Food and Nutrition Security Policy (FNS) in Brazil. Law nº 11.346, of September 15, 2006, called *Lei Orgânica da Segurança Alimentar e Nutricional* (LOSAN), creates the *Sistema Nacional de Segurança Alimentar e Nutricional* (SISAN), with the mission of strengthening the notion of the human right to adequate food, seen through programs and public actions, according to FAO (2021).

Law No. 11.346 defines the population's right to food and nutrition security, in the following terms:

> Artigo 3º. A segurança alimentar e nutricional consiste na realização do direito de todos ao acesso regular e permanente a alimentos de qualidade, em quantidade suficiente, sem comprometer o acesso a outras necessidades essenciais, tendo como base práticas

alimentares promotoras de saúde que respeitem a diversidade cultural e que sejam ambientais, cultural, econômica e socialmente sustentáveis (Lei nº 11.346, 2006).[1]

Food safety legislation is understood as a set of procedures, guidelines and regulations prepared by the authorities, aimed at protecting public health (Cunha, Magalhões & Bonnas, 2013). The Codex Alimentarius is a collection of internationally adopted food standards presented in a uniform manner; it includes provisions of an advisory nature in the form of codes of practice, guidelines, and other recommended measures in order to achieve its objectives (Codex Alimentarius, 2016).

Some tools have been developed to ensure food safety, such as food safety management systems, the Hazard Analysis and Critical Control Point (HACCP) and benchmarks such as ISO 22000. These systems help food companies overcome the challenges of controlling hazards in food production (Pereira, 2019). The hazard in food may be related to the biological, chemical or physical agent that is present in the food or the condition of the food with the potential to cause adverse health effects (Codex Alimentarius, 2016).

> O HACCP é um sistema preventivo de controlo da qualidade dos alimentos, criado no final da década de 60 pela Pillsbury (EUA), pelos laboratórios do Exército dos Estados Unidos e pela NASA, com o interesse de produzir alimentos seguros para o programa espacial dos Estados Unidos. O principal objetivo do sistema é a proteção da saúde pública, prevenindo os acidentes alimentares. O HACCP pode ser aplicável a qualquer fase da cadeia alimentar, pois irá identifica os perigos específicos que impactam no consumo, determinando medidas preventivas que evitam e estabelecem o controle dos perigos (Afonso, 2006).[2]

The HACCP System is based on seven principles, described in Chart 1, which should be used for its application (Codex Alimentarius, 2016).

---

[1] Article 3. Food and nutrition security consists in realizing the right of everyone to regular and permanent access to quality food, in sufficient quantity, without compromising access to other essential needs, based on health-promoting food practices that respect cultural diversity and that are environmentally, culturally, economically, and socially sustainable. (Law nº 11.346, 2006).[1]

[2] HACCP is a preventive food quality control system, created in the late 1960s by Pillsbury (USA), the United States Army laboratories and NASA, with the aim of producing safe food for the United States space program. The main objective of the system is the protection of public health, preventing food accidents. HACCP can be applicable to any stage of the food chain, as it will identify the specific hazards that impact consumption, determining preventive measures that avoid and establish the control of hazards. (Afonso, 2006).[2]

Chart 1 - The seven principles of HACCP

Principle 1	Conduct a hazard analysis.
Principle 2	Determine CCPs (Critical Control Points)
Principle 3	Establish the critical limit(s)
Principle 4	Establish a system to monitor CCP control
Principle 5	Establish corrective action to be taken when monitoring indicates that a particular CCP is not under control
Principle 6	Establish verification procedures to confirm that the HACCP system is working effectively
Principle 7	Establishment of data recording and archiving systems that document the entire HACCP plan

Source: Codex Alimentarius, (2016).

The necessary prerequisites for the implementation of the HACCP system include the adoption of the Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) program in the sectors, in accordance with the General Principles of Food Hygiene, with the relevant Codes of Practice and with appropriate food safety requirements. These programs must be established in a solid way, be fully operational and verified, favoring the efficient application and execution of the system. In addition, commitment and awareness at the management level are essential for the effective implementation of HACCP in companies in the food sector. (Codex Alimentarius, 2016).

HACCP has been used to solve security problems in food supply chains. Caranova (2008) performed the implementation of preventive systems for the safety of the final product, such as HACCP, and found four steps that are considered essential for the control, in order to minimize the danger: reception of fresh meat, storage of meat in refrigeration, mincing of meat and exposure in refrigeration. In all of them, the monitoring procedures are essentially based on a time/temperature control.

The concern with food quality and safety standards is one of the most important requirements for food companies seeking competitiveness in the sector. Markets that have proven food quality and safety will be able to better meet the attributes demanded by consumers and thus reach priority consumer markets in terms of sales volumes and profitability (Canova, 2008). Then, in item 2.3, a discussion is carried out on the methods adopted to assess the sector's competitiveness in international trade.

2.3   COMPETITIVENESS OF BRAZILIAN EXPORTS

Export competitiveness is an important indicator in the analysis of the flow of international trade. There are many methods available for analyzing a country's competitiveness; one of them is the Revealed Comparative Advantage Index (IVCR), which makes it possible to analyze competitiveness based on past information on trade flows (Ramos, 2020).

IVCR considers the assumptions of perfect competition, so it ignores trade barriers, import tariffs, export subsidies. The index identifies the level of exports of a given country and its regions, as well as the comparison between different countries. The formulation of the comparative advantage index is a good tool as it allows the analysis of explanatory factors of trade in each country or region (Tonhá, Cunha & Wander, 2010).

Another method is the Constant Market Share (CMS), which analyzes the factors that contributed to the performance of exports in a market in relation to the others, in a given period. Richardson (1971) defines that the CMS has the purpose of examining the country's export growth, which basically attributes the favorable or unfavorable growth of exports to both the structure of exports and competitiveness. The basic assumption of the model is that the share of participation of a country or region in the world market of a given product does not change; According to Leamer and Stern (1970,) when there is a change in this share, it must be implicit in the model and its performance is attributed to competitiveness, associated with relative prices.

In the CMS model, there are some hypotheses that explain the moment when the participation of a given country in world trade increases, causing its exports to grow above average, when: a) its concentrated on goods whose demand grows faster; b) its destined for markets/countries whose demand grows relatively faster; c) its benefiting from other gains in competitiveness, in addition to those mentioned (Sereia, Nogueira & Câmara, 2002).

According to Ramos (2020), the most used methods to quantify competitiveness in exports of agri-food products are the Revealed Comparative Advantage Index (IVCR), its derivatives (IVCRN and IVCRS) and the Constant Market Share (CMS). Some studies apply more than one method together, as in the case of Vicensotti, Montebello and Marjotta-Mastro (2019), in which a more comprehensive analysis was possible.

The authors verified the competitiveness of Brazilian beef in the international scenario, identifying the factors that affected it in the period between 1994 and 2015. For this, the

competitiveness indicators, Export Coefficient, Market Share and IVCR were calculated. The results show that Brazil has overcome some weaknesses and is in a favorable position in relation to the international meat trade (Vicensotti, Montebello & Marjotta-Maistro, 2019).

The Constant Market Share method has been used to analyze the behavior of exports for both industrial and agricultural products. In Brazil, several studies have been developed to analyze competitiveness in agribusiness, such as the one by Maranhão and Vieira (2016), who analyzed the sources of growth in Brazilian exports of soybeans, corn, sugar, wheat, oranges, cotton, coffee, and meat (beef, pork, and poultry) in the period from 1992 to 2013. The authors showed that the favorable performance of Brazilian agricultural exports, in addition to being related to global growth, was due to the competitive gains associated with technological modernization that promoted the expansion of productivity.

The Normalized Revealed Comparative Advantage Index (NRCA) was also used to measure competitiveness in the meat market. Rodrigues and Marta-Costa (2021) used this index to assess the competitiveness of beef exports in reference to the main exporting countries at a global and regional level. The application of the NRCA presented in a satisfactory wa, the development of the international scenario of competitiveness in this market, revealing the dynamics of increasing Brazil's comparative advantage and the fall of the main exporting countries.

Brazil is a major producer of animal protein and competes directly with other countries in the international market. The country's competitiveness is the result of the great availability of land, cheap labor, large supply of inputs, access to production technologies, among others (Saab, Neves & Claudio, 2009). Another important variable for the sector is sustainability, therefore, in item 2.4, the relevance of indicators for the treatment of this variable is discussed.

2.4   SUSTAINABILITY INDICATORS

The Triple Bottom Line (TBL) concept, developed by John Elkington in 1997, proposes that corporate activity is guided by three dimensions, namely: the economic, social, and environmental dimensions. By managing the three dimensions in a balanced and well-aligned way to evaluate a company there is an improvement in efficiency in the capacity of strategic decisions and in economic development (Elkington, 1997). Therefore, a sustainable company is one that manages to generate revenue for its shareholders, improve the quality of life of the

people around it and also protect the environment; In this way, the interests of the business, society and the environment are reconciled (Lee & Kim, 2009).

> Em 1992 com a Conferência das Nações Unidas sobre Meio Ambiente e Desenvolvimento, Rio-92, foi disseminado o conceito de Desenvolvimento Sustentável, que trazia a necessidade de pensar em novas formas de mensurar o crescimento e de garantir a existência de um processo transparente e participativo para o debate e tomada de decisões em busca do desenvolvimento sustentável. Esse desenvolvimento está condicionado tanto ao comportamento dos seres humanos, e os processos sociais existentes em cada território; quanto ao tempo que os ambientes naturais levam para se recuperar e conservar a integridade dos ciclos vitais (Guimarães & Feichas, 2009).[3]

Sustainability Indicators were created to assist in the assessment of established sustainability goals, providing stakeholders with adequate conditions for monitoring and supporting the decision-making process (Veiga, 2010). According to Guimarães and Feichas (2009), for indicators to be instruments of change towards the concept of sustainable development, they must measure different dimensions in order to apprehend the complexity of social phenomena; they should foster definitions in participatory models; communicate trends supporting the decision-making process and relate variables.

The *Indicadores de Desenvolvimento Sustentável* (IDS), developed by the *Instituto Brasileiro de Geografia e Estatística* (IBGE) in 2002, aim to monitor the sustainability of Brazil's pattern of development based on indicators that address multiple dimensions. The indicators stand out as an organized source of data, in which they can be analyzed and related to each other, being one of the most important sources of systematized information on environmental, social, economic, and institutional aspects (IBGE, 2017).

Another important indicator is the Human Development Index (HDI), as it considers that, in order to measure the development of a population, it is necessary to include cultural, political, and social aspects. For its composition, the GDP per capita, life expectancy and education of the population are considered (Guimarães & Feichas, 2009). The index is calculated annually and, little by little, has become a world reference, as it is based on the logic

---

[3] In 1992, with the United Nations Conference on Environment and Development, Rio-92, the concept of Sustainable Development was disseminated, which brought the need to think about new ways of measuring growth and ensuring the existence of a transparent and participatory process for debate and decision-making in pursuit of sustainable development. This development is conditioned both to the behavior of human beings, and the existing social processes in each territory; regarding the time it takes for natural environments to recover and preserve the integrity of life cycles (Guimarães & Feichas, 2009).[3]

that high human development facilitates sustainable development (Programa das Nações Unidas para o Desenvolvimento [PNUD], n.d.)

For Molina (2019), there are three indicators of sustainable development that are globally significant, namely the HDI, the Genuine Progress Index (GPI) and the Ecological Footprint. These indicators provide fundamental information for decision-making, as they make it possible to compare and measure the current results of society in relation to the objectives provided. With this information, actions are designed to help implement policies that aim to ensure the construction of a socially sustainable society.

Economic growth through sustainable actions is still a challenge, but it can be achieved through the union of citizen practices and government policies (Veiga, 2010). With the use of indicators that assess the social and environmental dimensions, it is possible to obtain a better perception of the country's sustainability, which, in turn, facilitates the comparison with economic development. In item 2.5, publications related to the topics already addressed in this reference are exposed.

2.5   RELATED STUDIES

In this subsection, examples of related studies that were identified through a survey of Brazilian academic production on the Brazilian animal protein market are exposed.

Data collection was carried out from March to July 2021, in the Web Off Science, Scopus, Google Scolar databases and also in the Brazilian Digital Library of Theses and Dissertations. The terms used in the research were: "brazilian meat market"; "competitiveness in meat exports"; "Sustainability in the meat market"; "Tariff and non-tariff barriers in meat exports". With these terms, associations were made between them to refine the research. The period of publications selected for the bibliographic portfolio was from 2005 to 2021, being considered articles published in journals, dissertations, and theses. After reading and analyzing the articles, it was possible to select 46 works for analysis.

For the analysis of the portfolio, the researches were classified according to their central theme, divided into three central themes. The first is competitiveness in the meat market, involving research that addresses the competitive advantages in meat exports from the Brazilian market. The second theme brings publications that deal with sustainability in the meat trade and its influence on exports. Finally, the third research group includes articles related to tariff and non-tariff barriers faced by Brazil in the global animal protein market.

For the first theme, 27 studies were selected, and in most studies, a single product is addressed. Thus, the central theme was divided into four subthemes according to the product studied: beef, pork, chicken, and studies covering the three meats. For this reason, Chart 2 presents the main results of publications on pork.

Chart 2 - Main results of the pork competitiveness theme

Autor (year)	Results
Fialho (2006)	Brazil has been increasing its share of the world pork trade in terms of value and quantity, at a higher rate than its main competitors. In the analyzed period, there was an increase in the competitiveness of pork due to the changes that the sector went through
Gonçalves and Palmeira (2006)	The work shows the competitiveness achieved by Brazil, after improvement in the production chain and the satisfactory internal rates that swine production obtained, reaching a prominent place in the productive matrix of Brazilian agribusiness.
Miele and Waquil (2007)	Brazil presented an exceptional performance in the period between 1995 and 2005, driven mainly by its performance in the external market, in view of the low dynamism of the internal market for this type of meat.
Rubin, Ilha and Machado Lopes (2012)	The European Union (EU) and the Commonwealth of Independent States (CIS) are potential and promising markets for pork. The results of the calculation of comparative advantages revealed that Brazil has increasing competitiveness in the sector studied for the period 1990-2005.
Gastardelo, Melz and Marion (2016)	From 1990 to 2014, the evolution of the competitiveness of pork exports from Brazil and the United States was analyzed through the Constant Market Share (CMS) model. The United States is the most competitive country in the analyzed period, followed by Brazil. Despite the United States being more competitive, Brazil's percentage growth was higher, 4,449.53%, while that of the United States was 2,055.96%. For both countries, more than ninety percent of this growth was due to increased competitiveness.

Source: research data (2021).

In the publication by Gonçalves and Palmeira (2006), the situation in which Brazilian pig farming found itself and its competitiveness was examined. Brazil's competitiveness is due to internal factors, such as the country's large territorial extension, the large supply of raw materials for production, such as inputs for pig feeding, and technological advances in this sector. Its results show that, after improvement in the production chain, swine production gained a prominent place in the agribusiness production matrix, achieving the country's competitiveness in the market.

The most recent study on the competitiveness of the pork market was by Gastardelo, Melz and Marion (2016), which highlighted the fragility of the sector related to animal health and cost of inputs. However, they also identified that Brazilian exports grew at higher rates than world rates. Rubin, Ilha and Machado Lopes (2012) mention that the expansion of pork exports from Brazil is directly linked to impeditive barriers in some regions. Thus, the authors suggest the search for trade agreements that eliminate these barriers, in order to stimulate competitiveness.

Publications on the competitiveness of pork meat point to the opening of trade in 1990 as the fact that contributed to the increase of Brazilian competitiveness in international trade. Production costs are also seen as an advantage for the country, as they have the lowest costs among the main producing and exporting countries. In addition, the performance reflects the incorporation of slaughter and processing technologies, livestock production with advances in genetics, grain availability, nutrition, organization, and coordination of the production chain. The most used methods in research to verify the competitiveness of the sector were the Revealed Comparative Advantage Index (IVCR), Constant Market Share (CMS), Regional Orientation Index (ROI) and Export Effort Index (EEI).

The sub-theme of **beef market** competitiveness in Brazil was the one with the highest number of publications since 2006. For the selection of studies, the degree of relevance of the works (number of citation) and year of publication were considered. This large number of publications is due to the relevance of cattle farming from a social point of view, since it generates numerous jobs, both direct and indirect (Aurélio Neto, 2018). In Chart 3, the main contributions of the selected studies are presented.

Chart 3 - Main results of the beef competitiveness theme

Autors (Year)	Results
Carvalho, Machado, Amin and Santana (2006).	The results show that competitiveness and structural effects boosted Brazilian exports from 1995 to 2003. Increasing Brazil's share in the world market.
Machado, Ilha and Rubin (2007)	Brazil did not lose competitiveness in the period from 1994 to 2002, despite the protectionism of the European Union and NAFTA. The European Union and NAFTA presented a low ICR in relation to the Brazilian ICR, however the index of the two blocks has been growing.
Silva, Marion, and Campos (2008)	The sub-periods (1999-2002 and 2003-2005) showed substantial growth in exports, a fact attributed to the increase in national productivity, to phytosanitary problems in the herds of Brazil's main competitors and continuity of the result of the expressive increase that occurred from 1999.

