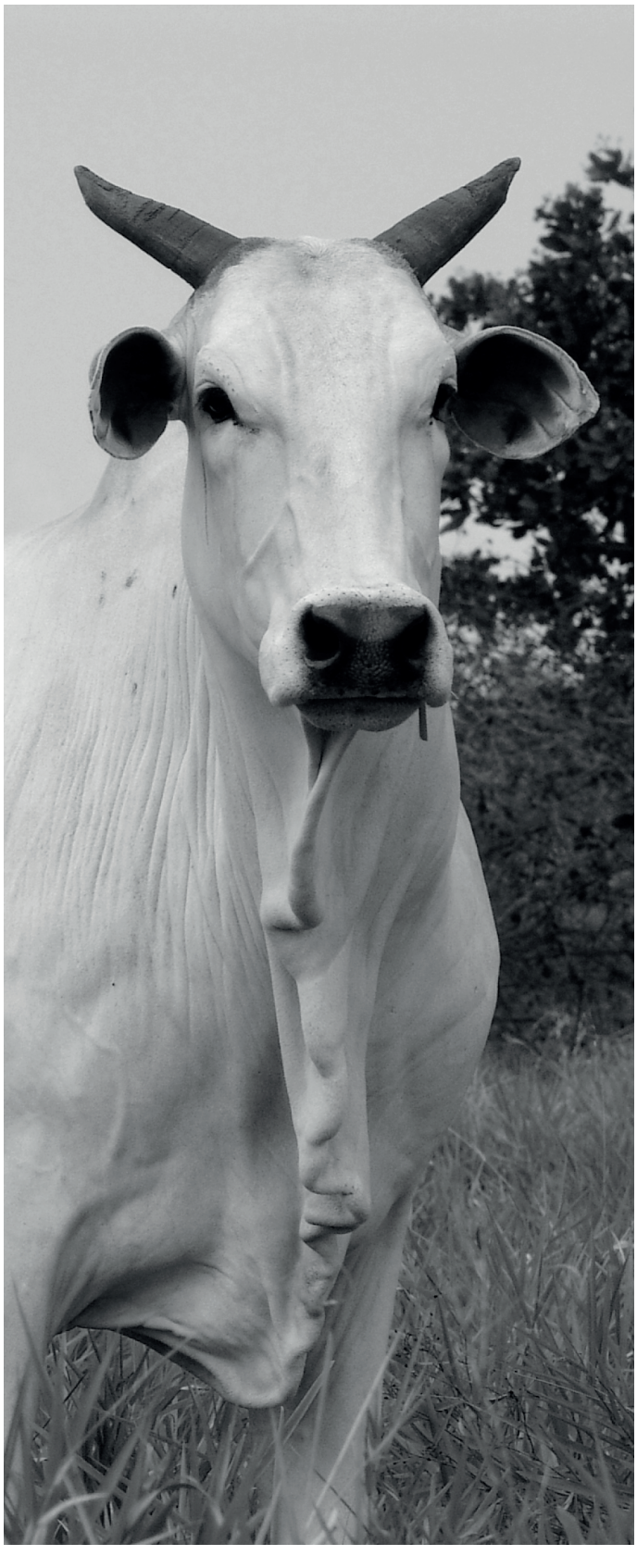

SEPTEMBER 2021

# PROJECT:
# CHINA STUDY

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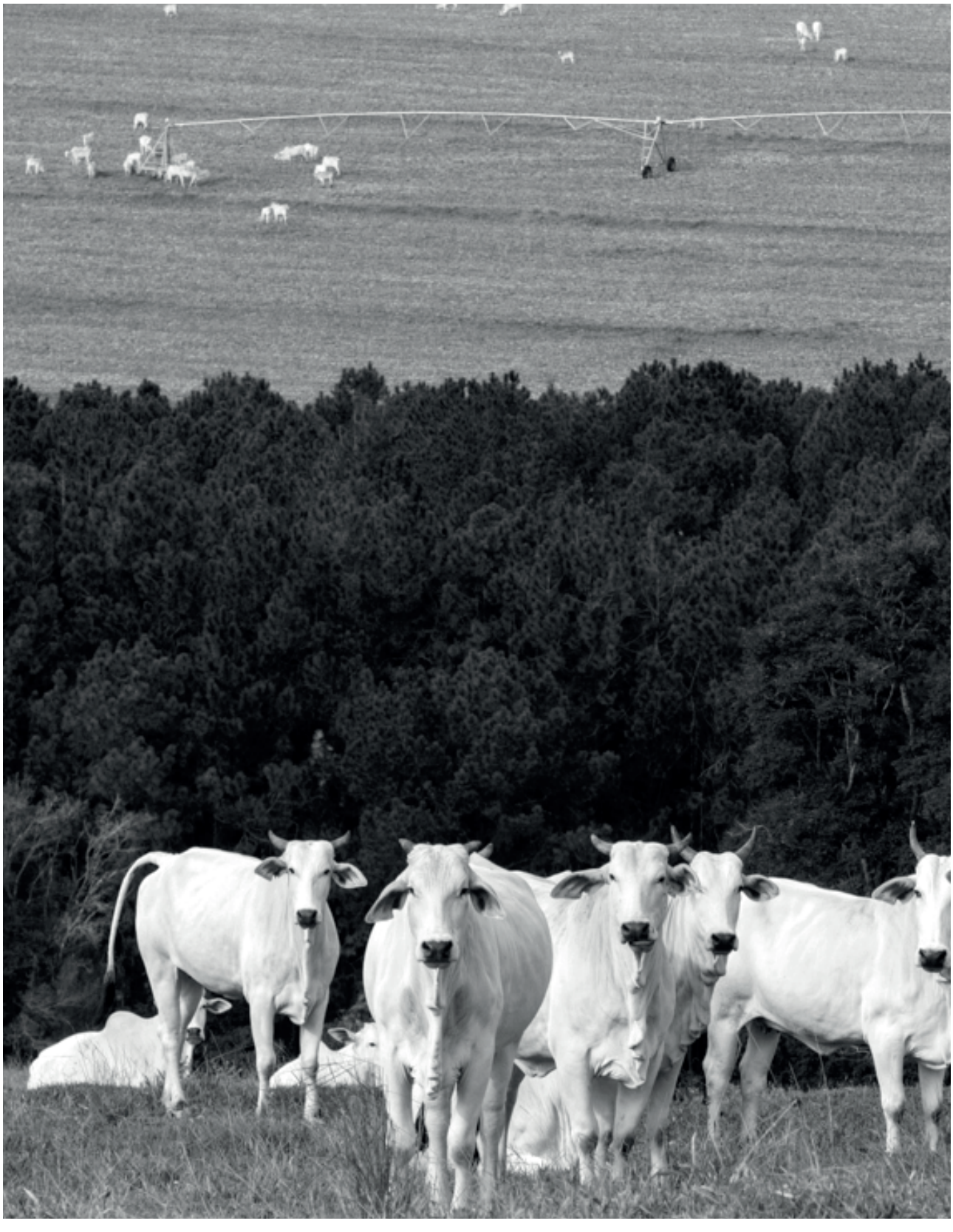

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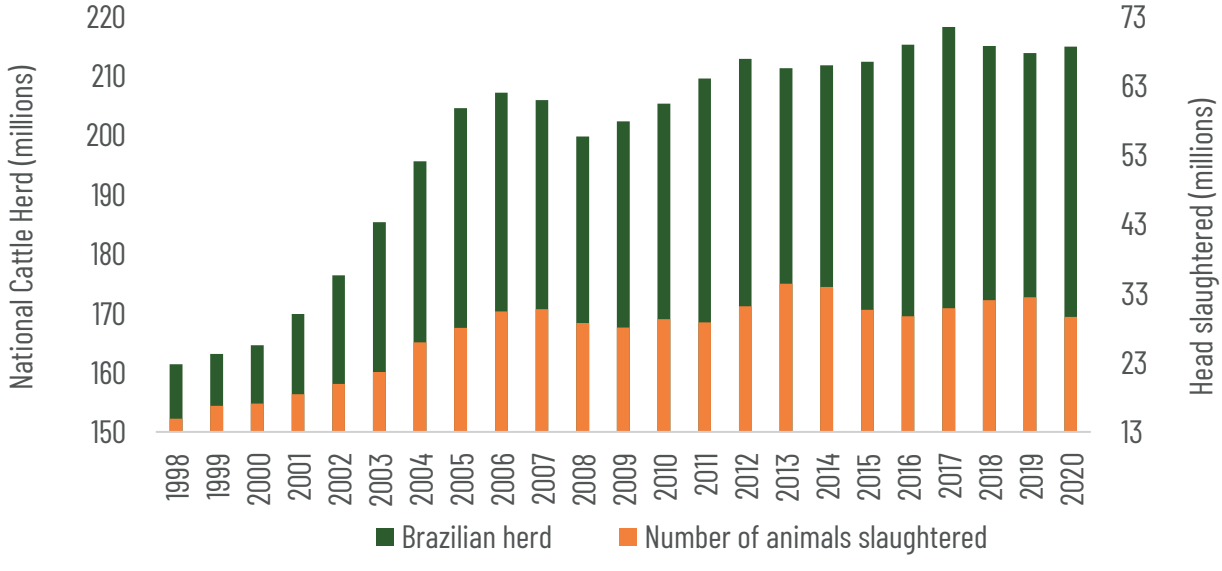
# EXECUTIVE **SUMMARY**

Brazil has the largest commercial cattle herd in the world, estimated at 215 million head, and of this total, approximately 13.8% were destined for slaughter in 2020 (IBGE) (figure 1).

From 1998 to 2020, the national herd grew 33.1% and the number of heads slaughtered increased 98.5%. This growth in off-take (slaughtering in relation to the total herd) is due to the reflection of the increase in global and domestic demand during the period analyzed, in addition to the greater use of agronomic techniques.

**Figure 1.**
Evolution of the Brazilian herd and the number of animals slaughtered, in millions of head, between 1998 and 2019.




**Source:** IBGE / Prepared by: Scot Consultoria

Brazil occupies a prominent position in the international market, being the largest producer of beef and the second largest exporter of the commodity (USDA), see table 1.

**Table 1.**
Beef exports and production in natura, in thousand tons of carcass equivalent, between 2015 and 2021.

| | COUNTRY | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021* |
|---|---|---|---|---|---|---|---|---|
| EXPORT | Brazil | 1,659 | 1,652 | 1,803 | 2,021 | 2,314 | 2,539 | 2,670 |
| | United States | 1,028 | 1,160 | 1,297 | 1,433 | 1,373 | 1,331 | 1,402 |
| | Australia | 1,770 | 1,412 | 1,416 | 1,582 | 1,738 | 1,455 | 1,360 |
| | India | 1,754 | 1,709 | 1,786 | 1,511 | 1,494 | 1,050 | 1,200 |
| | Argentina | 180 | 209 | 283 | 501 | 763 | 830 | 770 |
| | Other | 2,732 | 2,851 | 2,930 | 3,058 | 3,210 | 3,298 | 3,362 |
| PRODUCTION | United States | 10,817 | 11,507 | 11,943 | 12,256 | 12,384 | 12,381 | 12,397 |
| | Brazil | 9,425 | 9,284 | 9,550 | 9,900 | 10,200 | 10,100 | 10,470 |
| | European Union | 7,684 | 7,880 | 7,869 | 8,003 | 7,878 | 7,800 | 7,730 |
| | China | 6,169 | 6,169 | 6,346 | 6,440 | 6,670 | 6,550 | 6,685 |
| | India | 4,080 | 4,170 | 4,230 | 4,240 | 4,270 | 3,650 | 3,950 |
| | Other | 12,174 | 12,308 | 12,304 | 12,457 | 12,584 | 12.406 | 19,930 |

**Expectation*
**Source:** USDA / Preparation: Scot Consultoria

Brazilian exports grew 81.2% from 2010 to 2020 (Secex), driven by the last five-year period (2016-2020), which saw an increase of 59.7%.