Continuation of Chart 3

Souza, Camara and Sereia (2011)	The analysis of the results of the CMS model indicates that Brazil and Paraná have high competitiveness in the beef complex.
Dill, Corte, Barcellos, Canozzi and Oliveira (2013)	Brazil obtained competitive advantages in the period from 1991 to 2008, while the USA presented advantages between 1993 and 2003. Trade agreements increased the competitiveness of the countries involved, however there were decreases in the indexes when health problems were identified.
Buhse, Bender, Lopes and Moraes (2014)	In the period from 2005 to 2011, the three countries showed an increase in the share of world exports, however, Brazil's share approached 16% of world exports, while Argentina and Uruguay showed lower growth.
Reis (2015)	The increase in Brazilian beef exports between 1990 and 2002 is due to the increase in competitiveness in the international market. The conclusion is that this gain was caused by the exchange rate devaluation that occurred in the period.
Freitas, Costa, Florindo and Duarte (2014)	In 2006 and 2009, Brazilian exports to almost all countries grew. The growth in market share for other markets, mainly Hong Kong and Venezuela, was due to the competitiveness effect and the increase in imports from these countries.
Florindo *et al*. (2014)	The growth effect of world trade was the biggest contribution to the growth of exports, emphasizing that only India obtained positive results in all effects during the analyzed periods. In the case of Brazil, there was a change in the destination of its exports, from the European Union to Asian and South American countries, which pay a lower price for the product, affecting the performance of Brazilian exports.
Aurélio Neto (2018)	Brazil is competitive in the international trade of beef, and also has the potential to expand its participation in the world market, with the improvement of its logistics and the confrontation of trade barriers.
Stefanutti (2019)	The analyzed variables exert initial positive effects on Brazilian beef exports, but these effects do not last over time.
Rodrigues and Marta-Costa (2021)	Between 1998 and 2017, Brazil's comparative advantage rose significantly, making the country one of the strongest competitors internationally. The application of the NRCA satisfactorily presented the development of the international scenario of competitiveness in this market, revealing the dynamics of rise and fall of the main exporting countries.

Source: research data (2021).

The most cited publication in this selection was that of Carvalho, Machado, Amin, and Santana (2006), who analyzed the performance of Brazilian exports from 1995 to 2003. Based on the application of the Constant-Market-Share model, it was seen that Brazil managed to maintain its competitive position in the international market against its main competitors. Corroborating the authors, Aurélio Neto (2018) analyzed the same sector between 2000 and

2016, in such a way that he identified that the country's competitiveness is due to the ability to offer a quality product, within the animal health standard required by the main international markets, advances in genetics and strategies to promote the Brazilian product in the foreign market.

Bush et. al. (2014) researched the behavior and competitiveness of beef in Mercosur countries, from 1991 to 2011. With the application of the Constant Market Share model, it was found that Argentina, Brazil, and Uruguay showed an increase in the share of world exports. Another positive result in relation to Brazil's competitiveness in the beef market was demonstrated in the study by Machado, Ilha and Rubin (2007), who used the Revealed Competitiveness Index (RCI). The authors emphasize that public policies aimed at agriculture are essential for the country's growth in the international market.

Regarding the method used by the authors, 50% used the Constant Market Share method (CMS); 29% applied the Revealed Competitiveness Index (RCI) and 21% used other methods and indicators. The results indicate that the country has become competitive in the sector; growth took place gradually, following the international market and, little by little, increasing its Market Share.

The publications on the sub-theme of the chicken meat product demonstrate the importance of the country in this market and its consolidation as one of the main suppliers of the product. The great representation of the poultry sector in the Brazilian economy is due to the natural conditions of the Brazilian territory and its competitiveness in two other important products for chicken meat: corn and soy (Bender, Schwertner & Arruda Coronel, 2019). Thus, Chart 4 shows the results of the selected studies.

Chart 4 - Main results of the competitiveness of chicken meat

Autors (Year)	Results
Barcellos (2006)	Brazilian production of chicken meat is highly competitive, second only to the USA. Mercosur can be a very promising destination for Brazilian exports of chicken meat and soybeans, provided that some controversies are resolved, such as the existence of non-tariff barriers imposed by Argentina.
Souza, Camara and Sereia (2011)	The indicators for Brazil and the State of Paraná evolved at high geometric growth rates of chicken meat. Brazil and Paraná have high competitiveness and high market share in the analyzed segment.
Costa, Garcia and Brene (2015)	The chicken industry in the state of Paraná-Brazil occupies a prominent place in the national and international scenario due to its high degree of competitiveness expressed in productivity gains and low costs resulting from the competitive advantages of this industry.

Continuation of Chart 4

Saggin (2017)	The cooperatives from Paraná have IVCR much higher than those of Brazil and the main poultry meat producing countries. The EEI showed that the municipalities in Paraná where the refrigerators of the cooperatives under study are located reveal the dependence of the city's economy on the exports of these companies. The IC and the IF show that the European Union had a high level of protectionism.
Bender, Schwertner and Arruda Coronel (2019)	Chicken meat showed a revealed comparative advantage (IVCRS>0) throughout the analyzed period. Exports are directed to both the Middle East and Asia, but with a slight reduction over time for the Middle East and a more expressive reduction when analyzing Asia.
Souza Ribeiro, Santos, and Silva (2021)	There was a decrease in the performance of the South region in the sum of the country's chicken meat exports over the years. However, the region presents a Revealed Comparative Advantage and Relative Advantages in the external scenario throughout the analyzed period.

Source: research data (2021)

Barcellos (2006) and Costa, Garcia and Brene (2015) state that, due to the high production of soybeans and derivatives, mainly bran, the country is able to further increase its exports of chicken meat and conquer new markets through quality and product differentiation. The state of Paraná is indicated by Souza, Camara and Sereia (2011) and Costa, Garcia and Brene (2015) as the state that has evolved the most, presenting exceptional performance in both production and export of broiler chicken.

Publications on the competitiveness of chicken meat, for the most part, used a methodology that involved more than one method for analyzing competitiveness. As with pork, the most used were the Revealed Comparative Advantage Index (IVCR), Constant Market Share (CMS), Regional Orientation Index (ROI) and Export Effort Index (EEI), which are associated with each other and even to other indicators. In general, it can be said that the most used method to analyze Brazil's competitiveness in the meat market is the Constant Market Share (CMS) model, followed by the Revealed Comparative Advantage Index (IVCR).

Animal protein is a good source of energy as it has essential nutrients such as iron, zinc, and vitamin B12. Beef, pork, and chicken are the three most consumed sources of animal protein. Therefore, some researchers verified the country's competitiveness in the market, relating these three products, and the results are shown in Chart 5.

Chart 5 - Main results of the competitiveness theme of the meat complex

Autors (Year)	Results
Sereia, Oliveira Toneto and Camara (2005)	The trend of growth rates of beef exports in Paraná is similar to the cyclical behavior of exports of the meat complex in the 1990s (partly explained by the behavior of the world economy and partly by institutional changes and barriers related to food trade), while chicken and pork meat show increasing export growth rates throughout the analyzed period.
Souza, Sereia, Camara and Pizaia (2008)	Brazilian exports of the beef complex grew at rates higher than the growth of world exports throughout the analyzed period. Chicken and pork also showed accelerated growth. However, there is a need to expand the diversification of the agenda, in addition to the destination, factors that, together, can reduce the dependence of exports on few customers
Lima (2012)	In the analyzed period, Brazil had efficient production and greater commercialization than those of other countries operating in the international market. The study demonstrated the importance of diversifying trading partners and defined opportunities and future strategies to foster Brazil's competitiveness in global trade.
Maranhão and Vieira (2016)	When comparing the 1990s with the 2000s, there was a reduction in the competitiveness factor, which points to the need to stimulate productive investments.

Source: research data (2021).

With the analysis of the meat complex of Paraná, Sereia, Oliveira Toneto and Camara (2005) show that the growth rate of exports of **beef, pork, and chicken**, according to market share, was always positive during the 90's. As of the year 2000, exports were affected by the imposition of barriers, mainly beef, due to mad cow disease and foot-and-mouth disease. On the other hand, pork and especially chicken are gaining market share and becoming increasingly competitive.

For the second theme, 7 publications were selected that deal with sustainability in the meat trade, in particular, aspects related to meat exports, as shown in the Chart 6.

Chart 6 - Main results of the sustainability theme in the meat trade

Autors (Year)	Results
Araújo and Mendonça (2009)	The slaughterhouse certified with internationally recognized standards and structured GIS proves to be a company that offers quality products and that is concerned with the environment, health, and safety of its employees.
Santos, Mendonça and Mariani (2010)	The sector's environmental legislation is strict and is complied with by the surveyed industries, regardless of their economic or social situation. It was verified the lack of environment and strategies for the rationalization of water and energy.
Oliveira, Näss, Mollo, Canuto, Walker and Vendrametto (2012)	Brazilian chicken production is a large industry and has generated economic growth in the last five years. However, the production of this industry concentrates large emission of ammonia, which is related to climate change.
Stehfest, Van den Berg, Woltjer, Msangi and Westhoek (2013)	The model results show that, for most options, lower environmental gains than theoretical ones would actually be achieved, due to price feedbacks that lead to increased consumption and less intensive production. On the other hand, larger-than-expected effects may occur as a result of reduced European consumption.
Flores and Gavronski (2016)	The social dimension of sustainability exerts a positive influence on the export performance of beef exporting slaughterhouses. The environmental dimension of sustainability is associated with the ability of these companies to enter and maintain the international beef market.
Portocarrero and Araújo (2018)	The terms "public morals", "human life and health" or "peace and international security" according to measures linked to the social aspect of sustainability, there are divergences as to the scope of WTO decisions to protect these rights.
Feitosa (2019)	Modern grain agriculture and beef cattle for export are of significant importance to the economy of Tocantins, but they also contribute to aggravating some economic and social problems, such as land concentration, environmental degradation and the expulsion of small producers and farmers from rural areas.

Source: research data (2021).

On this subject, most publications are about beef; This result can be explained by the fact that cattle ranching has a great impact on the imbalances caused by productive activities to the environment and society. According to Stehfest et al. (2013), global animal production is responsible for about 18% of greenhouse gas emissions and occupies 80% of the global agricultural area, being one of the main responsible for the loss of biodiversity. But, due to this negative impact generated by the sector on the environment, companies in the sector have become susceptible to regulatory control by governments and international organizations through fines and cancellation of supply contracts (Flores & Gavronski, 2016).

The social pressures and restrictions imposed on product exports mean that companies are forced to look for ways to reduce their environmental impact and improve their image in the face of their social responsibility. Adaptation to more sustainable processes facilitates exporters' access to markets with stricter environmental standards, enabling an increase in sales revenues. In this way, the search for compliance with internationally recognized standards is seen as a competitive advantage in the market (Araújo & Mendonça, 2009 e Flores & Gavronski, 201).

The methodologies used in these studies were quite varied; from bibliographic research, multiple case studies, econometric models to the evaluation of IBGE, HDI and ANS indicators. Studies have shown that the animal protein sector generates many negative impacts on the environment, but that, with the control and regulation of the WTO in the international market, the search for the sector's sustainability is constant.

In the last theme, which includes publications, which address tariff and non-tariff barriers in the meat market, 7 articles were selected developed between the years 2011 to 2020, whose main results are shown in Chart 7.

The research with the highest number of citations is by Silva, Triches and Malafaia (2011), who identified that Brazil does not have a reliable traceability and certification system, which makes the battle to open or expand markets more difficult. Furthermore, with investments in Quality Assurance Schemes, the country will be able to face the non-tariff barriers imposed on the export of **beef.**

Chart 7 - Main results of the tariff and non-tariff barriers theme

Autors (Year)	Results
Silva, Triches and Malafaia (2011)	Brazil does not have a reliable traceability and certification system, making it difficult to fight for the opening and/or expansion of the coveted markets. Investments in Assured Quality Schemes that allow you to sell confidence to your customers should be a priority topic in the discussion agendas of the Brazilian beef chain. Only in this way will the country be able to face the non-tariff barriers imposed on the export of this product.
Aparecida Silva, Silva Lírio, Coronel and Gomes (2011)	Through the Coverage Index, we found that pork exports were affected by technical, sanitary, or phytosanitary restrictions, as the values were greater than zero for all countries. Regarding the Frequency Index, 100% of pork imports by the European Union, United States of America, Canada, and Brazil had some SPS or TBT notification.

Continuation of Chart 7

Rubin, Ilha and Machado Lopes (2012)	The barriers imposed turned out to be very high. There is a high degree of acceptance of Brazilian pork exports in those blocks that do not have impeding sanitary barriers.
Florindo, Medeiros and Mauad (2015)	Non-tariff barriers are an opportunity to increase the quality of Brazilian beef, based on strict management of production processes, while inertia in the face of explained deficiencies becomes a threat in an increasingly demanding market.
Mendonça, Carvalho and Reis (2017)	The results show an increase in the number of notifications, both for sanitary and phytosanitary measures (SPS) and for techniques (TBT). It was found that the peak of these measures occurred from 2009 to 2011. By estimating gravitational models, it was possible to verify the aggregate effect of the variables studied on the Brazilian pork trade flow.
Cruz, 2019	It was found that chicken meat faces food security issues, so the state needs to intervene and negotiate with other governments so that the competitive advantages acquired intra-firm are maintained and not erased by trade barriers.
Medeiros and Bender (2019)	The results indicate that, in general, with the implementation of both agreements, the Brazilian chicken meat sector can invariably suffer losses, especially with regard to production and, consequently, affect prices and producer surpluses.

Source: research data (2021).

Aparecida Silva et. al. (2011) showed that large **pork** import markets adopt strict sanitary policies, which go beyond the objective of protecting human and animal health, which ends up contributing to a greater share of exports of the product suffering some type of technical or sanitary restriction. Therefore, implementation of measures aimed at valuing the product, encouraging production and research are important to meet the new requirements required by the market, in order to increase the competitiveness of pork.

The export of **chicken meat** is influenced by non-tariff barriers imposed by its main importers; the most common are quotas, prior import licenses, anti-dumping measures and sanitary barriers. The main consequences caused by the barriers involve the generation of higher costs, longer transport time between shipment and the arrival of the product to the final customer, reduction in volume and prices and the stagnation in the growth of exports. In this way, it is necessary for the State to intervene in negotiations with other governments so that the competitive advantages acquired are not erased by trade barriers (Cruz, 2019).

Finally, research on the last theme used indicators, such as the Coverage Index, Frequency Index, Import Potential Index, and the Gravitational Model, as an analysis method. Trade barriers imposed by importing countries, namely tariff and non-tariff barriers, significantly impact Brazilian beef exports. As well as studies on competitiveness, research on

this central theme, for the most part, are centered on the analysis of a single type of meat, with publications covering the three most consumed proteins in the world being rare. From this, it becomes necessary to understand the representativeness of the animal protein sector, verifying the main variables that affect the Brazilian market.

3   TECHNICAL PRODUCTION RESEARCH METHOD AND TECHNIQUES

Considering that the objective of this dissertation is to analyze the relationship between sustainability and competitiveness of exports from the Brazilian market of animal protein (chicken, beef, and pork) in the period from 2000 to 2021, the methodological procedures are presented in this chapter, such as the research design, the research universe, data collection procedures and data analysis. In this way, the steps taken to achieve the proposed objectives are described.

3.1   RESEARCH DESIGN

The research, which originated this work, has a quantitative nature with a fundamental purpose, as it translates, in numbers, opinions and information to classify and analyze them, seeking the meaning based on the perception of the phenomenon that has within its context. In addition, it aims to generate new knowledge that contributes to scientific advancement (Kauark, Manhães & Medeiros, 2010).

When analyzing the meat export variable in association with sustainability indicators, quantitative research favors the interrelation of these data, which may reveal differences or similarities in their variations. Therefore, the descriptive approach was used to present and correlate the variables without manipulating them (Kauark, Manhães & Medeiros, 2010). In this case, the way in which the variables are related in view of the country's sustainability and competitiveness over the years contributes to the use of this level of research.

In accordance with its objectives, this study is also exploratory, which seeks to explore a problem in order to obtain its understanding. For Munaretto, Corrêa & Cunha (2013), exploratory research has as its main objective the improvement of ideas or the confirmation of intuitions, therefore, it seeks to understand the reasons, in addition to the motivations for certain attitudes and behaviors of people. The variables analyzed in the research were the HDI, ANS and the Market Share of exports, making it possible to understand the domestic and foreign market for animal protein and its relationship with sustainability.

As for the procedures, the research is characterized as bibliographical and documentary. Bibliographic, as it is based on the survey and analysis of various bibliographic materials, such as articles, dissertations, theses, and books, to support the research topic. Documentary, as reports and data from supporting agencies and entities are used. For Fontelles, Simões & Farias

et al. (2009), bibliographic research provides support for all phases of a research protocol and documentary research comprises the primary and secondary research data, which have not yet received any type of critical analysis.

In summary, the methodology used sought to respond to the objectives proposed by the study, aiming to cover the research universe.

3.2   UNIVERSE

Tariff and non-tariff barriers, imposed by the destinations of Brazilian meat, change according to time and country and, therefore, non-probabilistic accessibility sampling was used, since, according to Vergara (2006), in this search strategy, elements are selected for the ease access to them.

The countries that presented the highest arithmetic mean in imported value of each protein (beef, pork, and chicken) were used to search for tariff barriers and the main non-tariff barriers.

In order to analyze the competitiveness of Brazilian exports, it was necessary to divide the period studied into sub-periods, which will be carried out according to the events that generated the most impact on the export sector:

a) **First period: 2000 to 2004**. With its accession to the World Trade Organization (WTO), China has consolidated itself as an important provider of general manufactured goods on a global scale, being an economic power.

b) **Second period: 2005 to 2009**. Marked by the 2008 world crisis, which affected large economies, such as the United States and European Union countries. In this period, less developed countries, such as Brazil, did not feel the impacts of the crisis so much.

c) **Third period: 2010 to 2016**. In 2010, the process of global economic recovery began, and the Brazilian economy began to decline. Brazil went through a deep recession between 2014 and 2016, in which there was a worsening of the economic crisis, political crisis with the *impeachment* process of former president Dilma Rousseff.

d) **Fourth period: 2017 to 2021**. In 2017, the economy began to recover slowly and gradually. There were some negative shocks in these years, such as the truck drivers' strike in 2018; Argentina crisis; international uncertainty with the US-China trade war in 2019; and the health crisis with the arrival of the Coronavirus.

3.3   DATA GATHERING

The data to achieve objective A were obtained through documents available in public institutions, such as the *Ministério do Desenvolvimento, Indústria e Comércio Exterior* (MDIC) and the *Secretaria de Comércio Exterior* (SECEX), based on the Foreign Trade Information Analysis System (AliceWeb), which has data on Brazilian exports by country of destination and the United Nations Commodity Trade Statistics Data base [UnComtrade]. Searches were performed based on the codes of the Southern Common Nomenclature [NCM] and Harmonized System with 06 digits [SH06], for each of the analyzed proteins, listed in Chart 8. The results of this data collection were organized according to the four sub-periods and arranged in Appendix A of this research.

Chart 8 - Classification of meats by NCM code

NCM SH06	Description
Beef	
020110	Bovine carcasses and half carcasses, fresh or chilled
020120	Other cuts of beef, boneless, fresh or chilled
020130	Beef, boneless, fresh, or chilled
020210	Bovine carcasses and half carcasses, frozen
020220	Other cuts of beef, bone-in, frozen
020230	Beef, boneless, frozen
Pork	
020311	Carcasses and half carcasses of swine, fresh or chilled
020312	Legs, shoulders, and cuts of pork, boneless, fresh, or chilled
020319	Other pork meat, fresh or chilled
020321	Carcasses and half-carcasses of swine, frozen
020322	Pork legs, shoulders, and pieces, boneless, frozen
020329	Other pork meat, frozen
Chicken	
020711	Meat of domestic cocks and hens, not cut into pieces, fresh or chilled
020712	Meat of roosters and chickens of the domestic species, not cut into pieces, frozen
020713	Edible pieces and offal of domestic roosters and hens, fresh or chilled
020714	Edible pieces and offal of domestic cocks and hens, frozen

Source: research data (2022).

To select the main destinations for Brazilian protein (specific objective B), the data obtained in the collection of data for objective A were used, identified by the highest average value exported in the four periods analyzed in the study. Furthermore, in order to identify the main tariff and non-tariff barriers in these destinations, the base search of the International

Trade Center (ITC) was carried out, which is the joint agency of the WTO and the UN, which aims to connect companies to global markets.

To verify sustainable performance (specific objective C), the HDI was used, corresponding to the social performance indicator and the Genuine Net Savings (ANS), equivalent to the environmental performance. The country's HDI, from the years 2000 to 2019, was obtained through the UNDP database; the index is measured by a scale that goes from zero to 1.0, and the closer to 1.0, the higher the human development of the country. For environmental performance, the country's Genuine Net Savings (ANS) was used, which seeks to measure the growth rate of an economy calculated by gross national savings minus the depreciation of the capital produced, the depletion of subsoil assets and timber resources, the cost of pollution damage, plus a credit for education expenses (Banco Mundial, 2021). The ANS is calculated by the World Bank and is available in its database, World dataBank.

The HDI and the ANS were used in the study by Flores and Gavronski (2016) to verify the relationship of the sustainable performance of the main beef exporting slaughterhouses, so this data was chosen to achieve objective B. The last publication of the HDI and ANS was in 2020, disclosing the result for 2019; thus, for this research, an estimate was used for the years 2020 and 2021, through the average of the indicators between the years 2000 and 2019.

Finally, in order to achieve the specific objective C, an analysis was carried out about the performance of exports in the period of the Covid-19 pandemic, comparing with the year before its arrival. The results obtained in objective A for 2019, 2020 and 2021 were used, as well as annual reports regarding the animal protein market and the impact of the Pandemic on the world market.

3.4   DATA ANALYSIS PROCEDURES

After data collection, the next step is analysis and interpretation. For a better understanding of the data analysis procedure, Chart 9 was prepared in order to meet the specific objectives.

Chart 9 - Data analysis procedure according to the objectives

Objectives	Procedures
a) Analyze the competitiveness of Brazilian exports of animal protein (chicken, beef, and pork)	Use of the Constant Market Share (CMS) method with the division of the study period into four sub-periods.
b) identify the main destinations of Brazilian animal protein and their trade barriers.	Survey of the countries that most import proteins from Brazil and their main barriers.
c) Verify the relationship between Brazil's sustainable performance and export performance and its competitiveness in the face of the pandemic scenario.	Correlation between the Human Development Index, the Genuine Net Savings and the CMS. The results of the years 2019, 2020 and 2021 will be considered for this analysis, associating with the literature

Source: made by the author (2021).

To fulfill the first proposed objective, the analysis of the competitiveness of Brazilian meat exports, the Constant Market Share (CMS) model was used, as shown in item 2.6, since it was one of the most used models in the related publications of this research. This methodology was popularized by Leamer and Stern (1970), with further development by Richardson (1971) and Fagerberg and Sollie (1987). In this study, the approach proposed by Leamer and Stern (1970) was used, which is defined as follows:

Equation 1 - CMS

$$\sum_{j}^{n} = 1\left(E'_{J} - E_{J}\right) = \sum_{i}^{n} = 1\left(rE_{j}\right) + \sum_{i}^{n} = 1\left(r_{j} - r\right)E_{j} + \sum_{i}^{n} = 1\left(E'_{j} - E_{j} - r_{j}E_{j}\right)$$

Wherein:

E_J = value of exports of the analyzed product for market j, in period 1.

E'_J = value of exports of the product developed for market j, in period 2.

$E'_J - E_J$ = effective growth in the value of exports of the analyzed product for market j.

r = percentage of growth in the values of world exports of the product analyzed from period 1 to period 2.

r_j = growth percentage in the values of world exports for market j from period 1 to period 2.

n = number of markets.

For the development of the calculus, the General Algebraic Modeling System (GAMS) software was used, which creates a high-level programming language designed to build and

solve mathematical models numerically (Gilbert, 2017). With the tool, it was possible to decompose the export growth rate into four effects, as shown in Chart 10.

Chart 10 - CMS template effects

Effect of World Growth	Indicates whether the analyzed country's exports grew at the same rate as world trade.
Commodity Effect	It presents changes in the structure of the agenda, focusing on products with more or less accelerated demand growth.
Regional Market Effect	It presents changes resulting from the concentration of exports to more or less dynamic markets.
Competitiveness Effect	Determined by the residual effect resulting from the difference between world proportional growth and the effective growth of a country's exports.

Source: adapted from Gilbert (2017).

With this, the behavior of exports of beef, pork and chicken was analyzed, and the determining factors of their growth were identified, through the application of the Constant Market Share model. Data from objective A were also used to achieve part of the second specific objective, which was to identify the countries that most imported Brazilian meat. In objective B, a brief descriptive analysis was carried out, in which the first step was to identify the tariff and non-tariff barriers imposed by the main destinations; then, a compilation of non-tariff barriers was made, with the most recurrent ones being presented in the destinations studied. Tariff barriers, which refer to customs tariffs, were presented separately, according to destination and product; the non-tariff barriers, described in item 4.2.3, are imposed by all countries that import the most animal protein from Brazil, regardless of the type of meat.

To identify the relationships between the variables of objective C, statistical analysis of the data obtained in the study was performed, with a confidence level of 95%. The SPSS software was used to apply the Spearman correlation, in order to verify the intensity of HDI and ANS (sustainable performance) in relation to the Market Share (export performance) of each protein. According to Cohen (1992), results greater than 0.20 are considered a low correlation; there is median intensity above 0.50, and 0.80 or more is a strong correlation. Spearman's correlation was chosen, as the analyzed variables did not have a linear relationship.

Finally, special attention was given to the results obtained for the years 2020 and 2021, as it is an atypical year, due to the Covid-19 pandemic. The perspective of this analysis is to verify whether or not the competitiveness of exports was affected by the pandemic, as well as whether concerns about sustainability had any impact, since the country's focus was on meeting public health needs.

After presenting the methodological procedures, the next chapter presents the results and discussions that comprise this dissertation.

4   ANALYSIS AND DISCUSSION OF RESULTS

This chapter analyzes the exports of the Brazilian animal protein market using the Constant Market Share Method, relating these results to the indicators of genuine net savings. In addition, the main tariff and non-tariff barriers of its largest importers are presented.

4.1   CHARACTERIZATION OF EXPORTS FROM THE BRAZILIAN MARKET

The universe of this study is Brazil, located in South America; comprises a territory of 8.5 million km2, being the fifth largest country in territorial extension. The country is in development and stands out for the concentration of agricultural production and exports. As shown in Figure 2, Brazil is the world's largest producer of soy, coffee, orange juice and sugar; second largest producer of chicken meat and third of beef. In terms of exports, it leads all the products mentioned.

Figure 2. Brazilian Production and Exports in the World Ranking

Source: CNA (2022).

According to the *Confederação da Agricultura e Pecuária do Brasil* (CNA), the country is the fourth largest exporter of agricultural products in the world, behind only the European Union, USA, and China. This performance of Brazil has contributed in a decisive way to the macroeconomic stability. In addition, the agricultural sector has helped to face the economic effects of the pandemic and, in addition to guaranteeing domestic supply, the sector has shown growth in the volume of exports (CNA, 2021).

According to the General Indicators of Agrosite, in 2021, Brazilian exports totaled US$ 120,521,447,545 (MAPA, 2022). In Figure 3, the percentage of participation that each sector has in this amount is indicated. The soy complex represents the largest share of this amount, accounting for 40% of revenue, followed by meat, which represents 16%.

Figure 3. Agribusiness exports by sector.
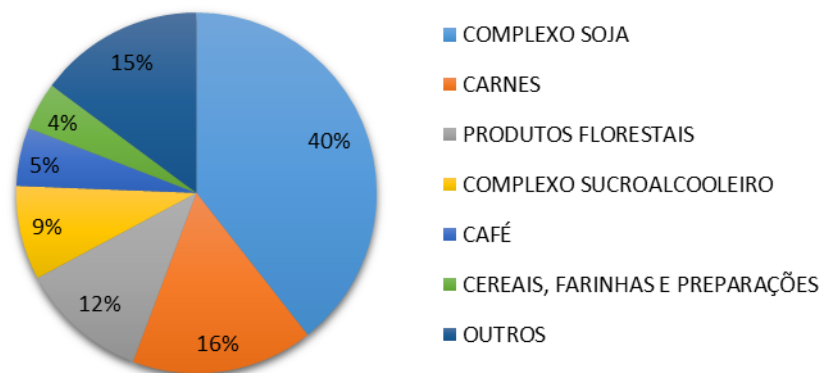
Source: MAPA (2022)

In the last 40 years, Brazilian agricultural production has developed in such a way that Brazil will be the great food supplier of the future (CNA, 2022). According to the WTO, between 1995 and 2021, global exports of agricultural products more than tripled, with the main Brazilian competitors losing market shares while the country's share increased.

The main regions of Brazil, which stand out in exports, are Mato Grosso, representing 19.89% of exports, followed by São Paulo, with 14.82%, and Paraná, with 12.22% of exports. In Figure 4 and Chart 11, the share of each region in exports is represented; then there are the products that make up this percentage exported.

Figure 4. Agribusiness exports by sector.

Legend:
- MATO GROSSO
- SAO PAULO
- RIO GRANDE DO SUL
- PARANA
- MINAS GERAIS
- GOIAS
- SANTA CATARINA
- MATO GROSSO DO SUL
- BAHIA
- OUTRAS
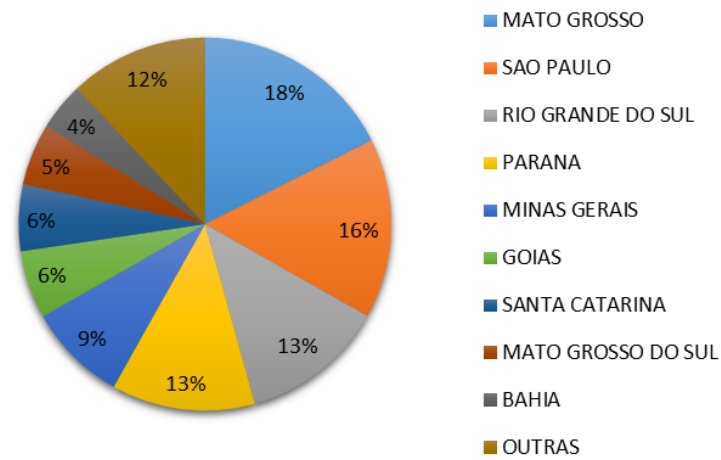
Source: MAPA (2022).

Chart 11 - Exports by product and region

Region	Sectors	Value (US$)	Weight(t)
BAHIA	Coffee	156.110.887	67.704.346
	Meats	42.574.301	13.527.848
	Soy complex	2.434.049.777	5.222.230.267
	Sugar and alcohol complex	5.640	5,313
	Forest products	1.028.648.215	2.943.456.318
GOIAS	Coffee	24.824.380	8.501.062
	Meats	1.804.363.789	501.898.779
	Cereals, flours, and preparations	237.808.171	1.099.916.572
	Soy	4.291.455.613	9.590.421.354
	Sugar and alcohol complex	382.365.270	1.086.402.975
MATO GROSSO	Meats	2.038.049.240	500.965.273
	Soy Complex	**13.286.932.911**	**29.671.777.924**
	Forest products	152.017.164	196.261.252
	Sugar and alcohol complex	63.703.827	114.433.299
	Cereals, flours, and preparations	**3.110.799.865**	**15.328.551.149**
MATO GROSSO DO SUL	Coffee	101	25
	Meats	130.487.9816	413.041.754
	Cereals, flours, and preparations	121.658.271	654.130.154
	Soy	3.006.948.351	6.654.278.957
	Sugar and alcohol complex	406.224.790	1.162.654.835
	Forest products	1.508.238.796	4.148.674.153
MINAS GERAIS	**Coffee**	**4.441.420.850**	**1.653.105.206**
	Meats	1.174.407.451	351.387.005
	Soy complex	2.394.140.563	5.118.974.781
	Sugar and alcohol complex	1.161.574.307	3.639.354.808
	Forest products	734.660.371	1.347.435.017
	Cereals, flours, and preparations	44.039.671	84.821.119

Continuation Chart 11

PARANA	Cereals, flours, and preparations	188.575.110	658.677.444
	Coffee	314.007.188	64.358.162
	Meats	333.5701.922	2.003.761.838
	Soy complex	6.361.579.086	14.192.807.037
	Sugar and alcohol complex	924.067.379	2.958.049.654
	Forest Products	**3.170.518.083**	**4.278.186.094**
RIO GRANDE DO SUL	Cereals, flours, and preparations	704.969.633	2.151.386.283
	Coffee	11.531.260	1.296.790
	Meats	2.330.236.169	1.172.281.215
	Soy complex	7.809.040.458	15.659.469.612
	Sugar and alcohol complex	360.430	490.617
	Forest products	1.751.508.838	5.386.710.896
SANTA CATARINA	Coffee	6.213.309	520.603
	Meats	**3.369.389.263**	**1.681.003.138**
	Cereals, flours, and preparations	27.595.087	31.895.863
	Soy	754.868.093	1.529.290.184
	Sugar and alcohol complex	37.499	43.162
	Forest products	2.110.813.131	2.776.252.531
SAO PAULO	Forest products	1.683.853.301	309.523.4137
	Coffee	708.742.791	230.974.120
	Meats	2.527.425.459	628.775.108
	Soy complex	2.573.172.337	5.701.067.654
	Sugar and alcohol complex	**6.555.165.835**	**18.020.808.455**

Source: MAPA (2022).

Mato Grosso leads exports of soybeans, with 29,671,777,924 tons exported, and of cereals, flours, and preparations, with 1,532,8551,149 tons. In the meat market, Santa Catarina stands out, with 1,681,003,138 tons exported, followed by Paraná and São Paulo. The state of Minas Gerais, on the other hand, is the one that exports the most coffee, with 1,653,105,206 tons. São Paulo appears in the lead, in the exportation of the sugar and alcohol complex, with 10,341,981,004 tons, and that of Juices, with 1,289,013,454 tons. And Paraná is the largest exporter of forest products, with 4278186094 tons of product exported in 2021.

These data reinforce the power of Brazil in the export market (Fernandes et al., 2019; Ferreira & Vieira, 2019), therefore, there is a need to understand the competitiveness that the country has in the world market of animal protein.

4.2 CONSTANT MARKET SHARE (CMS) ANALYSIS

In this section, the main results regarding the analysis of the Constant Market Share are presented, which shows the participation of Brazil in the flow of world trade in beef, pork, and

chicken, evidencing the sources of growth according to the effects that gave rise to them in an isolated way.

4.2.1 Market Share of Brazilian Animal Protein Exports

The Constant Market Share method evaluates the competitiveness of exports of a country or region, using the growth of world exports as a reference. That is, if the analyzed country's share of world exports does not change within a specific period the country is neither losing nor gaining competitiveness. In Chart 12, an evaluation of the effect of competitiveness was made, considering the growth of each period studied and the Market Share of Brazil in the period, measured in millions of dollars for each protein.

Chart 12 - Growth (in million US$) of animal protein exports and participation (%) of Brazil in world exports

BEEF	PI 2000 a 2004	PII 2005 a 2009	PIII 2010 a 2016	PIV 2017 a 2021
Growth of world exports	4.782.722,93	7.579.678,16	8.800.746,90	4.751.645,48
Growth of Brazilian Exports	1.450.890,44	605.807,27	493.558,95	2.897.512,93
% World growth	34,55%	35,71%	29,10%	10,59%
% Of growth Brazil	288,62%	25,12%	12,82%	57,15%
Market Share **Brazil**	**7,06%**	**10,92%**	**11,93%**	**13,68%**
PORK	**PI 2000 a 2004**	**PII 2005 a 2009**	**PIII 2010 a 2016**	**PIV 2017 a 2021**
Growth of world exports	6.249.093,59	5.345.778,4	-2.319.202,16	8.698.391,87
Growth of Brazilian Exports	580.479,40	-11.750,41	124.459,85	1.009.500,22
% World growth	65,59%	29,57%	-8,54%	29,01%
% Growth Brazil	357,23%	-1,05%	10,16%	68,91%
Market Share Brazil	**3,21%**	**5,47%**	**4,97%**	**5,64%**
CHICKEN	**PI 2000 a 2004**	**PII 2005 a 2009**	**PIII 2010 a 2016**	**PIV 2017 a 2021**
Growth of world exports	2.544.584,61	5.148.185,64	1.998.968,27	1.760.166,23
Growth of Brazilian Exports	1.685.926,63	1.490.333,44	162.137,08	421.740,52
% World growth	44,08%	51,17%	11,51%	8,06%
% Growth Brazil	209,35%	44,93%	2,80%	7,56%
Market Share Brazil	**21,95%**	**32,28%**	**32,01%**	**29,24%**

Source: made by the author with data from UnComtrade (2022).