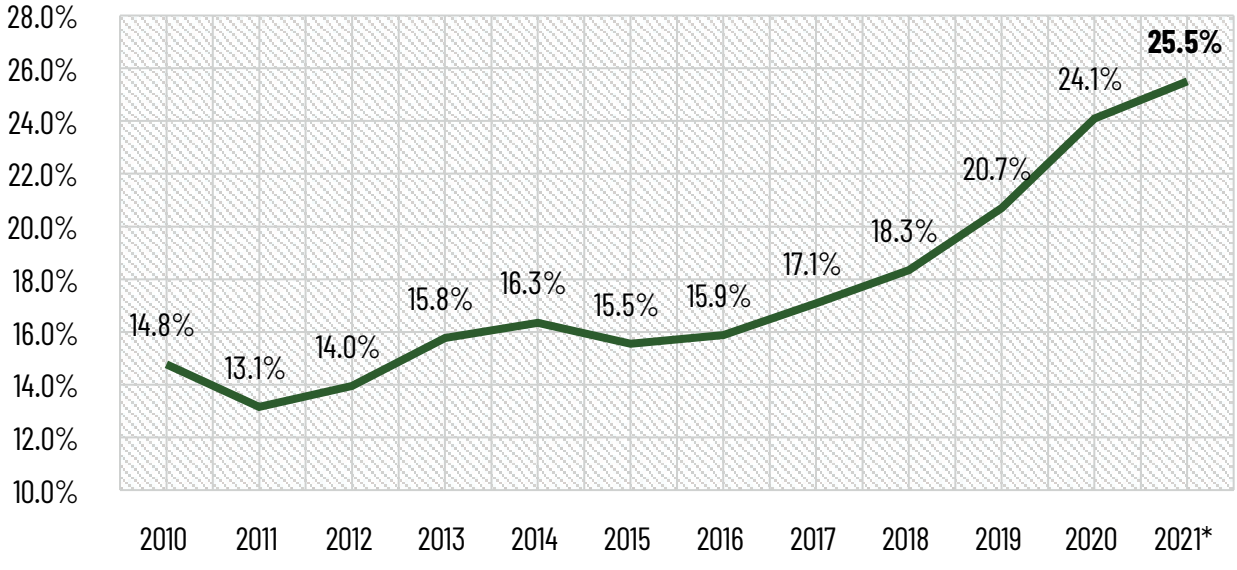
In this period, China increased demand for meat following the outbreak of African swine fever (ASF) in the country, which began in 2018 and decimated a portion of the Chinese herd. In addition, the trade war between the United States and China in 2019 and 2020, favored Brazilian shipments.

In the domestic market, the current situation in the beef cattle industry is one of retention of females, resulting in fewer cattle going to slaughter. Between 2019 and 2020 cattle slaughter, in head count, fell by 8.8% (figure1).

With weaker domestic demand, due to the economic crisis caused by the influenza pandemic, a larger portion of production was destined for the foreign market.

The increase in external demand allowed for the greater share of exports in relation to the meat produced in 2020. Shipments represented 24.1% of production in carcass equivalent. See Figure 2.

**Figure 2.**
Share of in natura beef exports in relation to Brazilian production, in %, between 2010 and 2021.




**estimate*
**Source:** IBGE, SECEX, USDA / Preparation: Scot Consultoria

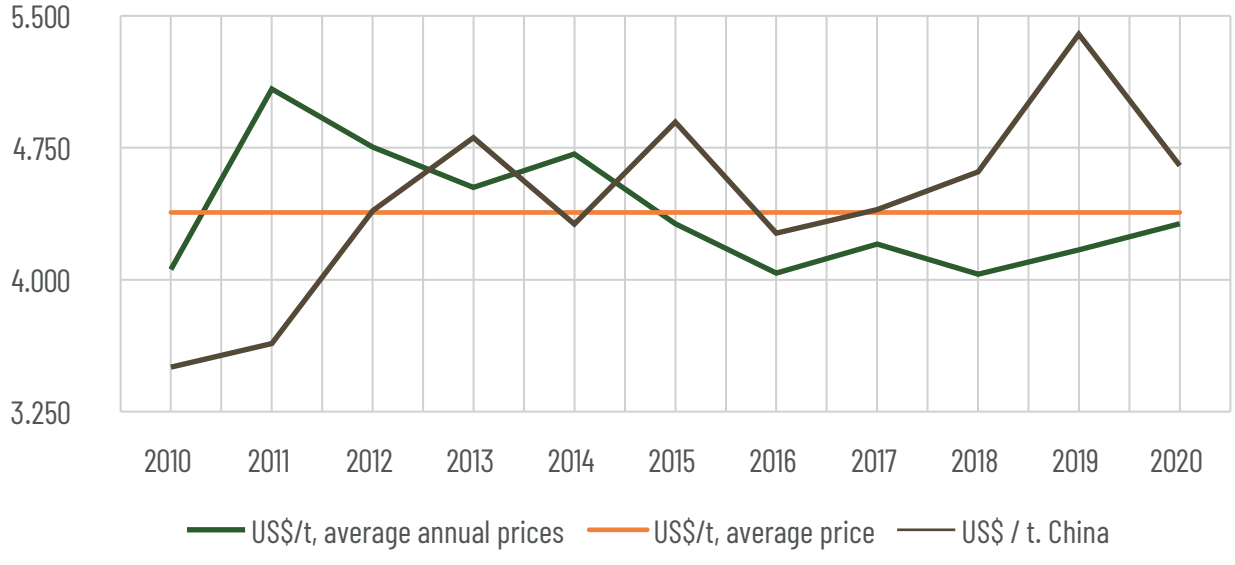
The Chinese market has been the main driver of Brazilian exports in recent years and in 2020 accounted for 45.7% of total beef shipments and 51.3% of revenues.