Brazilian exports of beef, pork, and chicken, in the years 2000 to 2021, had significant differences between the analyzed periods, with the last period being the one with the highest growth in value of exports. Of the three proteins, beef was the one that presented assiduity in the growth of the Market Share and pork was the one that had the greatest uniformity in the percentage of the Market Share, in the four periods.

In the period from 2000 to 2004, Brazilian exports increased in value and had a growth rate even higher than the world average. Beef presented a Market Share of 7.06% and a growth of 288.62% in the period; this increase was possible due to the productivity gains of the Brazilian herd (Silva, Marion & Campos, 2008; Machado, Ilha & Rubin, 2007). Pork increased its exports by 357.23%, while world exports increased by 65.59%, with a Market Share of 3.21%; this growth was also pointed out in research by Fialho (2006) and Rubin, Ilha and Machado Lopes (2012).

Chicken meat also had great evolution in the first period, with a market share of 21.95%. Barcellos (2006) pointed out the high competitiveness of the Brazilian product in the international market and Souza, Camara and Sereia (2011) and Costa, Garcia and Brene (2015) highlighted that the productivity of the state of Paraná contributed to this result for the country. Another highlight was the growth of world trade which provided the growth of animal protein exports (Miele & Waquil, 2007; Souza *et. al.,* 2008; Saggin, 2017) that were still booming at the time driven by the growing demand from China, making the period favorable for the Brazilian economy, which largely depended on export.

The world crisis, faced between 2005 and 2009, did not generate impacts for Brazilian exports, as beef grew by 25.12%, an increase that is in line with the results of Freitas et al. al., (2014); Rodrigues and Marta-Costa (2021). The good performance of chicken meat, with an increase of 44.93% in the exported value, was also reinforced by Saggin (2017), Bender, Schwertner and Arruda Coronel (2019) and Souza Ribeiro, Santos & Silva (2021). Pork, on the other hand, did not show growth, but managed to increase its market share by 5.47%.

However, period III had lower growth in exports; beef exports increased by 12.82%; pork, at 10.16%; and chicken, at 2.80%. Even though growth in the period did not reach high levels, as in previous years, the country's market share was not significantly affected; beef, for example, increased its percentage to 11.93%; chicken meat remained at 32%; and pork reduced to 4.97%. This low growth in exports was due to the Brazilian economic crisis of 2014, which ended the cycle of high commodity prices in the foreign market, affecting exports and reducing the inflow of foreign capital into the country (Paula & Pires, 2017).

Continuing the 2015/2016 recession, at the beginning of 2017, unemployment reached its peak with a rate of 13.7% of unemployed Brazilians (IBGE, 2021), but, throughout the year, new jobs were generated, and the rate had a small drop associated with the increase in GDP, which started the slow and gradual process of economic recovery (*Ministério da Economia*, 2018). However, with the arrival of the Covid-19 Pandemic in 2020, the economic recovery reform agenda had to be postponed (Silva & Silva, 2020).

In Period IV, a drop in Brazilian participation in chicken meat exports is seen. On the world stage, protein exports fell by 2.91% compared to the previous period; Brazil, on the other hand, had a growth of 4.76% in the export of chicken meat. Also, beef and pork had a significant growth in the period, being 57.15% and 68.91% respectively, surpassing the growth in value of Period I and increasing its Market Share. The increase in pork exports is explained by the effects of African Swine Fever, which, according to the OECD (2021), not only affected China but the entire Asian continent, increasing the demand for the Brazilian product.

The good performance of Brazil, in the export of animal protein, is seen based on the increase of the country's participation in the world market, demonstrating the productive potential and living up to the natural and acquired competitive advantages, which are highlighted in the studies by Silva, Marion and Campos (2008); Machado, Ilha and Rubin (2007); Stal, Sereia and Silva (2010); Souza, Camara and Sereia (2011); Costa, Garcia and Brene (2015); Bender, Schwertner and Arruda Coronel (2019); Ferreira and Vieira (2019); Medeiros and Bender, (2019); Malafaia, Biscola, and Dias, (2020); Souza Ribeiro, Santos e Silva (2021).

Over the four periods analyzed, beef showed growth and greater participation in the export market, indicating that the country maintained investments and improvements in the sector. Rodrigues and Marta-Costa (2021) and Stefanutti (2019) had already pointed out that with continuous investments and adaptation of the sector to sanitary barriers, Brazil would become the main international supplier of the protein. Therefore, the Market Share of 13.68% was obtained, being the highest of all analyzed periods.

4.2.2   Growth decomposition of Brazilian exports from 2000 to 2021

The results obtained, with the application of the Constant Market Share model, made it possible to verify the sources responsible for the variation of the values of each analyzed period.

In Chart 13, the country's performance in relation to world performance is seen according to the effect of world growth, commodity, regional market, and competitiveness.

Chart 13 - Decomposition of the change in the value of Brazil's animal protein exports

BEEF	Period I	Period II	Period III	Period IV
World Growth Effect	173.667,87	861.077,85	1.026.046,38	538.232,44
Commodity Effect	38.239,16	- 58.426,12	395.754,78	369.554,38
Regional market effect	131.709,96	636.911,04	-1.796.480,00	- 461.354,37
Competitiveness effect	1.107.273,40	- 833.755,47	868.237,61	1.007.854,40
Total Change	1.450.890,41	605.807,30	493.558,95	2.376.995,61
PORK	Period I	Period II	Period III	Period IV
World Growth Effect	106.586,82	331.708,49	114.372,12	354.710,25
Commodity Effect	8.345,41	- 177.073,20	98.402,21	419.654,56
Regional market effect	- 48.994,96	298.956,41	- 666.066,40	- 107.880,80
Competitiveness effect	514.542,12	- 465.342,12	577.751,93	959.150,09
Total Change	580.479,40	- 11.750,41	124.459,85	655.432,68
CHICKEN	Period I	Period II	Period III	Period IV
World Growth Effect	354.945,49	1.697.050,40	665.833,58	- 55.300,58
Commodity Effect	20.162,09	72.151,78	- 597.835,55	- 257.207,07
Regional market effect	- 93.503,37	- 138.834,48	126.936,77	920.193,56
Competitiveness effect	1.404.322,43	- 140.034,19	- 32.797,72	- 1.554.050,00
Total Change	1.685.926,63	1.490.333,51	162.137,08	946.368,01

Source: made by the author with data from the Uncomtrade (2022)

In all analyzed periods, Brazilian exports of beef and chicken increased substantially. In period I, most of the increase in export values of the three proteins corresponded to the impact of the country's competitiveness which boosted exports, followed by the general growth of world trade (Carvalho *et. al.*, 2006; Reis, 2015).

Pork and chicken showed negative values in the effect of the regional market, showing that export destinations were not concentrated in markets that had rapid growth. Beef, on the other hand, had a great contribution from the export destinations factor, confirming the results of Buhse et. al., (2014) and Florindo et al. (2014). Other factors contributed to its overall growth, such as professionalization, the abundance of raw materials, inputs, industrialization, and the specialization of companies to work in the foreign market (Gonçalves & Palmeira, 2006).

In period II, the three meats presented negative values in the competitiveness effect, indicating that this variable fell slightly in the period. But, even so, beef and chicken presented an increase in the total composition, as the world export growth favored this scenario;

Furthermore, beef was favored by the regional effect (Buhse et al., 2014 and Florindo et al., 2014) and chicken meat, by the effect of the commodity. Pork had a drop in values, mainly in the competitiveness effect, which was also evidenced in the study by Gastardelo, Melz and Marion (2016).

The destinations of exports of beef and pork, in period III, did not contribute to the positive value of the total change; chicken meat, on the other hand, benefited from the fact that its exports are directed to growing markets. In comparison with period II, beef showed an increase in the effect of world growth, commodity, and competitiveness, and, according to Florindo et al. (2014), it was possible with the end of the American crisis of 2008. The positive value of the effect of world growth indicated that pork exports grew in the same proportion; associated with competitiveness, it was responsible for maintaining the country's exports, corroborating the research by Gastardelo, Melz and Marion (2016).

In the last two analyzed periods, the destination effect of chicken meat exports corroborated for the growth of exports in a positive way (Saggin, 2017). This result was driven by China's rapid growth and the country's growing demand for Brazilian commodities (Maranhão & Vieira, 2017). Also, competitiveness presented a negative value, indicating the need for flexibility agreements for markets with which Brazil already has a commercial relationship, as a way of improving policies to encourage product competitiveness (Saggin, 2017).

In period IV, which portrays the current situation, chicken meat had a positive value in the analysis of total change, as well as in period III, due to the destination markets for its exports, but also, according to Bender, Schwertner and Arruda Coronel (2019), because it was provided by the natural conditions of the Brazilian territory and its competitiveness in two other important products for chicken meat: corn and soybeans.

Also, in the last period, beef and pork increased their competitiveness, and this period had the highest value in total change. The effect of the destination of exports was not favorable for the two proteins, but, as it is a promising sector with a growing degree of international insertion and its ability to condition the development of the Brazilian economy, they arouse interest and increasingly direct attention to the expansion of the market (Sereia, Oliveira Toneto and Camara, 2005).

4.2.3   Brazilian animal protein exports destinations and the main trade barriers

The markets to which Brazil exports play a key role in competitive performance (Lima, 2012). Destinations with greater commercial openness and which have technical standards, already known by exporters, facilitate expansion into the international market.

The country's animal protein exports are concentrated in a few destinations, as 81% of the exported value of beef went to only twelve countries: 68% of chicken and 90% of pork went to eleven countries. Figures 5, 6 and 7 illustrate the value exported to the major destinations of each protein per analysis period.

Figure 5. Brazilian beef exports (in US$) by destination country
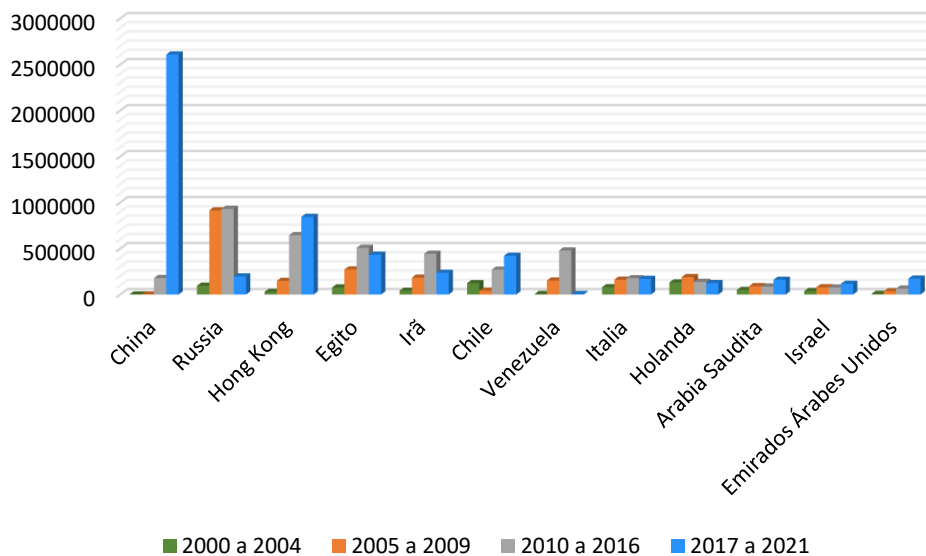
Source: made by the author with data from the Uncomtrade (2022).

The main destinations for beef are China (17%), Russia (14%), Hong Kong (11%), Egypt (9%), Iran (6%), Chile (6%), Venezuela (5%), Italy (4%), Netherlands (4%), Saudi Arabia (2%), Israel (2%) and United Arab Emirates (2%). Russia has the highest accumulated sum in the first two periods of analysis, and, until 2014, the import of Brazilian protein was led by it, but from 2015 onwards, China took the lead, showing a significant volume in the last period.

The reduction in exports to Russia occurred, most significantly, at the end of 2017, when some Brazilian meatpacking plants were disabled from exporting due to the detection of *ractopamine* (muscle growth stimulants in the production of food products), which is banned in the Russian market (MAPA, 2021). But, even with these restrictions, Brazil managed to

expand its exports, as it occurred due to the improvement of the animal health of the herd, increase in production capacity, the low cost of production in relation to competitors and the new trade agreements (Aurélio Neto, 2018 and Rodrigues & Marta-Costa, 2021).

Among the 12 countries that most import beef, four are Muslim (Iran, Egypt, Israel, and Saudi Arabia). Brazilian production for these countries follows the norms of the Halal Ritual, which consists of specific slaughter and preparation practices, agreed with the embassies of the countries (International Trade Centr*e* [ITC], 2022).

The taxes charged for the importation of Brazilian beef are varied and differ according to the type of product. Egypt was the only destination that does not have a tariff. In Chart 14, the tariff charged by NCM code for beef is identified.

Chart 14 - Tariff barriers on Brazilian beef exports

Destination Country	Product by NCM code					
	02011	02012	02013	02021	02022	02023
China and Hong Kong	20%	12%	12%	25%	12%	12%
Russia	15%	15%	15%	15%	15%	15%
Egypt	0%	0%	0%	0%	0%	0%
Iran	26%	26%	4%	4%	4%	4%
Chile	6%	6%	6%	6%	6%	6%
Venezuela	20%	20%	12%	10%	10%	12%
Italy and Holland	12,8% + 176,8 EUR/100 kg					12,8% + 221,1 EUR/100 k
Saudi Arabia	0%	0%	0%	5%	5%	6%
Israel	12% + 9,75 NIS per Kg			0%	0%	0%
Arab emirates	0%	0%	0%	5%	5%	5%

Source: made by the author with data from the ITC (2022)

In addition to tariff barriers, there are several other non-tariff barriers imposed by importing countries; one of them is the systems approach, which refers to a series of measurements that determine the sanitary, technical, microbiological and compliance characteristics of some food products. Also, a prior authorization license is required for import, customs procedures, compliance with anti-dumping measures and compliance with labeling and packaging requirements (ITC, 2022).

Diseases such as foot-and-mouth disease and bovine spongiform encephalopathy (BSE) are the main causes of beef export restrictions (Florindo, Medeiros & Mauad, 2015). Traceability is a fundamental point for the competitiveness of the product, as it guarantees production control and the quality of the final product, but, due to frequent changes in the rules of the cattle breeding system, Brazil has not yet managed to establish a reliable traceability and

certification system (Silva, Triches & Malafaia, 2011). Therefore, investment in quality, which allows for reliable certification, makes commercial relationships more transparent and mitigates non-tariff barriers.

Most of the pork meat exported is destined for Russia (36%), this is pointed out by Lima (2012) as the most important protein destination. Other destinations stand out, such as China (15%) and Hong Kong (13%), followed by Ukraine (5%), Singapore (5%), Argentina (5%), Uruguay (4%), Angola (2%), Chile (2%), Georgia (1%) and United Arab Emirates (1%).

Figure 6. Pork exports from Brazil (in US$) by country of destination
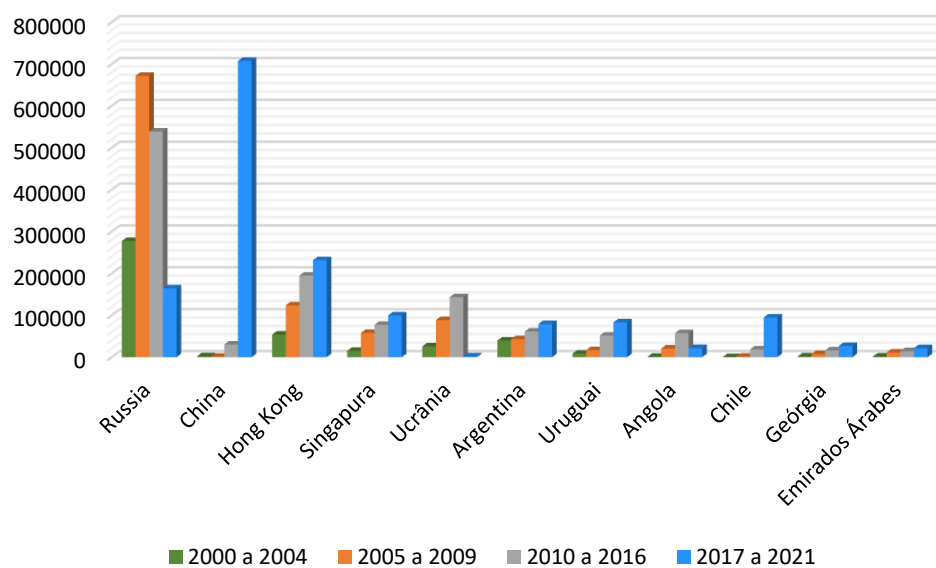
Source: Made by the author with data from Uncomtrade (2022)

As with beef, in 2018, there was also a drastic reduction in pork exports to Russia, with 259,410 tons of the Brazilian product being exported in 2017; in 2018, there were only 6,66 tons. But, according to MAPA, in November 2021, due to compliance with the requirements imposed by the Russian Federation and the guarantees that were presented by the competent Brazilian authority, restrictions on pork and beef refrigeration plants were removed. With this, it is expected that Russian demand, not only for pork, but also for other proteins, will increase in the coming periods.

Until the analyzed period, Russia is the biggest buyer of red meat, being one of the most relevant markets; but, with the current sanctions suffered by the country, as a result of the war with Ukraine, there is a scenario of reduced exports. Therefore, it is important to establish commercial agreements with new markets.

On the other hand, with the reduction in pork production in East Asia, due to the outbreak of African Swine Fever (OECD, 2021), there was an increase in exports to other markets, such as China and Hong Kong. In the period from 2010 to 2016, 3% of total exports were destined for China and 16% for Hong Kong; in the period from 2017 to 2021, 46% of the total exhortations were destined for China and Hong Kong remained with 15%.