The devaluation of the Brazilian currency in relation to the US currency increased the competitiveness of beef in the international market, collaborating with the increases in shipments.

Specifically in trade with China, the higher demand for meat (emergency status) due to African swine fever has directly influenced the volumes shipped by Brazil as of the end of 2019.

At that time, the average sale prices to China were well above the average price of beef exported by Brazil, considering all destinations. See Figure 5.

**Figure 3.**
Average price per ton, average annual prices, and average annual prices to the Chinese market, in US$/ton, of in natura beef exported by Brazil between 2010 and 2020.



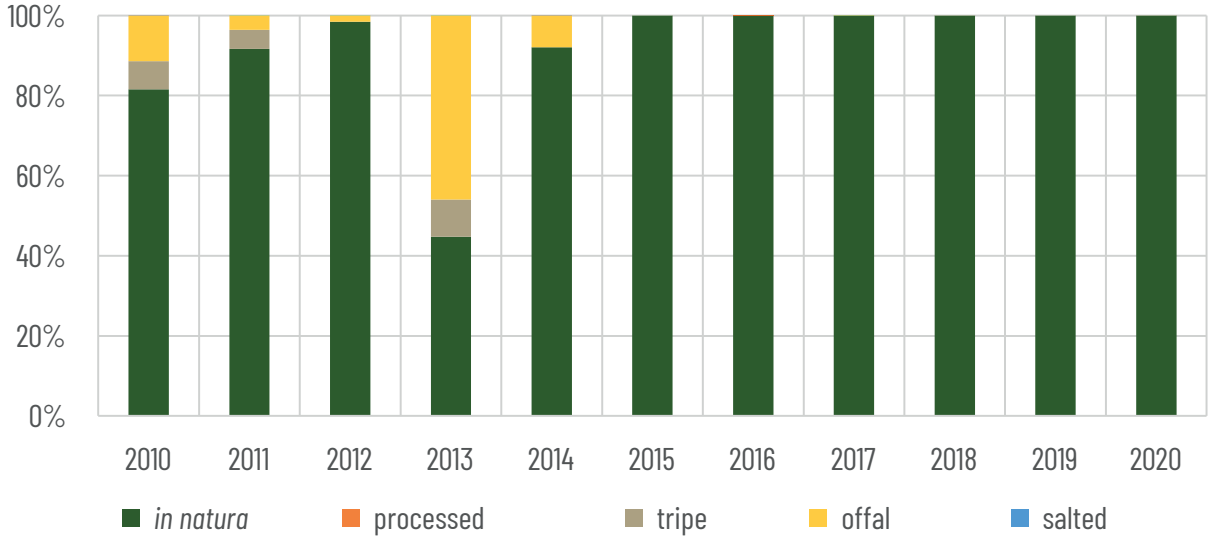

**Source:** Secex / Preparation: Scot Consultoria

Note that since 2020, with the partial recovery of swine production in China and increases in Chinese chicken and beef production, and the participation of other countries in beef exports to the Asian country, prices have fallen but are still above average.

For comparison, in January/21, the average price of beef exported to China was US$4,639.14 per ton, against US$4,510.13 per ton in the average of all destinations.

China buys mainly *in natura* beef from Brazil, representing more than 90% of the shipments in the last ten years (figure 4).

**Figure 4.**
Share of in natura beef shipments destined for the Chinese market between 2011 and 2020.




**Source:** Secex / Preparation: Scot Consultoria

*In natura* beef exports to China are mostly "Boneless meat of bovine animals, frozen".

The lowest participation among *in natura* meat shipments for the category was 99.4%, in 2010.

**Table 2.**
Participation of ***in natura* beef** in the total volume exported (%) and participation by NCM in relation to the total in natura beef shipped, from 2015 to 2020.

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| **Participation of in natura beef in the total volume** | 99.94% | 99.94% | 99.95% | 99.96% | 100.00% | 99.98% |
| Carcasses and half-carcasses of bovine animals, fresh or chilled | 0% | 0% | 0% | 0% | 0% | 0% |
| Boneless beef forequarters, fresh/chilled | 0% | 0% | 0% | 0% | 0% | 0% |
| Unboned beef hindquarters, fresh/chilled | 0% | 0% | 0% | 0% | 0% | 0% |
| Other cuts of beef, with bone in, fresh or chilled | 0% | 0% | 0% | 0% | 0% | 0% |
| Boneless beef, fresh or chilled | 0% | 0% | 0.01% | 0% | 0% | 0% |
| Carcasses and half-carcasses of beef, frozen | 0% | 0% | 0% | 0% | 0% | 0% |
| Boneless beef forequarters, frozen | 0% | 0% | 0% | 0% | 0% | 0% |
| Beef boneless hindquarters, frozen | 0% | 0% | 0% | 0% | 0% | 0% |
| Other beef cuts with bone in, frozen | 0% | 0% | 0% | 0% | 0.02% | 0% |
| Boneless beef, frozen | 100.00% | 100.00% | 99.99% | 100.00% | 99.98% | 100.00% |

**Source:** Secex / Preparation: Scot Consultoria

To have access to the Chinese market, the meat processing industry must have, essentially, the certification of the Federal Inspection Service (SIF). In addition, an indication from MAPA is required to be qualified, informing that the establishment meets the sanitary requirements.

The information is analyzed by the importer, for qualification, with the obtaining of an International Health Certificate (CSI), and from there to start exporting.

Table 16 shows the list of plants authorized to export to the Chinese market, by company, region, and Federal Inspection Service number.

**Table 16.**
Detailing the slaughterhouses qualified to export to the Chinese market.

| ENABLED SLAUGHTERING PLANT | SIF | STATE | MUNICIPALITY |
|---|---|---|---|
| MINERVA S. A. | 431 | GO | Palmeiras de Goiás |
| JBS S/A | 2058 | GO | Senador Canedo |
| JBS S/A | 4507 | GO | Mozarlândia |
| PRIMA FOODS S. A. | 177 | MG | Araguari |
| JBS S/A | 504 | MG | Ituiutaba |
| FRISA FRIGORÍFICO RIO DOCE S/A | 2051 | MG | Nanuque |
| JBS S/A | 3225 | MG | Iturama |
| AGROINDUSTRIAL IGUATEMI EIRELI | 1440 | MS | Iguatemi |
| FRIGORÍFICO SUL LTDA | 889 | MS | Aparecida do Taboado |
| NATURAFRIG ALIMENTOS LTDA. | 3974 | MS | Rochedo |
| JBS S/A | 42 | MT | Barra do Graças |
| FRIGORIFICO REDENTOR S/A | 411 | MT | Guarantã do Norte |
| MARFRIG GLOBAL FOODS S. A. | 1751 | MT | Tangará da Serra |
| NATURAFRIG ALIMENTOS LTDA. | 1811 | MT | Barra Do Bugres |
| MARFRIG GLOBAL FOODS S. A. | 1900 | MT | Pontes e Lacerda |
| MARFRIG GLOBAL FOODS S. A. | 2015 | MT | Várzea Grande |
| AGRA AGROINDUSTRIAL DE ALIMENTOS S/A | 3941 | MT | Rondonópolis |
| VALE GRANDE INDUSTRIA E COMERCIO DE ALIMENTOS S/A | 4490 | MT | Matupá |
| FRIGORÍFICO RIO MARIA LTDA | 112 | PA | Rio Maria |
| MASTERBOI LTDA | 2437 | PA | São Geraldo do Araguaia |
| FRIGOL S. A. | 2583 | PA | Água Azul do Norte |
| MERCURIO ALIMENTOS S/A | 4554 | PA | Castanhal |
| MINERVA S. A. | 791 | RO | Rolim de Moura |
| MARFRIG GLOBAL FOODS S. A. | 232 | RS | Bagé |
| MARFRIG GLOBAL FOODS S. A. | 847 | RS | São Gabriel |

*continue...*

| ENABLED SLAUGHTERING PLANT | SIF | STATE | MUNICIPALITY |
|---|---|---|---|
| MARFRIG GLOBAL FOODS S. A. | 2007 | RS | Alegrete |
| JBS S/A | 337 | SP | Lins |
| JBS S/A | 385 | SP | Andradina |
| MINERVA S. A. | 421 | SP | Barretos |
| BARRA MANSA COMÉRCIO DE CARNES E DERIVADOS LTDA | 941 | SP | Sertãozinho |
| NATURAFRIG ALIMENTOS LTDA. | 1365 | SP | Pirapozinho |
| BON - MART FRIGORÍFICO LTDA | 2121 | SP | Presidente Prudente |
| MARFRIG GLOBAL FOODS S. A. | 2543 | SP | Promissão |
| FRIGOESTRELA S. A. | 2924 | SP | Estrela D'Oeste |
| FRIGOL S. A. | 2960 | SP | Lençóis Paulista |
| COOPERATIVA DOS PRODUTORES DE CARNE E DERIVADOS DE GURUPI | 93 | TO | Gurupi |
| PLENA ALIMENTOS S/A | 3215 | TO | Paraíso do Tocantins |

**Source:** MAPA / Preparation: Scot Consultoria

Periodically, Chinese missions inspect Brazilian plants for certification by the General Administration of Quality Supervision, Inspection, and Quarantine of the People's Republic of China (AQSIQ).

Other requirements considered in the qualification process are: production capacity, sanitary inspection, the risk of contamination, polluting sources, water treatment, and product storage and transportation. Part of these requirements are monitored through the environmental license.

## REQUIREMENTS REGARDING SANITARY ISSUES, TRADE, AND PRODUCT STANDARDS

As already mentioned, the certification of the Federal Inspection Service (SIF) is necessary for the commercialization of beef with China and aims to ensure the quality of edible and inedible products for the domestic and foreign markets.

The main Chinese requirement is a slaughter age of up to thirty months.

This requirement is related to sanitary issues, due to the lower manifestation of bovine spongiform encephalopathy (BSE) or mad cow disease in cattle under 30 months old.

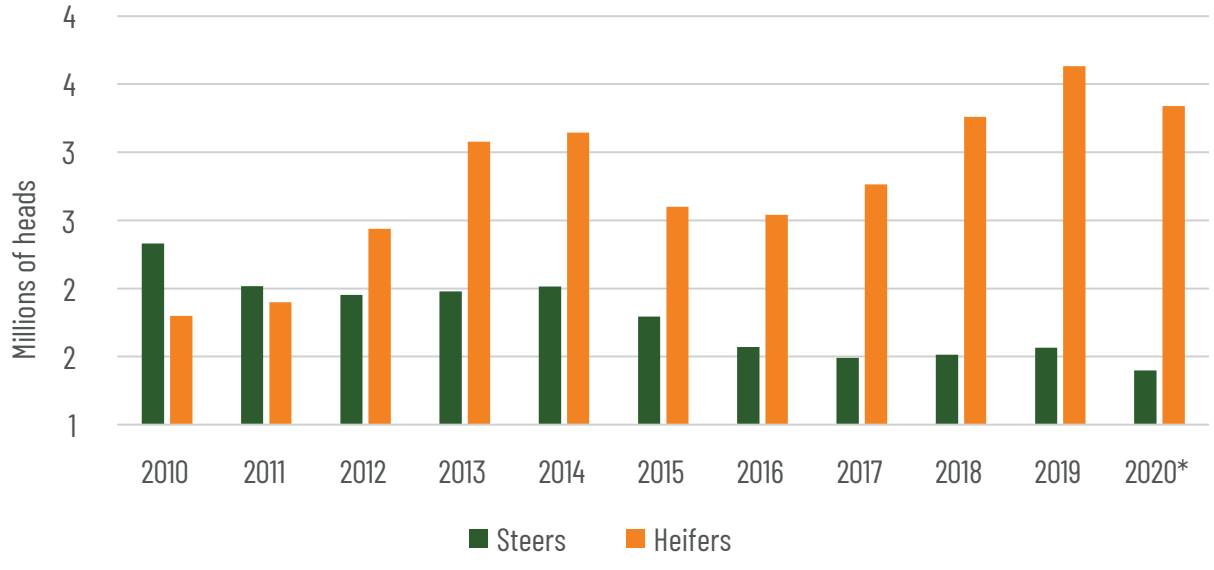
The incidence of bovine spongiform encephalopathy (BSE) completely suspended beef exports to China, through a self-imposed embargo promoted by the Brazilian government.