Russia, Singapore, and the United Arab Emirates were the destinations that did not charge tariffs related to customs duty, charged for the importation of Brazilian pork. Angola, on the other hand, is charged 20% of taxes; China and Hong Kong charge 20% for chilled pork and 12% for frozen; Ukraine also has different tariffs for chilled meat (12%) and frozen meat (10%). The other destinations have a single tariff for the product: Uruguay, 10%; Argentina, 8%; Chile, 6%; and Georgia, 5% (ITC, 2022). Despite the reduction of tariff measures, over the years, they are still capable of negatively influencing the trade, even more when associated with non-tariff measures (Mendonça, Carvalho & Reis, 2017).

One of the non-tariff barriers imposed by destinations for the acceptance of pork is compliance with sanitary and phytosanitary measures. Thus, imports that may present SPS risks are prohibited, such as the banning of products originating in countries or regions affected by infectious diseases; banning products that may be toxic or poisonous to consumers. The measures included in this category are generally of a temporal nature and aim to protect life, human, animal, and plant health in the country (ITC, 2022).

Non-tariff barriers prevent the expansion of the Brazilian pork market (Aparecida Silva *et. al.,* 2011); thus, the implementation of interregional free trade agreements, or through multilateral agreements, would bring significant gains for the sector, as well as the expansion of production capacity (Rubin, Ilha & Machado Lopes, 2012). In this sense, the reduction or elimination of barriers would make Brazil even more competitive in the international pork market.

In the analyzed period, 16% of chicken meat exports were destined for Saudi Arabia; for Japan, 9%; for China, 7%, as well as for the United Arab Emirates; Hong Kong, 3%, as well as Singapore, Kuwait, South Africa, and Russia; and 2% to the other countries, which are reported in Figure 7.

Figure 7. Chicken meat exports from Brazil (in US$) by country of destination
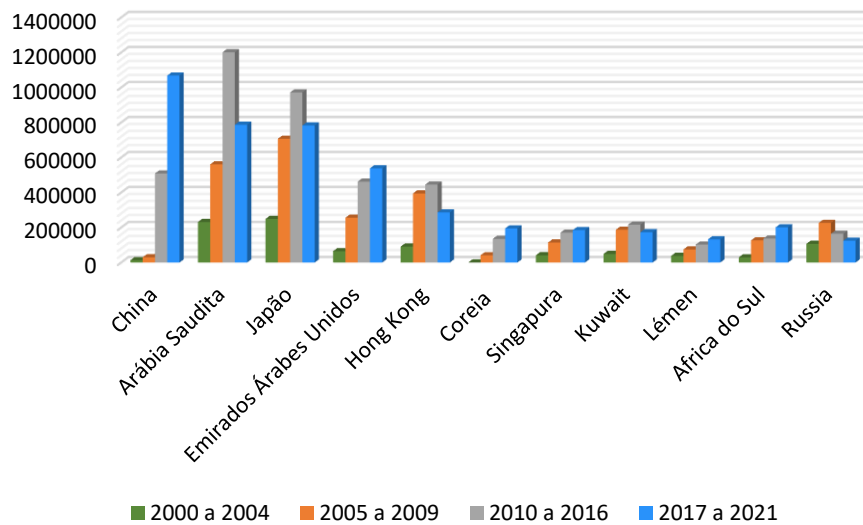
Source: Made by the author with data from Uncomtrade (2022).

A The largest share of chicken meat exports is destined for Asian countries. Saudi Arabia and Japan have the highest accumulated sum, while China stands out with a large volume in the last two periods. Until 2009, Brazilian chicken could not be exported to the Chinese market, but with the opening of the market, the country became one of the main destinations for the protein (Ferreira & Vieira, 2019). Another fact that explains the concentration of these destinations is that there is greater consumption of chicken meat and its by-products in the East; parts, such as chicken feet and cartilage, are preferred by these markets (Souza *et al.,* 2008).

Russia applies the highest import tariff on Brazilian beef, at 25%, followed by China, Hong Kong, Saudi Arabia, and Korea, at 20%; Japan, with 11.90%; United Arab Emirates and Kuwait, 5%; Singapore and South Africa have not recorded a fare collection (ITC, 2022).

The requirements presented by the countries for the importation of the product range from the authorization/import license, related to TBT, authorizations for SPS reasons, tolerance limits for residues or contamination by certain substances, restricted use of certain substances, certification and testing requirements and labeling and packaging requirements. Requirements are made regarding the conditions under which the product must be stored and/or transported, on the passage through the specified customs port and, also, it is required that the sanitary conditions are met by the establishments and equipment used during the manufacturing and product processing. Still, some countries impose bans for religious and economic reasons (ITC, 2022).

As with other meats, trade barriers become obstacles to expanding exports of the product. The country has been showing advances in genetics, health, and nutrition in the production of chicken meat, which guarantees quality and increased added value (Medeiros & Bender, 2019). Trade negotiations with other governments can ignite the advantages of the Brazilian product (Cruz, 2019), easing the barriers imposed on exports.

Therefore, for the expansion of Brazilian exports of animal protein, it is essential to know and map each requirement imposed by the main destinations. Animal protein exports from Brazil have a high potential to increase competitiveness by conquering new markets. For this, the country needs to face the challenge of adapting or establishing trade agreements that offer growth conditions. Trade barriers can be treated as an opportunity for the country to improve and expand exports; thus, as a consequence, it will be possible to further increase your productivity.

4.3   ANIMAL PROTEIN EXPORTS AND SUSTAINABLE PERFORMANCE

With the growth of Brazilian exports, the concern with the impact of productive activities on society and the environment is highlighted, as it is a sector that has a negative impact on biodiversity (Stehfest *et al.*, 2013). Therefore, to carry out the analysis of sustainable development, two indicators were used, the ANS and the HDI, relating them to the Market Share of each protein studied. It is seen in Figure 8 that the variation in the HDI is minimal from one period to another; ANS, on the other hand, presents a slightly more significant variation.

Figure 8. Export market share and sustainable performance
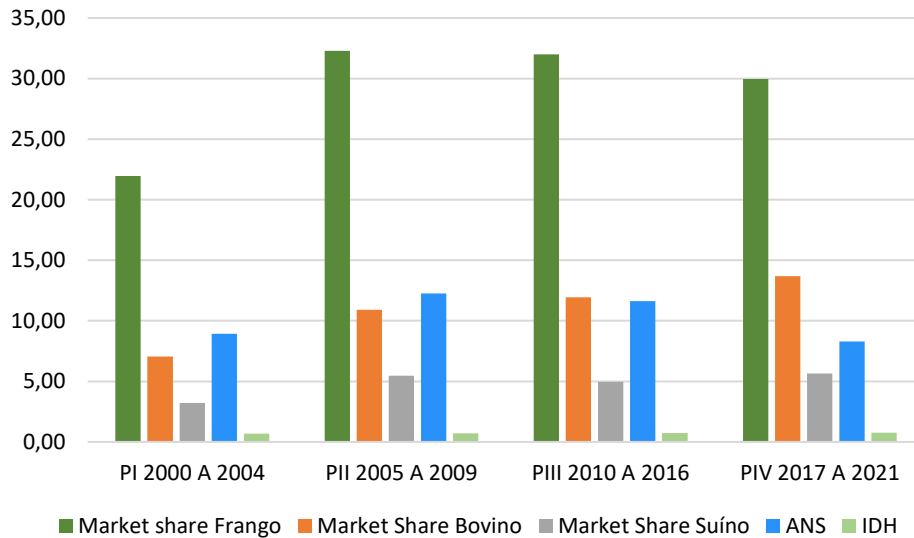
Source: Made by the author with data from Uncomtrade (2022), World data bank (2022) and PNUD (2022).

In the period from 2000 to 2004, the HDI average was 0.693 and adjusted net savings had a percentage of 8.94%. In the period from 2005 to 2009, the HDI was 0.708 and the ANS 12.35%, showing a 2% growth in the HDI and 37% in the ANS in relation to the previous period. Making the same comparison with the Market Share of exports, growth is also seen, inferring that, as the country improved its Sustainable performance, it also improved its Market Share. Over the years, it is seen that the adoption of more sustainable measures is a constant concern of the meatpacking industries, in order to incorporate the concept of sustainability as a competitive strategy (Araújo & Mendonça, 2009; Santos, Mendonça & Mariani, 2010; Feitosa, 2019).

Comparing the PII with the PIII, there is an increase in the HDI and a decrease in the ANS, both by 5%. In this comparison, pork and chicken also suffered a drop in their Market Share; on the other hand, beef grew by 9%. The growth of Brazilian exports happened together with international trade and was fundamental for a more inclusive development, considering several factors, such as the social and sustainable aspect (Portocarrero e Araújo, 2018).

From period III to period IV, the HDI continued to show a growth of 2%, but the ANS had a decrease of 29% (from 11.62% in the PIII to 8.28% in the PIV). Beef and pork presented an increase, but chicken meat continued to suffer a decrease in its Market Share. Above all, the Brazilian production of chicken meat generates jobs and has an important social rule in the

Brazilian economy; technological advances in the sector arise to mitigate problems related to sustainable production (Oliveira *et. al*., 2012).

Although chicken meat has the highest Market Share among the three proteins analyzed, it is also the one that had the most variations between 2000 and 2021, as it had a standard deviation of 5.44 compared to 0.92 for pork and 2.81 for beef. In Chart 15, the Spearman correlation was used, with a confidence level of 95%, in order to validate whether there is a relationship between HDI and ANS when compared to the Market Share.

Chart 15 - Spearman's Correlation

	IDH	ANS
Chicken Market Share	0,091	0,821
Beef Market Share	0,198	0,368
Pork Market Share	0,552	0,368

Source: Made by the author with data from Uncomtrade (2022), World data bank (2022) and PNUD (2022).

Chicken meat was the one with the lowest correlation with the HDI, inferring that the variation in the HDI does not influence the variation in the Market Share of chicken protein; ANS, on the other hand, has a strong correlation with meat, that is, as the country's genuine net savings increase, the share of Brazilian chicken meat in the foreign market also increases. Beef showed a clear correlation with the two variables and pork had a medium correlation with the HDI and weak with the ANS, being the protein that was most influenced by the variation of the HDI. In this sense, the result of this analysis is in line with the research by Flores and Gavronski (2016), that pointing out that sustainability has little influence on Brazil's export performance.

However, it is seen that the concern for the environment is increasingly present in the production chain; the meatpacking industries seek to implement actions that reduce the environmental impact, which ranges from the creation process to the industrialization of the product (Araújo & Mendonça, 2009; Santos, Mendonça & Mariani, 2010; Oliveira et. al., 2012; Flores & Gavronski, 2016; Portocarrero and Araújo, 2018; Feitosa, 2019).

Genuine net savings exerted a greater influence than the HDI on exports. Therefore, it is important to adopt environmentally sustainable processes, which, in addition to reducing operating costs, allow access to markets in countries with stricter environmental standards. Even if the HDI did not show a high correlation, the development of socially responsible practices in Brazil could generate advantages, such as productivity gains due to the greater concentration of skilled labor.

4.4   COVID 19 PANDEMIC AND BRAZILIAN ANIMAL PROTEIN EXPORTS

Concerns about food safety became stronger in 2020 with the arrival of the pandemic, increasing restrictions on international trade in food, and especially animal protein, due to strict border controls and the preference for local production. Dweck, Rocha and Freitas (2020) pointed to a probable reduction in Brazilian exports, in addition to a change in their composition, with an increase in the importance of goods of agricultural origin. This reduction would have negative effects on the trade balance and increase the external vulnerability of the Brazilian economy.

With Covid-19, international trade was subject to great difficulties, due to the reduction in world demand for goods, due to restrictions on supply capacity in various sectors and countries (Ribeiro, Baumann, Oliveira, *et. al.,* 2020). According to the OECD (2021); major economies had a drop in their gross domestic product in 2020, such as the United States, which had a retraction of 0.47%; Japan reduced by 0.09%; Germany at 0.04%; India at 0.17%; United Kingdom by 0.20%; France at 0.06%; and Italy at 0.12%. In 2021, this scenario changed, and the mentioned countries showed growth in GDP.

Analyzing all products and services exported by Brazil, in 2020, exports had a balance of US$ 209,180.2 million, 5.4% lower than in 2019, but in 2021, it totaled US$ 280,814.6 million, showing an increase of 27% compared to 2019 (SECEX, 2022). Figure 9 shows the behavior of meat exports studied in the period from 2000 to 2021.

Figure 9. Value in Millions of Exports of animal protein over the period
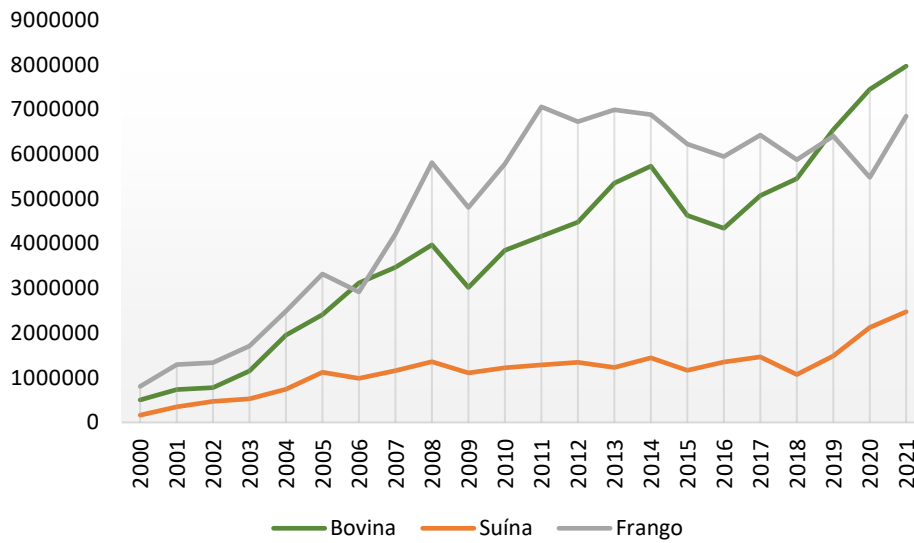
Source: Made by the author with data from the Uncomtrade (2022).

Beef has been growing since 2016 and, even with the arrival of the pandemic, in 2020 it grew 14% compared to the previous year and ended 2021 with an increase of 7%. Pork exports jumped in 2019 and 2020 and, like beef, showed a significant 43% increase in exports. Chicken meat, on the other hand, had a sharp drop in exports of 14% compared to 2019, but in 2021, it recovered and had a 17% growth in value.

Based on the ascending analysis that the export value line presents in Figure 9 chicken meat was the product that was impacted by the arrival of the pandemic. But, when analyzing the exported volume of the product, in 2020, which was 4.231 million tons, an increase of 0.40% is seen compared to 2019. What happened was a reduction in the revenue obtained in the period in question. In 2021, product shipments reached a new record of 4,498 million tons, surpassing the mark of just over 4.3 million tons, which had remained unbeatable since 2016 (ABPA, 2021).

With the arrival of the pandemic, Brazilian exports were subjected to stricter security controls for their entry into importing countries. The adoption of protocols developed for the most varied fronts of action, cutting-edge technologies for monitoring, implementation of spacing in transport, and use of PPE were some examples considered by the meatpacking industries (ABPA, 2021).

The pandemic has brought numerous problems to the whole world, in addition to the high number of deaths and infected by the disease. There were also difficulties in trade, stoppages, increased unemployment, political conflicts, emergency measures, among many

other situations that interfered with the experienced scenario. However, as seen, this pandemic scenario did not affect the animal protein market, but rather reinforced Brazil's responsibility as a major food provider to the world.

5   FINAL REMARKS

Brazil plays an important role in supplying food to the world, especially soy and meat. The country's animal protein exports grew gradually, following the international market, a fact provided by the competitive advantages of the sector. In this sense, the present research aimed to analyze the relationship between sustainability and competitiveness of exports of the Brazilian animal protein market (chicken, beef, and pork) in the period from 2000 to 2021.

The Constant Market Share model made it possible to identify the main sources of export growth. The results reveal that the effect of world growth was essential for the increase in exports of the three proteins. The destinations of Brazilian meat also strengthened the commercialization of the product, as well as the effect of competitiveness. Beef showed growth in its share over the years and was the protein that most influenced the effect of competitiveness, with the availability of land and pastures, increase in the herd, genetic improvement, improved management, favorable weather conditions being the main competitive advantages of the product.

Exports are concentrated in a few destinations, where 81% of the exported value of beef was destined for only twelve countries. China, Russia, and Hong Kong are the destinations that concentrate the largest volume of the product, with growth potential due to the increase in population; In addition, many markets are still unexplored due to the imposition of trade barriers. Therefore, non-tariff barriers should be treated as an opportunity to increase product quality, through investments in systems that involve traceability, food safety and sustainability.

Pork has a smaller market share when compared to other meats, but even so, it increased its share in the market during the analyzed period. Factors such as grain availability, advances in genetics, slaughtering and processing technologies contributed to this result. The competitiveness effect was what most influenced the change in the value of exports, but there are still many barriers that impede the expansion of the sector. About 90% of product exports were destined for only eleven countries, especially China, Russia, and Hong Kong. The large production capacity that the country has associated with the reduction of tariff and non-tariff barriers would be the ideal scenario for the expansion of pork exports, making Brazil even more competitive.

Chicken meat is the protein with the highest percentage of participation in the international market; the effect of world growth was essential for this to happen. Advantages, such as climate, technical innovations, logistical factors, availability of labor, natural and

financial resources, contributed to the increase in productivity and, consequently, in exports. The largest importers of the product are China, Saudi Arabia, and Japan, concentrating the largest sum accumulated in Asian countries, since the product is preferred by these markets.

Commercial, sanitary, and phytosanitary restrictions on animal protein exports become an obstacle to the expansion of the sector, therefore, there is a need for flexibility agreements to improve policies to encourage competitiveness. In addition, the opening of new markets (not only for beef, pork, and chicken, but for all agribusiness products) would be an important step towards strengthening the Brazilian market.