Regarding the traceability of animals, both regions request data from the farms where the animals are raised, to guarantee the sanitary quality from the animals' origins. This information is verified through the GTA (Animal Transit Guide, in Portuguese).

Nevertheless, the strictness of traceability in these countries does not match that imposed by the European Union.

Note in Figure 19, that there was a significant increase in heifer slaughter from 2017/2018 onwards, pulled by the down phase of the cycle at that time, and from 2019 onwards, with a weight of Chinese demand.

**Figure 5.**
Slaughter of steers and heifers, in millions of head, between 2010 and 2019.



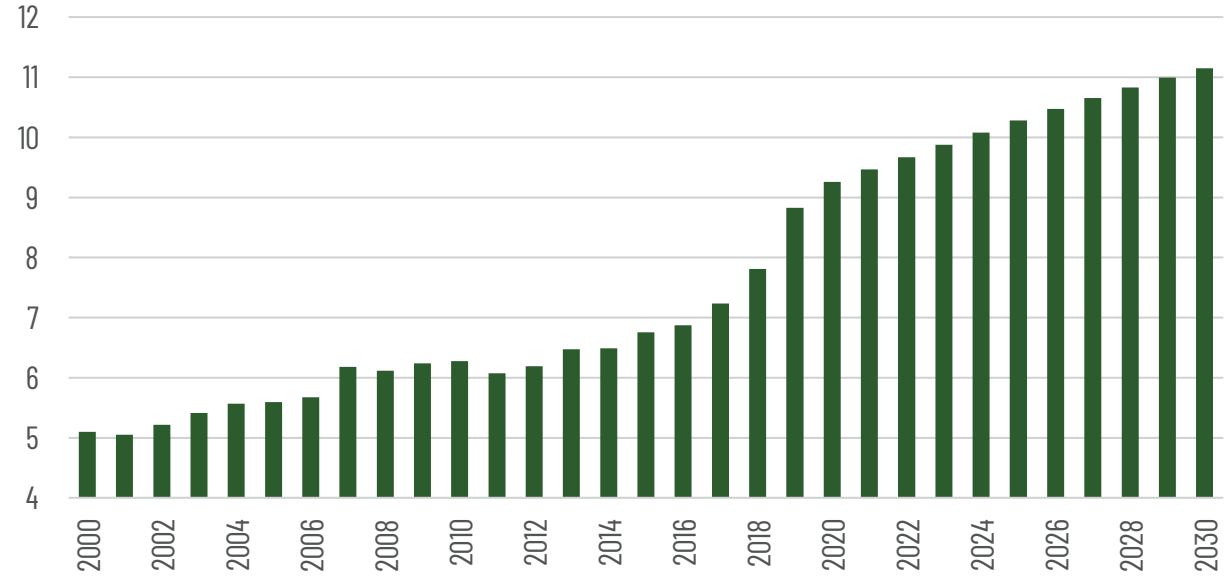

**Estimation based on consolidated data through Q3 2020 and partial data for the year 2020.*
**Source:** IBGE / Preparation: Scot Consultoria

The Chinese demand for beef is expected to remain firm in the coming years. The fall in the age of slaughter and the increase in the average weight of carcasses in Brazil reflects an advance in technology, intensification, and improvement in the zootechnical indexes of the national cattle breeding.

Based on the real evolution of GDP per capita and the estimated income elasticity in each year, the variation of per capita beef consumption in China was projected, resulting from the product of these variables.

From the per capita consumption and population projections, Chinese domestic demand through 2030 was projected in millions of tons of carcass equivalent. See Figure 6.

**Figure 6.**
Evolution and estimates of China's domestic beef consumption between 2020 and 2030, in millions of tons carcass equivalent.




**Source:** DE ZHOU *et al.* (2020) / FAO / FMI / OCDE / USDA / Scot Consultoria

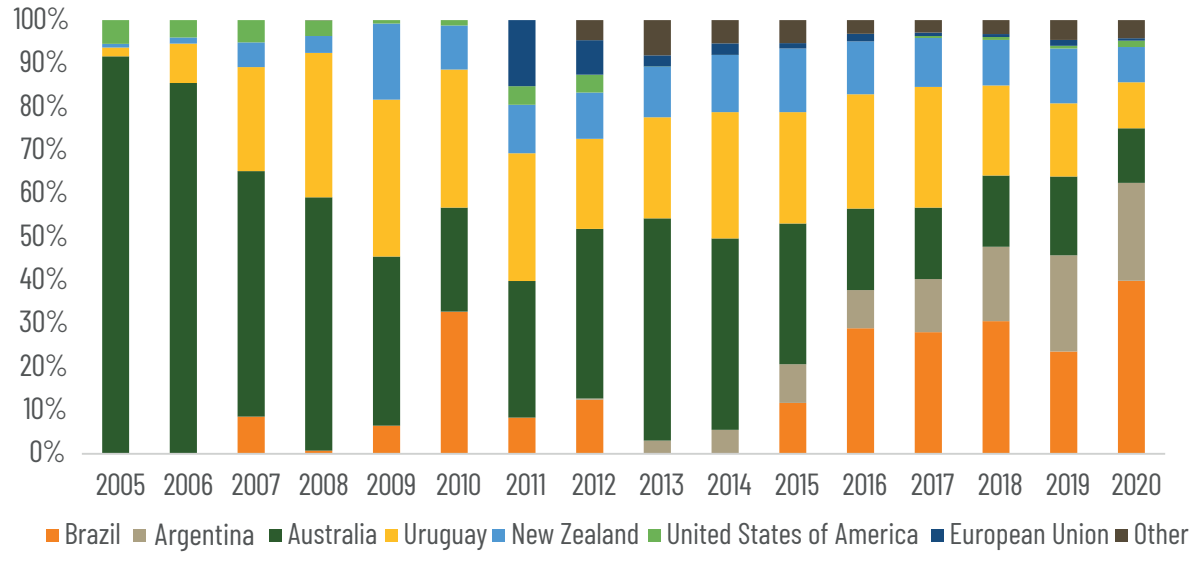
Between 2020 and 2030, with an increase of 18.4% for per capita consumption and 1.7% for population, Chinese domestic demand for beef is estimated to grow by 20.4%, from 9.26 million tons of carcass equivalent in 2020 to 11.15 million in 2030.
China does not make environmental requirements for meat production, but according to the interviewees, of the developing consumer markets, it is the one that has shown the most upward trend regarding these requirements. The environmental demand, inclusive, can vary according to each client.