When relating the competitive performance of beef, pork, and chicken with the HDI and the ANS, to verify the relationship that sustainable meat has on exports, a strong correlation is not seen. Thus, these indicators do not have a great influence on the competitive performance in the Brazilian animal protein market. Factors such as world growth, export destinations and trade barriers exert the greatest influence on the country's export performance. On the other hand, it is seen that sustainability is increasingly present in the sector and should be incorporated as a factor for the analysis of the country's competitiveness.

The Covid-19 pandemic caused many uncertainties to the market; a reduction in world demand for food was expected as a result of the imposition of restrictions related to food safety and, consequently, a reduction in Brazilian exports. Chicken meat suffered a 14% reduction in exported value in the first year of the pandemic, but in 2021 it recovered, reaching a new record in terms of quantity and value exported. On the other hand, beef and pork did not suffer a reduction, on the contrary; in 2020 and 2021, there was a significant growth in the value exported.

Finally, this research affirmed the relevance of Brazil in international trade, especially with regard to agribusiness and, in particular, the meat trade. In addition, the research added to the literature, considering that research on exports in the agribusiness sector, considering the variable of sustainability, still occupies a restricted space in the academic field.

In the development of this research, some limitations were found, such as the lack of updating of data for the calculation of sustainable performance, which depends on the HDI and the ANS, since the information on these indicators was only updated until the year 2019. In addition, the model used to verify the country's competitiveness makes it possible to calculate the past performance of exports, not allowing the prediction of future scenarios.

For future research, it is suggested to use a greater number of sustainability indicators to verify the country's sustainable performance, allowing a more in-depth analysis of the

relationship between sustainability and competitiveness. In addition, other models can be used together with the Constant Market Share, in order to verify the export performance from various angles and enable the projection of future scenarios for the sector.

REFERENCES

Afonso, A. (2006). Metodologia Haccp. *Segurança e Qualidade Alimentar*, *1*, 12-15.

Agência Brasileira de Promoção de Exportações e Investimentos [ApexBrasil]. (2017). *Manual sobre barreiras comerciais e aos investimentos*. Recuperado em 15 de agosto de 2021 em http://www.apexbrasil.com.br/uploads/clique%20aqui.pdf

Akabane, G. K., Lopes, C. P., & da Silva, F. P. (2010). O sistema de rastreabilidade para a sustentabilidade no agronegócio brasileiro. *Revista da Micro e Pequena Empresa*, *4*(2), 80-94.

Alencar, Á. G. D. (2001). Do conceito estratégico de segurança alimentar ao plano de ação da FAO para combater a fome. *Revista brasileira de política Internacional*, *44*(1), 137-144.

Ali, J., & Pappa, E. (2015). Global meat market: structural changes across geographical regions. *South Asia Research*, *35*(2), 143-157.

Alves, E., Gazzola, R., & Marra, R. (2008). The meat market in Brazil: a partial equilibrium model. *Revista de Economia e Sociologia Rural*, *46*(4), 1189-1208

Aparecida Silva, F., Silva Lírio, V., Arruda Coronel, D., & Maciel Gomes, M. F. (2011). Identificação e efeitos de medidas não tarifárias impostas aos principais exportadores de carne suína. *Revista de Economia Mackenzie*, *9*(3).

Aparicio, G., González-Esteban, Á. L., Pinilla, V., & Serrano, R. (2018). The world periphery in global agricultural and food trade, 1900–2000. In *Agricultural Development in the World Periphery* (pp. 63-88). Palgrave Macmillan, Cham.

Araújo, G. C. D., & Mendonça, P. S. M. (2009). Análise do processo de implantação das normas de sustentabilidade empresarial: um estudo de caso em uma agroindústria frigorífica de bovinos. *RAM. Revista de Administração Mackenzie*, 10, 31-56.

Associação Brasileira das Indústrias exportadoras de Carnes. [ABIEC]. (2022). *Exportações*. Recuperado em 02 de março de 2021 em http://abiec.com.br/exportacoes/

Associação Brasileira de proteína anima. [APBA]. (2021). *Relatório anual*. Recuperado em 13 de maio de 2021 em http://abpa-br.org/wp-content/uploads/2021/04/ABPA_Relatorio_Anual_2021_web.pdf

Aurélio Neto, O. (2018). O Brasil no mercado mundial de carne bovina: análise da competitividade da produção e da logística de exportação brasileira. *Ateliê Geográfico,* 12(2), 183–204. https://doi.org/10.5216/ag.v12i2.47471

Baldwin, R. (2016). A Organização Mundial do Comércio e o futuro do multilateralismo. *Journal of Economic Perspectives* , *30* (1), 95-116.

Banco Mundial. (2021). *World dataBank*. Recuperado em 02 de outubro de 2021 em https://databank.worldbank.org/home.aspx

Barcellos, O. (2006). Uma reflexão do comércio internacional dos setores de carne de frango e de soja do Brasil e Mercosul. *Perspectiva Econômica*, *2*(2), 15-36.

Belik, W. (2003). Perspectivas para segurança alimentar e nutricional no Brasil. *Saúde e sociedade*, *12*, 12-20.

Bender, M., Schwertner, J. J., & Arruda Coronel, D. (2019). Competitividade das exportações brasileiras de carne de frango: uma análise empírica. *Observatorio de la Economía Latinoamericana*, (septiembre).

Bizawu, K., de Paiva Toledo, A., & Lopes, L. C. P. (2017). Sustentabilidade econômica e Organização Mundial do Comércio – OMC: a crise ética mundial nas relações entre estados. *Veredas do Direito: Direito Ambiental e Desenvolvimento Sustentável*, 14(30), 99-116.

Bonnomi, N. P. (2020). Barreiras Sanitárias e Protecionismo no contexto da Organização Mundial do Comércio. *Revista Brasileira de Direito Internacional*, 6(2), 1-17.

Buhse, A., P, Bender, R., F°., Lopes, T. D. A. M, & Moraes, B. M. (2014). Competitividade das exportações de carnes dos países do Mercosul: Uma análise a partir do Constant Market-Share. *Perspectiva Econômica*, 10 (2), 94.

Caranova, A. R. P. (2008). *Implementação de um sistema de segurança alimentar num talho baseado na metodologia HACCP*. Bachelor's thesis, Universidade Técnica de Lisboa. Faculdade de Medicina Veterinária.

Cardoso, G. M. (2019). Barreiras tarifárias e não tarifárias que afetam as exportações brasileiras de carne de frango. *Relações Internacionais-Florianópolis*.

Carneiro, J. M. T. (2019). O impacto das estratégias de sustentabilidade ambiental no desempenho de exportação da agroindústria brasileira: influência das capacidades organizacionais e ambiente institucional. *Tese. Doutorado em Administração*. Recuperado em 19 de setembro de 2021 em https://www.maxwell.vrac.puc-rio.br/46080/46080.PDF.

Carvalho, FMAD, Machado, LVN, Amin, MM, & Santana, ACD. (2006). *Análise do desempenho das exportações brasileiras de carne bovina: uma aplicação do método Constant-Market-Share, 1995-2003*. https://locus.ufv.br//handle/123456789/20053

Claudino, E. S., & Talamini, E. (2013). Análise do Ciclo de Vida (ACV) aplicada ao agronegócio: uma revisão de literatura. *Revista Brasileira de Engenharia Agrícola e Ambiental*, *17*(1), 77-85.

Codex Alimentarius. (2016). *Higiene dos Alimentos – textos básicos*. Recuperado em 09 de junho de 2021 em https://acisat.pt/wp-content/uploads/2016/10/codex_alimentarius.pdf

Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112, 155-159.

Confederação da Agricultura e Pecuária do Brasil. [CNA]. (2022). *Panorama do Agro*. Recuperado em 25 de Março de 2022 em https://www.cnabrasil.org.br/cna/panorama-do-agro

Costa, L. D. S., Garcia, L. A. F., & Brene, P. R. (2015). Panorama do setor de frango de corte no Brasil e a participação da indústria avícola paranaense no complexo dado seu alto grau de competitividade. *Simpósio Internacional de Gestão de Projetos, Inovação e Sustentabilidade, São Paulo*.

Cruz, A. C. (2019). Avicultura industrial do Oeste paranaense: barreiras não-tarifárias e estratégias competitivas. 68 f. Dissertação (Mestrado em Desenvolvimento Regional e Agronegócio) - *Universidade Estadual do Oeste do Paraná,* Toledo. https://tede.unioeste.br/handle/tede/4233

Cunha, F. M. F., Magalhães, M. B. H., & Bonnas, D. S. (2013). Desafios da gestão da segurança dos alimentos em unidades de alimentação e nutrição no Brasil: uma revisão. *Contextos da Alimentação–Revista de Comportamento, Cultura e Sociedade*, *1*(2).

Department of Agriculture United States. [USDA]. (2020). *Relatórios de agência*. Recuperado em 21 de abril de 2021 em http://www.usda.gov

Dill, M. D., Corte, V. F. D., Barcellos, J. O. J., Canozzi, M. E. A., & Oliveira, T. E. D. (2013). Análise comparativa da competividade do Brasil e EUA no mercado internacional de carne bovina. *Revista Ceres* , *60* , 765-771.

Djorović, M. T., Stevanović, S., & Lazić, V. M. (2009). Global meat market. *Ekonomika poljoprivrede*, *56*(3), 343-358.

Dyck, J. H., & Nelson, K. E. (2003). *Structure of the global markets for meat* (No. 1474-2016-120830).DOI 10.22004 / ag.econ.33701

Dweck, E., Rocha, C. F., & Freitas, F. (2020). *Impactos macroeconômicos e setoriais da Covid-19 no Brasil*. Nota Técnica. Texto para Discussão 007, IE-UFRJ.

Elkington, J. (1997). *Cannibals with forks: the triple bottom line* of 21 st century bussiness. Reino Unido: Capstone.

Fagerberg, J. & Sollie, G. (1987). *The Method of Constant Market Shares Analysis Reconsidered*. Applied Economics 19: 1571-83.

Feitosa, C. O. (2019). *Panorama das atividades agropecuárias de exportação do Tocantis: soja e carne*. Geosul, 34(71), 154-174.

Ferreira, M. D. P., & Vieira, J. E. R., F°. (2019). Inserção no mercado internacional e a produção de carnes no Brasil. *Repositório do conhecimento do IPEA*. Recuperado em 20 de abril de 2021 em http://repositorio.ipea.gov.br/handle/11058/9285

Fernandes, A. M., Teixeira, O. D. S., Rios, H. V., Canozzi, M. E. A., Schultz, G., & Barcellos, J. O. J. (2019). Insights of innovation and competitiveness in meat supply chains. *International Food and Agribusiness Management Review. Wageningen, The Netherlands. Vol. 22, n. 3 (2019), p. 413-427*

Fialho, R. (2006). *Competitiveness of the Brazilian meat swine s exports from 1990 to 2004*. 2006. 110 f. Dissertação (Mestrado em Economia e Gerenciamento do Agronegócio;

Economia das Relações Internacionais; Economia dos Recursos) - Universidade Federal de Viçosa. URI http://locus.ufv.br/handle/123456789/95

Flores, F. S., & Gavronski, I. (2016). A influência da sustentabilidade sobre o desempenho exportador no mercado internacional da carne bovina. *Revista Ciências Administrativas*, *22*(1), 192-224.

Florindo, T. J., de Medeiros, G. I. B., da Costa, J. S., & Ruviaro, C. F. (2014). Competitividade dos principais países exportadores de carne bovina no período de 2002 a 2013. *Revista de economia e agronegócio*, *12*(1, 2, 3).

Florindo, T. J., Medeiros, G. I. B. D., & Mauad, J. R. C. (2015). Análise das barreiras não tarifárias à exportação de carne bovina. *Revista de Política Agrícola*, 24(2), 52-63.

Freitas, K. R. T., Costa, J. S. Da., Florindo, T. J., & Duarte, N. D. L. (2014). Competitividade no mercado de carne bovina: uma comparação entre as exportações brasileiras e argentinas no período 2006-2013. *Revista de Economia Agrícola* , *61* (2), 53-75.

Fontelles, M. J., Simões, M. G., Farias, S. H., & Fontelles, R. G. S. (2009). Metodologia da pesquisa científica: diretrizes para a elaboração de um protocolo de pesquisa. *Revista paraense de medicina*, *23*(3), 1-8.

Fornazier, A. & Vieira, J. E. R., F°. (2013). *Heterogeneidade estrutural na produção agropecuária: uma comparação da produtividade total dos fatores no Brasil e nos Estados Unidos* (No. 1819). Texto para Discussão.

Food and Agriculture Organization of the United Nations. [FAO]. (2021). *Programas em Brasil*. Recuperado em 06 de junho de 2021 em http://www.fao.org/brasil/programas-e-projetos/programa/pt/

Food and Agriculture Organization of the United Nations. [FAO]. (2020). *Programas em Brasil*. Recuperado em 20 de junho de 2021 em http://www.fao.org/news/story/en/item/1364561/icode/

Gadzalo, I., Sychevskiy, M., Kovalenko, O., Deineko, L., & Yashchenko, L. (2020). Assessment of global food demand in unexpected situations. *Innovative Marketing*, 16(4), 91-103. doi:10.21511/im.16(4).2020.08

Galdeano-Gómez, E. (2010). Exportação e desempenho ambiental: uma análise da produtividade ao nível da empresa. *Economia Mundial* , *33* (1), 60-88.

Gastardelo, T. A. R., Melz, L. J., & Marion, P. J., F°. (2016). A competitividade das exportações de carne suína: os casos do Brasil e dos Estados Unidos. *Revista UNEMAT de Contabilidad*e, 5(9).

Gasques, J. G., Bastos, E. T., Valdes, C., & Bacchi, M. R. P. (2012). Total factor productivity in Brazilian agriculture. Productivity growth in agriculture: an international perspective. *Oxfordshire: CAB International*, p. 145-162.

Garrido, A. E. (2004). As barreiras técnicas ao comércio internacional. *Instituto Nacional de Metrologia, Normalização e Qualidade Industrial, Rio de Janeiro. Access in March*, *31*, 2005.

Gilbert, J. (2017). *Analytical approaches to evaluating preferential trade agreements*. URI https://hdl.handle.net/20.500.12870/373

Giordano, S. R. (2005). *Gestão Ambiental no Sistema Agroindustrial*. In: Zylbersztajn, D.;

Gonçalves, R. G., & Palmeira, E. M. (2006). Suinocultura brasileira. *Observatorio de la economía Latinoamericana*, (71), 01-11.

Guimarães, R. P., & Feichas, S. A. Q. (2009). Desafios na construção de indicadores de sustentabilidade. *Ambiente & sociedade*, *12*, 307-323.

Instituto Brasileiro de Geografia e Estatística. [IBGE]. (2017). *Indicadores de Desenvolvimento Sustentável – IDS*. Recuperado em 01 de outubro de 2021 de https://sidra.ibge.gov.br/pesquisa/ids/tabelas

Instituto Brasileiro de Geografia e Estatística. [IBGE] .(2021). *Desemprego*. Recuperado em 15 de dezembro de 2021 em https://www.ibge.gov.br/explica/desemprego.php

Instituto De Pesquisa Econômica Aplicada. [IPEADATA]. (2021). *Abate de bovinos: quantidade*. Recuperado em 16 de maio de 2021 em http://www.ipeadata.gov.br/Default.aspx

International Trade Centre. [ITC]. (2022). *Mapa de acesso ao mercado*. Recuperado em 12 de abril de 2022 em https://www.macmap.org/

Kauark, F. D. S., Manhães, F. C., & Medeiros, C. H. (2010). Metodologia da pesquisa: um guia prático. *Itabuna: Via Litterarum*.

Leamer, E. E., & Stern, R. M. (1970). Quantitative International Economics Chicago. *IL: Al*.

Lee, K. H., & Kim, J. W. (2009). Current status of CSR in the realm of supply management: the case of the Korean electronics industry. *Supply Chain Management: An International Journal*.

Lei nº 11.346, de 15 de setembro de 2006. (2006). Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN com vistas em assegurar o direito humano à alimentação adequada e dá outras providências. *Diário Oficial da União, Brasília*, *16 SET. 2006*. Recuperado em 06 de junho de 2021 em http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2006/lei/l11346.htm

Lima, C. (2012). Caracterização das exportações e da competitividade internacional do complexo de carnes brasileiro. *Santa Catarina: Apec Unesc*

Lopez, J. M. C. & Gama, M. (2011). *Comércio exterior competitivo*. Edições Aduaneiras. 4ª Ed. São Paulo.

Machado, T. de A., Ilha, A. da S., & Rubin, L. da S. (2007). Competitividade da carne bovina brasileira no comércio internacional (1994-2002). *Brazilian Journal of Latin American Studies*, *6*(10), 87-101. https://doi.org/10.11606/issn.1676-6288.prolam.2007.82291.

Malafaia, G. C., Biscola, P. H. N., & Dias, F. R. T. (2020). Os impactos da COVID-19 para a cadeia produtiva da carne bovina brasileira. *Comunicado técnico*, *154*.

Maranhão, R. L. A., & Vieira, J. E. R., F°. (2016). *A dinâmica do crescimento das exportações do agronegócio brasileiro* (No. 2249). Texto para Discussão.

Medeiros, A. P. D., & Bender, R., F°. (2019). Mercado de carne de frango brasileiro no contexto dos novos acordos regionais de comércio: Transpacífico e Transatlântico. *Revista de Economia e Sociologia Rural*, 57(4), 618-635.

Mendonça, T. G., de Carvalho, D. E., & Reis, M. P. D. O. (2017). *Exportações brasileiras de carne suína Medidas técnicas, sanitárias e fitossanitárias.* Revista de Política Agrícola, 26(3), 124-141.

Miele, M., & Waquil, P. D. (2007). Cadeia produtiva da carne suína no Brasil. *Revista de Política Agrícola*, *16*(1), 75-87.

Ministério da Agricultura, Pecuária e Abastecimento. [MAPA]. (2021*). União Eurasiática abre novas cotas para importação de carne com tarifa zero*. Recuperado em 07 de março de 2021 em https://www.gov.br/agricultura/pt-br/assuntos/noticias/uniao-eurasiatica-abre-novas-cotas-para-importacao-de-carne-com-tarifa-zero

Ministério da Agricultura, Pecuária e Abastecimento. [MAPA] (2022). *AGROSTAT - Estatísticas de Comércio Exterior do Agronegócio Brasileiro*. Recuperado em 17 de maio de 2022 em http://indicadores.agricultura.gov.br/agrostat/index.htm

Ministério da Economia. (2018). *Recuperação da economia em2017 reforça previsão de crescimento de 3% neste an*o. Recuperado em 20 de dezembro de 2021 em https://www.gov.br/economia/pt-br/assuntos/noticias/planejamento/recuperacao-da-economia-em-2017-reforca-previsao-de-crescimento-de-3-neste-ano

Ministério da economia. [Comex Stat]. (2022). *Estatísticas de comércio exterior em dados abertos.* Recuperado em 27 de março de 2022 em https://www.gov.br/produtividade-e-comercio-exterior/pt-br/assuntos/comercio-exterior/estatisticas/base-de-dados-bruta

Molina, M. C. G. (2019). Desenvolvimento sustentável: do conceito de desenvolvimento aos indicadores de sustentabilidade. *Revista Metropolitana de Governança Corporativa (ISSN 2447-8024)*, *4*(1), 75-93.

Munaretto, L. F., Corrêa, H. L., & da Cunha, J. A. C. (2013). Um estudo sobre as características do método Delphi e de grupo focal, como técnicas na obtenção de dados em pesquisas exploratórias. *Revista de Administração da Universidade Federal de Santa Maria*, *6*(1), 9-24.

Nassar, A. M. (2004). *Produtos da agroindústria de exportação brasileira: uma análise das barreiras tarifárias impostas por Estados Unidos e União Europeia* (Doctoral dissertation, Universidade de São Paulo).

Organization for Economic Co-Operation and Development. [OECD]. (2021). Agricultural Perspectives 2021-2030. *OECD Publishing*, *Paris*. https://doi.org/10.1787/47a9fa44-es

Oliveira, G. G. D. (2021). *Produção de carne bovina: estratégias para mitigar o metano entérico produzido*. 28 f., il. Trabalho de Conclusão de Curso (Bacharelado em Agronomia) — Universidade de Brasília, Brasília. https://bdm.unb.br/handle/10483/29557

Oliveira, D. D. S., Näss, I. D. A., Mollo, M., Neto, Canuto, S. A., Walker, R., & Vendrametto, O. (2012). *Issues of sustainability on the Brazilian broiler meat production chain*. In Embrapa Informática Agropecuária-Artigo em anais de congresso (ALICE). In: International Conference Advances In Production Management Systems, Rhodes, 2012. Competitive Manufacturing for Innovative Products and Services: proceedings... Greece: International Federation for Information Processing.

Paula, L. F. D., & Pires, M. (2017). *Crise e perspectivas para a economia brasileira*. Estudos avançados, 31(89), 125-144.

Pereira, A. R. E. (2019). *Avaliação da eficácia do sistema de gestão de segurança alimentar da" Empresa de carnes*. Dissertação de mestrado em Tecnologia e Ciência Alimentar (Doctoral dissertation). http://hdl.handle.net/1822/72658

Portocarrero, I. R., & Araújo, P. D. A. (2018). A evolução da inclusão dos aspectos sociais da sustentabilidade no livre-comércio internacional. *Rev. de Direito, Economia e Desenvolvimento Sustentável*. Porto Alegre, 4(2).

Programa das Nações Unidas para o Desenvolvimento. (n.d.). Plano Estratégico do PNUD - Índice *de Desenvolvimento Humano*. Recuperado em 02 de outubro de 2021 em https://www.br.undp.org/content/brazil/pt/home/idh0/conceitos/o-que-e-o-idh.html

Programa das Nações Unidas para o Desenvolvimento. (n.d.). *Relatórios de Desenvolvimento Humano*. Recuperado em 16 de janeiro de 2022 em https://hdr.undp.org/en/indicators/137506

Ramos, L. S. (2020). Mensuração da competitividade nas exportações agropecuárias: uma análise empírica. *Revista Competitividade e Sustentabilidade*, 7(3), 668-687.

Richardson, J. D. (1971*). Constant-market-shares analysis of export growth*. Journal of International Economics, 1(2), 227-239.

Reis, J. D. (2015). Análise do crescimento das exportações brasileiras de carne bovina entre 1990 e 2002: uma aplicação do modelo constant market share. *Ceres*, 55(3).

Reis, L. C. S., & Gonçalves, J. D. C. Neto. (2014). Produção de alimentos: agricultura familiar x cultura de exportação no Brasil, sob a perspectiva da sustentabilidade. *Revista Brasileira de Políticas Públicas*, 4(1).

Ribeiro, F., Baumann, R., Oliveira, G. A., Giesteira, L. F., Tironi, L. F., & Alves, A. P. (2020). Comércio exterior, política comercial e investimentos estrangeiros: considerações preliminares sobre os impactos da crise do Covid-19. *Carta Conjunt.(Inst. Pesqui. Econ. Apl.)*, 1-26.

Rodrigues, L. M. S., & Marta-Costa, A. A. (2021). Competitividade das exportações de carne bovina do Brasil: uma análise das vantagens comparativas. *Revista de Economia e Sociologia Rural*, *59*(1), 1-14.

Rubin, L. da S.; Ilha, A. da S.; Machado Lopes, T. de A. (2012). Exportações de carne suína: performance e possibilidades frente à eliminação de barreiras. *Organizações Rurais & Agroindustriais, [S. l.]*, v. 14, n. 1, 2012. Disponível em: http://revista.dae.ufla.br/index.php/ora/article/view/456. Acesso em: 5 set. 2021.

Saab, M. S. B., Neves, M. F., & Cláudio, L. D. G. (2009). O desafio da coordenação e seus impactos sobre a competitividade de cadeias e sistemas agroindustriais. *Revista Brasileira de Zootecnia*, *38*(SPE), 412-422. DOI 10.11606/T.12.2004.tde-11012006-154745

Saggin, A. C. (2017). A competitividade e o desempenho das exportações de carne de aves das cooperativas paranaenses (2006-2016). Dissertação (Administração - Mestrado Profissional) - *Universidade Estadual do Oeste do Paraná,* Cascavel.

Santos, M. G., Mendonça, P. S. M., & Mariani, M. A. P. (2010). Sustentabilidade ambiental: o caso dos frigoríficos exportadores de carne bovina de Mato Grosso do Sul. *Revista Científica da Ajes*, 1(1).

Secretaria de Comercio Exterior. [SECEX]. (2022). *Balança Comercial e Estatísticas de Comércio Exterior*. Recuperado em 15 de fevereiro de 2022 em https://www.gov.br/produtividade-e-comercio-exterior/pt-br/assuntos/comercio-exterior/estatisticas

Sereia, V. J., Oliveira Toneto, T., & da Camara, M. R. G. (2005). Exportação e a competitividade paranaense do complexo carne. In *Congresso da Sociedade Brasileira de Economia, Administração e Sociologia Rural* (Vol. 43).

Sereia, V. J., Nogueira, J. M., & da Camara, M. R. G. (2002). As exportações paranaenses e a competitividade do complexo agroindustrial. *Revista Paranaense de Desenvolvimento*, (103), 45-59.

Silva, L. G., Marion, P. J., F°., & Campos, Í. (2008). A dinâmica das exportações brasileiras de carne bovina (1994-2005). *Revista de Estudos Sociais*, 10(19), 23-49.

Silva, S. Z. D., Triches, D., & Malafaia, G. (2011). Análise das barreiras não tarifárias à exportação na cadeia da carne bovina brasileira. *Revista de política agrícola*, 20(2), 23-39.

Silva, D. B. (2012). Sustentabilidade no Agronegócio: dimensões econômica, social e ambiental. *Comunicação & Mercado*, *1*(3), 23.

Silva, M. L., & da Silva, R. A. (2020). *Economia brasileira pré, durante e pós-pandemia do covid-19: impactos e reflexões*. Observatório Socieconômico da COVID-FAPERGS.

Souza, L. G. A. D., Sereia, V. J., Camara, M. R. G. D., & Pizaia, M. G. (2008). *O comércio brasileiro de carnes e a competitividade brasileira a partir da década de 90* (No. 1349-2016-106968).

Souza, L. G. A. D., Camara, M. R. G. D., & Sereia, V. J. (2011). As exportações e a competitividade da carne bovina brasileira e paranaense no período 1990-2005. *Revista Paranaense de Desenvolvimento*, (114), 153-178.

Souza Ribeiro, J. R., Santos, F. V. D., & Silva, L. A., F°. (2021). Competitividade das exportações de frangos da região sul do brasil–1997-2018. *Revista Estudo & Debate*, *28*(2).

Souza, G. D. S., Souza, M. O. D., Marques, D. V., Gazzola, R., & Marra, R. (2011). Previsões para o mercado de carnes. *Revista de Economia e Sociologia Rural*, *49*(2), 473-492.

Stal, E., Sereia, V. J., & Silva, R. C. D. (2010). Estratégias de internacionalização do setor agroindustrial brasileiro de carnes: exportação ou investimento direto no exterior?. *Future Studies Research Journal: Trends and Strategies*, *2*(2), 132-161.

Stefanutti, H. H. (2019). *Determinantes das exportações brasileiras de carne bovina no período de 2000 a 2018*. Trabalho de conclusão de curso. Recuperado em 11 de agosto de 2021 de https://repositorio.ufu.br/handle/123456789/27569

Stehfest, E., Van Den Berg, M., Woltjer, G., Msangi, S., & Westhoek, H. (2013). Options to reduce the environmental effects of livestock production–comparison of two economic models. *Agricultural Systems*, 114, 38-53.

Thomé, K. M., Reis, R. P., & Paiva, F. D. (2013). Mercado de carnes Brasil-Rússia: uma análise a partir da perspectiva da nova economia institucional. *Organizações Rurais & Agroindustriais*, *15*(1), 75-86.

Thorstensen, V. (1998). A OMC-Organização Mundial do Comércio e as negociações sobre comércio, meio ambiente e padrões sociais. *Revista brasileira de política internacional,* 41(2), 29-58.

Tonhá, H. M., Cunha, C. A. D., & Wander, A. E. (2010). *Vantagem Comparativa Revelada da carne bovina brasileira*. Recuperado em 10 de agosto de 2021 em http://repositorio.bc.ufg.br/handle/ri/16963

Ucak, H. (2007). Trends in Meat Industry–Production, Consumption and Trade. *Acta Scientiarum Polonorum. Oeconomia*, *6*(4), 125-131.

Veiga, J. E. D. (2010). Indicadores de sustentabilidade. *Estudos avançados*, *24*, 39-52. https://doi.org/10.1590/S0103-40142010000100006

Vergara, S. C. (2006). Projetos e relatórios de pesquisa. *São Paulo: Atlas*.

Vicensotti, J. M., Sanjuan Montebello, A. E., & Marjotta-Maistro, M. C. (2019). Competitividade brasileira no comércio exterior da carne bovina. *Revista IPecege*, 5(1), 7–18. https://doi.org/10.22167/r.ipecege.2019.5.7

Vieira, J. E. R., F°. (2016). *Expansão da fronteira agrícola no Brasil: desafios e perspectivas*. Recuperado em 18 de setembro de 2021 em http://repositorio.ipea.gov.br/handle/11058/9239

Vieira, J. E. R., F°., Gasques, J.G., & Sousa, A. D. (2012). Can Brazil feed the world? Not yet, but it has the potential! In: *The Futures Of Agriculture*. Brief n. 33: Global Forum on Agricultural Research (GFAR), Rome.

Viegas, I. F., Jank, M. S., & Miranda, S. H. D. (2007). Barreiras não tarifárias dos Estados Unidos e União Europeia sobre as exportações agrícolas brasileiras. *Informações Econômicas*, *7*(3), 27-38.

World Commission on Environmet and Development. [WCED]. (1987). *Our Common Future. Oxford*: Oxford University Press, 1987.

World Trade Organization. [WTO]. (2020) *Export prohibitions and restrictions: Information note*. World Trade Organization, Geneva. Recuperado em 23 de setembro de 2021 em https://www.wto.org/english/tratop_e/covid19_e/export_prohibitions_report_e.pdf

World Trade Organization. [WTO]. (2021a). *Environment – CTE Work*. Recuperado em 29 de maio de 2021 em https://www.wto.org/english/tratop_e/envir_e/cte00_e.htm

World Trade Organization. [WTO]. (2021b). *Environment – CTE Work*. Recuperado em 14 de agosto de 2021 em https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm

APPENDAGE A - DESTINATIONS OF ANIMAL PROTEIN EXPORTS FROM BRAZIL

(US$)

Beef destination	2000 to 2004	2005 to 2009	2010 to 2016	2017 to 2021
Afghanistan	0	948.811	396.952	52.132
Albania	566.271	5761.807	5455.165	11524.024
Algeria	37158.854	117086.205	77456.982	51080.031
Angola	4937.644	24358.937	33408.321	15134.202
Argentina	884.085	52.478	81.048	24244.587
Armenia	50.968	1113.527	593.236	555.739
Aruba	636.026	2586.860	3096.790	6151.383
Australia	115.667	128.040	100.228	2234.909
Austria	213.649	0	0	0
Azerbaijan	42.939	643.569	1819.308	784.738
Bahamas, The	90.655	154.327	613.993	1042.181
Bahrain	934.646	2761.559	1451.968	3158.120
Belgium	3201.405	2329.149	3224.420	3622.911
Bermuda	101.154	277.106	437.627	908.030
Bolivia	0	0	272.553	295.467
Bosnia and Herzegovina	71.083	7665.599	548.776	1.136
British Virgin Islands	145.908	235.499	0	38.859
Brunei	107.894	259.365	0	53.995
Bulgaria	10365.035	56920.672	0	0.934
Cameroon	27.015	92.569	86.183	66.486
Canada	81.249	128.462	187.802	2783.022
Cape Verde	291.866	1242.647	1455.428	1164.715
Central African Republic	0	0	0	652.966
Chile	123760.782	42084.043	270007.148	421395.718
China	557.643	753.816	178963.599	2609083.365
Comoros	256.825	723.522	702.347	1150.567
Congo, Dem. Rep.	25.147	389.150	212.997	328.784
Congo, Rep.	46.460	524.130	406.267	242.970
Cote d'Ivoire	535.310	2294.365	245.430	714.021
Croatia	1202.765	7040.539	1578.104	2.051
Cuba	0	0	1364.279	2534.138
Curaçao	0	0	1843.355	5831.841
Cyprus	2149.634	998.526	145.030	100.916
Czech Republic	211.316	76.479	0	0
Denmark	4252.772	10120.748	1680.618	930.339
Djibouti	30.098	27.273	133.092	107.447
Egypt, Arab Rep.	77053.403	271574.665	507747.910	432211.869
Equatorial Guinea	947.451	2179.879	1331.760	436.977

Estonia	390.834	276.169	143.356	0
Faeroe Islands	289.636	172.815	0	0
Finland	5058.240	11847.765	4879.659	1482.321
Fm Sudan	0	280.697	11.904	0
France	8124.168	15710.545	3184.440	2787.180
Gabon	131.897	2560.963	2441.079	7106.945
Gambia, The	86.238	189.133	130.358	0
Georgia	53.676	976.592	4191.522	7066.889
Germany	53623.935	69554.413	59088.977	43056.470
Ghana	181.454	3061.585	54.630	273.496
Gibraltar	219.078	114.248	0	3.312
Greece	4277.706	4917.017	996.310	717.793
Grenada	66.956	114.236	79.868	139.032
Guinea	0	205.287	126.570	47.199
Haiti	42.587	472.680	80.811	87.985
Honduras	0	53.129	592.830	71.158
Hong Kong, China	28500.974	148309.758	645237.702	844277.581
Hungary	138.278	307.023	0	0
Indonesia	205.910	0	122.059	39590.950
Iran, Islamic Rep.	41497.303	183913.141	443032.949	236007.121
Iraq	0	4003.931	9950.756	11911.368
Ireland	8834.084	11064.963	655.693	88.016
Israel	36659.373	79168.082	76530.025	116781.778
Italy	79432.113	160743.697	176794.740	169688.622
Japan	89.656	0.592	275.027	34.787
Jordan	703.769	15230.401	44749.745	60026.738
Kazakhstan	472.723	7006.446	3530.477	50.870
Korea, Dem. Rep.	1525.717	121.877	230.661	0.233
Korea, Rep.	1096.099	1250.703	405.533	1819.716
Kuwait	3846.145	11405.144	10420.599	4893.705
Kyrgyz Republic	0	75.926	1205.626	0
Latvia	212.577	267.099	1900.674	34.016
Lebanon	14414.622	62435.840	79709.708	55609.802
Liberia	138.300	972.147	239.106	927.396
Libya	8900.414	49161.284	42274.393	26681.506
Lithuania	490.778	1293.223	1108.385	62.191
Madagascar	0	0	1296.861	0.214
Malaysia	853.119	5336.444	6552.423	19482.982
Maldives	180.130	650.395	450.226	1241.054
Mali	0	43.561	186.023	30.514
Malta	2788.091	1591.724	176.675	182.115
Marshall Islands	0	70.959	116.727	375.443
Mauritania	42.043	114.496	248.366	112.357
Mauritius	465.990	549.386	348.667	810.214