The key players consulted believe that because Chinese demand for animal protein is high and likely to firm in coming years, the trend is that environmental requirements will be required in about 5 to 10 years, depending on Chinese herd growth, domestic consumption, the consequent need for meat imports to supply domestic consumption, and political alignment between governments.

Figure 7 shows the evolution of the participation of the main beef exporters to China in recent years.

Note that as of 2010, Brazil emerges among the major exporters. In 2013 and 2014, due to the Chinese embargo on Brazilian beef, there were no shipments, and these resumed in 2015 and, in 2016, Brazil was already the main supplier of the product in the Chinese market.

**Figure 7.**
Chinese beef imports from 2005 to 2020, by country of origin, in millions of tons of carcass equivalent.




** Estimate*
**Source:** USDA, compiled by Scot Consultoria

Considering the factors analyzed and the expectations for the main participants in this market, we present the projections for Chinese beef imports until 2030 and the representativeness of the main exporting countries in relation to the volume shipped to this destination.

According to Scot Consultoria, China is expected to import 3.62 million tons of beef carcass equivalent in 2030, a volume 32.8% greater than the volume registered in 2020.

We project a 15.0% growth in Chinese beef production from 2020 to 2030, while domestic consumption is expected to increase by 20.4% over the same period, maintaining the need for imports to meet domestic consumption.

The change in the consumption profile of the Chinese population, with beef increasing its share in the diet in recent years, draws attention. With this, even after the resumption of pig production levels, expected for 2022/2023, the expectation is that per capita consumption of beef and other proteins, such as chicken and fish, will continue to increase.

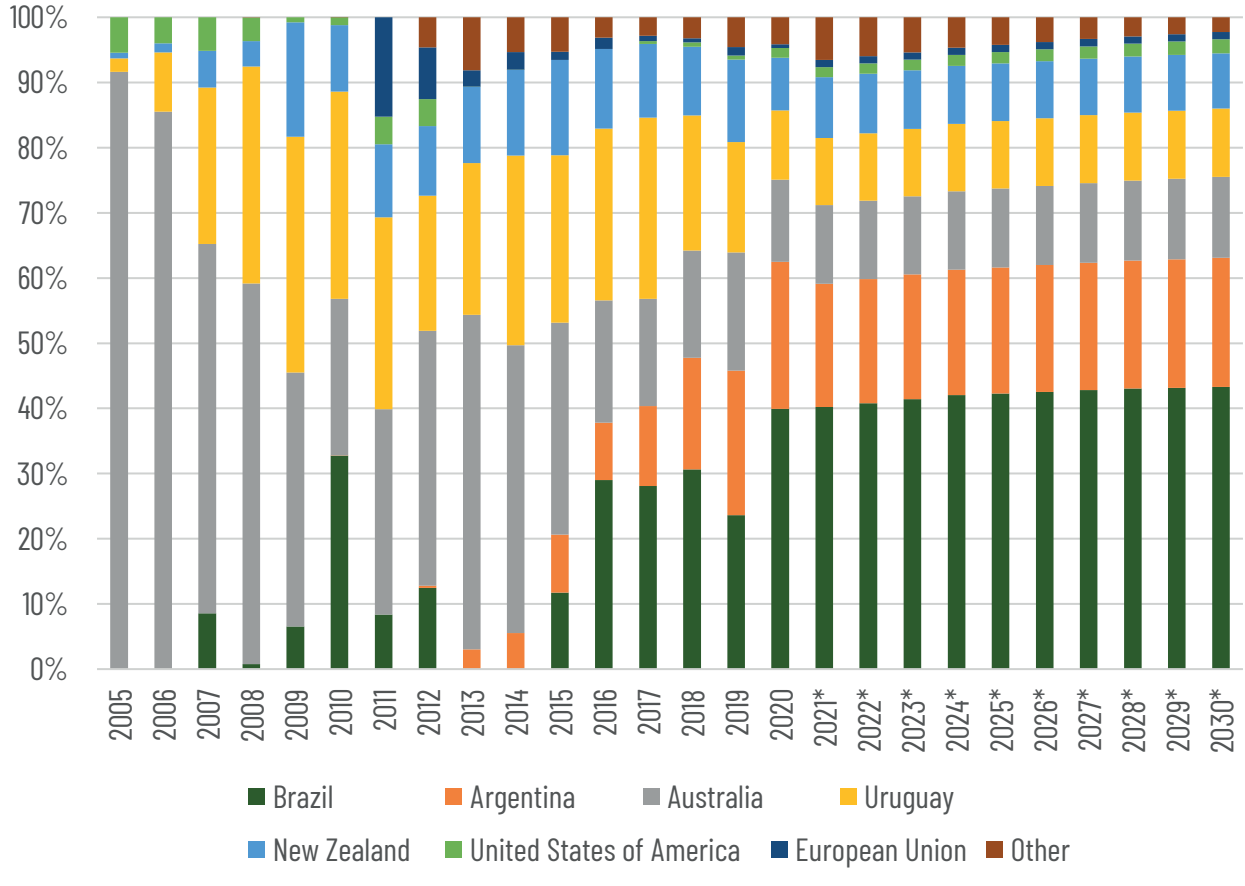
Brazil is expected to remain the main beef exporter to the Chinese market in the coming years, accounting for 43.3% of Chinese imports in 2030. In 2020, the share was 39.9% of the total.