Mayotte	0	0	0	2637.040
Moldova	1066.630	4912.322	282.552	73.119
Montenegro	0	4787.749	1240.918	224.324
Morocco	72.184	0	461.797	781.496
Mozambique	313.095	601.979	116.034	59.328
Myanmar	0	0	6.826	771.756
Namibia	0	394.273	215.698	96.410
Netherlands	131712.493	189719.718	137524.678	124146.657
Netherlands Antilles	1961.156	4084.179	4174.244	0
New Zealand	32.421	154.812	73.423	0
Niger	0	0	0	21118.586
Nigeria	34.861	158.165	144.242	0
North Macedonia	1868.853	10780.191	1750.590	1941.015
Norway	4347.462	5108.166	1937.097	819.339
Occ.Pal.Terr	0	0	23466.545	23513.937
Oman	201.274	497.858	1115.330	4351.044
Other Asia, nes	2.807	313.949	0	429.947
Pakistan	0	538.743	101.382	1.587
Panama	0	105.230	179.415	358.043
Paraguay	0	6.535	790.026	6374.849
Peru	711.210	2651.919	1626.186	9477.930
Philippines	17716.825	39876.016	33887.449	108402.527
Poland	620.094	1297.754	0	1.482
Porto Rico	0	0	0	6049.405
Portugal	11320.131	15732.704	4537.242	4202.362
Qatar	880.321	4511.706	4958.010	14683.539
Romania	41.311	29015.080	0	0.836
Russian Federation	95902.227	914455.960	931537.704	195857.420
Saudi Arabia	48905.507	91064.707	86426.231	160256.220
Senegal	319.541	1370.250	479.582	750.636
Serbia, FR(Serbia/Montenegro)	552.912	7702.786	5223.068	7983.118
Sérvia	0	0	0	14608.387
Seychelles	0	249.382	466.215	972.368
Sierra Leone	161.130	43.801	131.114	40.274
Singapore	14090.441	24905.214	40945.748	79550.077
South Africa	3685.685	4175.316	318.038	2408.675
Spain	52145.200	60442.029	42079.144	42998.915
Sri Lanka	252.419	466.701	157.484	70.042
Sudan	0	0	385.078	0
Suriname	0	159.679	0	149.478
Sweden	15172.213	30198.655	26673.038	18659.172
Switzerland	19123.013	30615.317	11048.980	8117.303
Syrian Arab Republic	30.389	1490.945	2020.407	0
Tajikistan	0	147.824	84.218	157.944

Tanzania	0	105.188	115.685	156.526
Thailand	0	0	399.888	4443.210
Tunisia	0	4035.565	5252.491	3804.602
Turkey	202.509	1623.987	2702.495	44732.881
Turkmenistan	0	0	469.664	544.097
Ukraine	1615.328	31753.042	9167.306	64.720
United Arab Emirates	7668.293	35529.234	64317.860	172475.355
United Kingdom	72949.042	106322.232	26356.881	20229.319
United States	190.326	515.233	725.543	124266.183
Uruguay	325.783	4673.617	3834.233	73035.266
Uzbekistan	84.224	446.786	390.862	0
Venezuela	6081.053	151587.629	479152.071	5675.695
Vietnam	0	8356.919	10119.267	6259.095
Yemen	28.419	84.723	145.623	0

Pork Destination	2000 to 2004	2005 to 2009	2010 to 2016	2017 to 2021
Albania	3127.082	14758.564	11137.483	7432.866
Angola	1132.794	20800.521	57353.759	21823.741
Anguila	21.219	33.128	84.635	194.129
Argentina	39614.128	42994.885	61206.433	79187.791
Armenia	1187.105	7104.628	9926.975	3932.517
Aruba	31.734	55.800	1232.991	2017.788
Australia	0	0	51.125	658.699
Azerbaijan	117.389	1069.976	5209.329	1338.516
Bahamas, The	71.568	73.829	348.117	533.464
Belarus	147.874	0	1889.868	1039.943
Bermuda	90.984	221.851	270.673	154.675
Bolivia	1.868	4.548	0.097	824.542
Bonaire	0	0	287.772	209.398
Bosnia and Herzegovina	0	792.051	150.086	1.364
British Virgin Islands	62.765	52.921	167.119	174.570
Brunei	50.376	69.589	84.645	0
Bulgaria	4021.914	10576.261	0	0.699
Cameroon	125.962	536.350	330.780	0.942
Canada	377.465	64.461	0	75.931
Cape Verde	30.532	185.080	119.419	378.801
Cayman Islands	120.648	482.068	1.802	7.203
Chile	139.278	1319.968	18601.274	94804.861
China	2062.858	1075.106	30373.119	707659.523
Congo, Dem. Rep.	39.552	354.639	1536.132	6777.163
Congo, Rep.	31.477	401.844	460.740	1168.855
Congo, República Democrática	0	0	0	9860.788
Cote d'Ivoire	86.757	174.937	469.205	2820.491
Cuba	338.368	1946.884	109.604	101.354

Curaçao	0	0	2721.057	359.288
Denmark	81.185	69.096	695.817	185.136
Ecuador	303.190	2513.947	6016.416	0.743
Egypt, Arab Rep.	0	127.334	739.277	404.027
Equatorial Guinea	146.636	613.850	676.709	450.377
Estonia	1006.116	0	0	0
France	198.163	1718.364	81.762	7.817
Gabon	198.744	2723.838	2391.309	2558.880
Georgia	2018.139	7566.019	16323.220	26922.495
Germany	2077.501	97.296	75.674	18.842
Ghana	64.778	124.679	78.996	35.947
Greece	441.523	700.749	0	68.935
Guam	0	0	0	209.631
Guatemala	239.391	0	0	0
Haiti	289.769	1468.300	1784.802	1113.336
Hong Kong, China	53921.128	123798.809	194839.281	231760.802
Hungary	222.126	0	0	0
Israel	60.403	91.734	85.335	30.504
Italy	1189.955	482.991	0	11.492
Japan	97.354	53.152	4413.837	27464.400
Kazakhstan	1639.293	10258.651	4090.851	1981.218
Kenya	83.367	682.873	478.558	0
Korea, Dem. Rep.	1028.852	977.533	0	0.184
Korea, Rep.	963.364	6339.019	295.905	7291.876
Kyrgyz Republic	0	0	2497.288	384.888
Lebanon	0	210.628	400.896	648.013
Liberia	47.070	253.336	261.667	739.872
Lithuania	3386.365	1137.424	246.687	0
Macao	165.243	48.662	136.319	178.548
Marshall Islands	0	0	0	321.997
Mauritius	0	0	64.345	260.345
Mexico	389.558	0	0	7.666
Moldova	3177.810	28487.034	10396.853	2098.512
Montenegro	0	3473.376	67.668	1.515
Mozambique	45.546	119.179	542.040	583.202
Namibia	0	359.783	80.798	93.066
Netherlands	12244.648	1244.327	334.660	204.190
Netherlands Antilles	1769.519	2176.880	2796.945	0
North Macedonia	908.624	53.389	0	0
Oman	97.531	41.482	61.027	37.443
Panama	0	0	84.240	2234.234
Paraguay	6.462	2.313	1148.248	566.577
Philippines	258.769	99.422	2162.231	20619.025
Poland	246.327	72.840	0	46.745

Porto Rico	0	0	0	9237.735
Portugal	0	768.286	0	21.920
Russian Federation	277526.915	672027.509	539079.467	164463.482
Saint Maarten (Dutch part)	0	0	83.683	1384.946
Saudi Arabia	161.759	48.058	342.848	33.450
Senegal	63.994	141.872	154.766	91.837
Serbia, FR(Serbia/Montenegro)	610.672	1756.556	381.447	45.041
Seychelles	0	187.194	529.520	909.479
Singapore	15080.297	57911.422	77341.302	99851.208
South Africa	5666.165	7926.762	1061.148	12457.020
Spain	577.356	134.019	131.039	0.286
Sri Lanka	0	0	0	262.289
Suriname	5.994	135.733	159.874	0
Switzerland	402.294	73.872	104.285	57.519
Tanzania	0	66.534	133.812	0
Thailand	0	0	1029.368	1291.815
Timor Leste	0	0	0	680.050
Trinidad and Tobago	139.020	177.162	126.153	0
Turkey	91.429	928.987	449.725	696.386
Turkmenistan	0	46.586	218.235	658.858
Ukraine	25924.992	88661.031	143249.484	1974.455
United Arab Emirates	1669.962	11173.570	14471.318	21623.497
United Kingdom	286.326	143.018	0	72.325
United States	334.527	445.571	1908.482	29388.694
Uruguay	8602.030	16928.822	51589.918	83208.689
Uzbekistan	1797.744	1656.743	296.851	0
Venezuela	16.866	6467.038	32914.309	1605.115
Vietnam	0	38.547	656.020	43298.114
Zambia	0	0	143.490	178.374
Zimbabwe	0	357.169	36.477	0

Chicken destination	2000 to 2004	2005 to 2009	2010 to 2016	2017 to 2021
Afghanistan	0	2881.740	8832.453	15881.876
Albania	1333.148	7334.774	12805.094	23720.684
Angola	16225.162	49913.095	118027.368	63540.811
Anguila	3.662	58.257	228.350	406.747
Antigua and Barbuda	562.620	2120.463	3167.601	4957.438
Argentina	13331.894	5036.374	8665.234	6263.206
Armenia	980.366	4834.744	9086.610	2183.629
Aruba	1058.796	4377.500	7097.448	7312.450
Australia	0	41.323	298.843	197.201
Austria	1608.573	184.820	132.307	53.974
Azerbaijan	3882.481	15841.153	15426.280	292.669

Bahamas, The	74.317	2780.108	9726.651	14984.067
Bahrain	12400.288	24896.053	35997.766	43472.282
Belarus	2216.353	0	230.479	711.107
Belgium	931.915	3788.839	19633.567	1750.665
Belize	0	139.537	564.647	2.759
Benin	707.313	4623.008	15631.976	4467.121
Bermuda	17.259	80.557	168.016	118.098
Bolivia	120.490	1325.533	8019.292	4102.295
Bonaire	0	0	0	693.646
Bosnia and Herzegovina	172.778	876.152	622.832	1.233
British Virgin Islands	145.201	22.234	63.537	136.442
Brunei	0	71.832	362.473	80.687
Bulgaria	5252.390	6371.072	1488.153	324.779
Cambodia	0	0	0	2599.823
Cameroon	1404.935	326.751	780.232	456.692
Canada	8862.422	36244.543	38903.653	35222.120
Cape Verde	517.986	4442.370	2429.506	1066.483
Cayman Islands	1763.101	3394.338	77.330	272.255
Central African Republic	26.885	84.698	943.624	1693.231
Chad	0	223.938	817.652	1810.586
Chile	36.884	828.427	34701.262	90398.162
China	13024.609	29956.611	508628.178	1068019.020
Comoros	826.758	1354.965	278.361	3025.458
Congo, Dem. Rep.	1936.443	8782.591	9599.361	10548.243
Congo, Rep.	1591.296	14901.596	23108.735	10692.759
Cook Islands	0	117.143	227.626	0
Cote d'Ivoire	1168.456	608.032	423.318	166.700
Croatia	581.272	7429.474	17704.494	0.340
Cuba	14446.417	24868.039	46918.035	59774.255
Curaçao	0	0	13703.991	11531.468
Cyprus	78.270	1468.836	826.301	63.344
Czech Republic	13117.638	4044.084	910.707	0
Denmark	548.577	2413.789	858.531	324.254
Djibouti	139.891	584.654	1287.486	3659.741
Dominica	0	691.905	1016.387	1469.813
Dominica Island	0	0	0	2146.676
Dominican Republic	0	51.045	58.672	5821.890
East Timor	0	0	3131.073	6364.047
Egypt, Arab Rep.	2264.337	34476.735	149205.066	98180.656
Equatorial Guinea	372.466	5374.303	9236.884	3366.717
Estonia	194.237	2482.971	66.337	0
Ethiopia(excludes Eritrea)	0	0	275.744	233.090
Finland	79.807	385.899	0	56.171
Fm Sudan	12.320	366.100	2836.149	0

France	7725.606	14668.580	8047.878	774.551
French Polynesia	41.576	395.323	0	0
Gabon	2859.504	12152.227	12274.821	7596.635
Gambia, The	476.229	1170.181	3236.171	4110.176
Georgia	3749.152	13461.936	9256.758	13824.098
Germany	110907.334	76454.919	14331.271	16875.197
Ghana	2334.229	20682.679	33892.466	20716.439
Gibraltar	0	234.650	97.823	2.358
Greece	1989.824	2726.173	818.501	1291.372
Grenada	857.408	3326.959	5411.012	6180.877
Guinea	125.095	612.265	2647.656	3553.464
Guinea-Bissau	104.764	432.266	352.728	161.218
Guyana	3.864	47.753	48.574	650.560
Haiti	1245.307	1818.032	1899.671	4953.756
Hong Kong, China	91177.242	394813.839	445334.357	286233.540
Hungary	684.016	1280.823	1603.666	34.627
Indonesia	230.418	375.540	101.888	12.781
Iran, Islamic Rep.	5405.203	19784.178	33818.533	2176.781
Iraq	1492.687	65550.761	142952.133	142959.554
Ireland	1447.395	3759.480	2765.082	1362.275
Israel	68.990	252.660	156.882	214.055
Italy	9203.232	7118.204	4925.685	1021.924
Japan	249160.704	706834.798	971866.931	782962.086
Jordan	6791.710	44455.928	73487.756	78019.193
Kazakhstan	611.318	3969.127	2960.186	1405.073
Kenya	41.983	594.447	2143.415	819.890
Korea, Dem. Rep.	90.925	378.973	0	13.837
Korea, Rep.	395.986	41368.696	135311.546	155760.359
Kuwait	49010.993	187160.044	216059.597	172868.532
Kyrgyz Republic	38.007	1558.859	1502.943	659.348
Latvia	231.435	685.513	25.508	0.459
Lebanon	28.094	4934.349	20575.476	9607.307
Liberia	439.924	1653.556	1891.907	5676.914
Libya	15.003	0	77215.140	78982.276
Lithuania	322.331	930.708	355.800	0
Macedonia	0	0	0	15233.116
Madagascar	476.493	208.658	225.707	23.732
Malaysia	3633.823	3484.480	4058.860	17978.998
Maldives	773.153	3868.134	11640.264	12206.371
Mali	0	68.855	138.960	186.957
Malta	96.171	367.943	240.968	104.371
Marshall Islands	0	80.204	0	250.009
Mauritania	321.175	6084.686	5518.546	8409.984
Mayotte	0	0	0	724.386

Mexico	0	0	48060.865	140615.494
Moldova	1376.807	9664.238	1557.126	4445.262
Mongolia	0	0.785	189.986	197.645
Montenegro	0	4059.724	2056.040	1016.478
Morocco	263.820	505.729	743.102	615.002
Mozambique	1329.005	9397.966	9380.997	3341.868
Namibia	233.790	1568.608	1429.149	4974.046
Nepal	12.285	97.433	367.867	0
Netherlands	120294.012	215836.317	109841.443	56374.417
Netherlands Antilles	3613.506	9336.947	12454.104	0
New Caledonia	1602.845	3383.584	3973.194	3066.515
New Zealand	296.559	703.908	78.892	0
Niger	0	46.027	242.029	206.554
Nigeria	56.342	62.130	222.646	130.679
North Macedonia	2269.488	12165.041	19206.623	10180.362
Oman	21342.111	56508.360	109959.813	119846.675
Pakistan	204.308	439.489	452.161	557.297
Panama	0	54.825	265.414	261.911
Paraguay	85.719	346.725	201.098	66.534
Peru	455.977	1251.069	8994.837	35997.402
Philippines	782.419	4367.979	15342.469	53797.790
Poland	2791.414	201.249	1144.068	13.449
Portugal	3670.275	9863.057	2440.121	1537.124
Qatar	19114.345	62766.137	104978.515	113938.971
Romania	11868.419	34200.738	4517.716	391.429
Russian Federation	106877.275	226254.167	164525.239	124439.959
Saint Christopher and Nevis	0	0	0	2605.481
Saint Maarten (Dutch part)	0	0	0	2396.867
Sao Tome and Principe	8.315	229.371	119.582	180.290
Saudi Arabia	231675.344	560786.863	1201228.801	787051.172
Senegal	1808.826	3626.385	70.490	0.397
Serbia, FR(Serbia/Montenegro)	664.235	2846.695	10022.915	2989.280
Seychelles	125.440	771.807	3176.232	2625.291
Sierra Leone	573.724	612.871	2029.262	3137.246
Singapore	41431.757	114465.432	170714.045	185030.835
Sint Maarten	0	0	0	5237.801
Slovak Republic	1289.007	948.529	295.376	0.085
Slovenia	71.677	24.914	139.028	23.156
Somalia	23.497	0	42.327	1333.181
South Africa	29219.554	126495.477	136950.385	200823.267
South Korea	0	0	0	204153.086
South Sudan	0	0	424.564	2235.132
Spain	34188.801	54554.142	59261.513	38349.339
Sri Lanka	601.141	2413.408	249.854	75.223

St. Kitts and Nevis	0	349.518	1402.203	1718.327
Sudan	0	0	3299.585	958.230
Suriname	2560.175	5712.497	6232.582	3338.977
Sweden	554.242	616.023	69.342	0.522
Switzerland	4741.520	29105.192	38449.912	28046.950
Syrian Arab Republic	0	2024.980	2004.735	237.914
Tajikistan	201.212	6752.911	3700.237	1790.500
Tanzania	39.867	185.041	379.054	1934.270
Thailand	7.497	0	232.715	1503.437
Togo	43.041	394.239	989.502	765.423
Tonga	0	8.155	130.973	204.342
Trinidad and Tobago	93.915	111.563	160.625	28.890
Tunisia	19.026	748.506	2217.311	810.913
Turkey	4398.782	16045.175	26480.047	32593.290
Turkmenistan	454.218	824.393	519.840	5749.094
Ukraine	14011.265	6326.101	851.981	424.888
United Arab Emirates	64799.632	255823.032	462068.505	538135.671
United Kingdom	80806.962	51638.847	14369.951	15088.664
United States	439.906	1040.393	979.000	672.147
Uruguay	119.547	29.325	322.365	596.465
Uzbekistan	944.190	514.485	205.740	386.651
Venezuela	32588.716	249539.856	291100.162	16357.772
Vietnam	17.303	16691.443	17567.490	30435.031
Virgin Islands (UK)	0	0	0	465.168
Yemen	38022.258	74607.815	102378.622	132417.934
Zambia	192.698	0	79.579	265.399
Zimbabwe	0	0	3896.588	135.523