This scenario is positive for the national beef cattle industry, not only because of the increase in demand for Brazilian beef, but also because of the productive gains expected in the production base, due to the greater use of technology (nutrition,

sanitation, genetics, management) and the intensification of production to meet the criteria required by China, which buys from Brazil only cattle under thirty months of age.

Figure 8 shows the projections regarding the participation of the main exporters to China, in percentage.

**Figure 8.**
Evolution of the shares (%) in Chinese beef imports from 2010 to 2020 and projections until 2030, in millions of tons of carcass equivalent.




** Estimate*
**Source:** Scot Consultoria

## LOW CARBON SYSTEMS

Since 2010, the ABC Plan fosters the agricultural sector with actions involving GHG emissions mitigation technologies and Climate change adaptation actions.

Among them is the incentive to recover degraded pastures, the use of integrated systems, no-till farming, biological nitrogen fixation, forestry, and waste treatment, which will be commented on further on.

In addition, the producer's perception of changes in consumption, management, and business sustainability has exerted influence, resulting in increased intensification of pasture areas, and use of other strategies, such as supplementation and integrated systems.

## CARBON NEUTRAL MEAT (CCN)

Carbon Neutral Meat (CCN) or "Carbon Neutral Brazilian Beef," is a concept brand developed by Embrapa in 2018.

**Figure 9.**
Carbon Neutral Meat (CCN) label.


**Source:** Embrapa

The label attests that the production of greenhouse gases (GHGs) produced by the animals (cattle), mainly methane ($CH_4$), are neutralized by the sequestration and accumulation of carbon in trees/pastures present in the production system.

To receive the label, the amounts of carbon accumulated by the tree/pasture component in the production system are quantified, with the help of software developed by Embrapa, called "SIS", which simulates the management and economic analysis of forest plantations.

## LOW CARBON MEAT (CBC)

Low Carbon Beef (CBC), another brand developed by Embrapa, differs from CCN by its focus on pasture reform, especially in regions with sandy soils, susceptible to greater degradation, and in agricultural frontiers.

In the CBC label, the sequestered carbon is fixed through pastures, being necessary for the certification of the meat: fertilization of pastures, application of good animal handling practices protocols, and all the correct forage management, such as height of pasture entrance and exit, and adequate animal load for the area.

In general terms, the concept refers to production in integrated systems or not, with pasture and without the presence of trees. With the right management, soil quality is improved and, consequently, the carbon storage capacity increases.

## GRAZING LAND IN BRAZIL

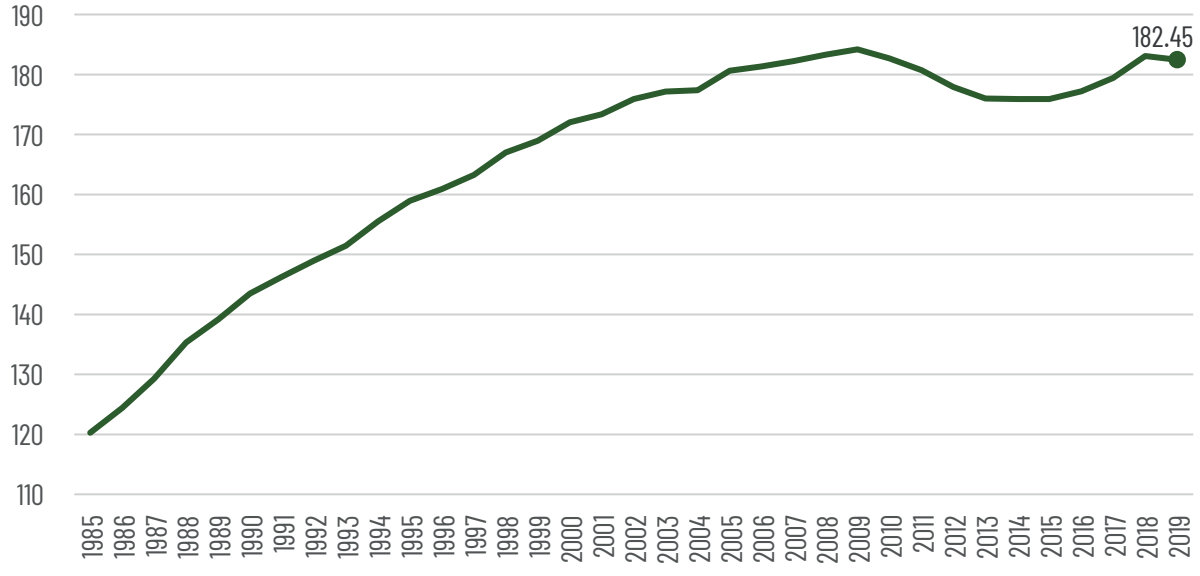
The latest official data are from the Agricultural Census, conducted in 2017, by the Brazilian Institute of Geography and Statistics (IBGE).

In that year **159.50 million hectares were computed**, of which 47.32 million hectares were natural pastures* and 112.18 million hectares were planted pastures**.

The Agricultural Census figures diverge from recent data from the **Image Processing and Geoprocessing Laboratory of the Federal University of Goiás (Lapig/UFG)**, which point to 104.54 million hectares of grazing land with signs of degradation. Lapig estimates **182.45 million hectares with grazing land** in Brazil. We will use this area estimate for the analyses and considerations contained in this study.

Taking 1985 as the initial date, the increase in area was 51.7%, however, we highlight the bias of maintenance of the fall for the coming years, with the increasing use of technology in livestock (nutrition, genetics, health, management, etc.), which includes the reform and recovery of degraded grazing area, increasing the stocking rate. The use of some of these technologies in Brazilian cattle ranching will be discussed later in the study.

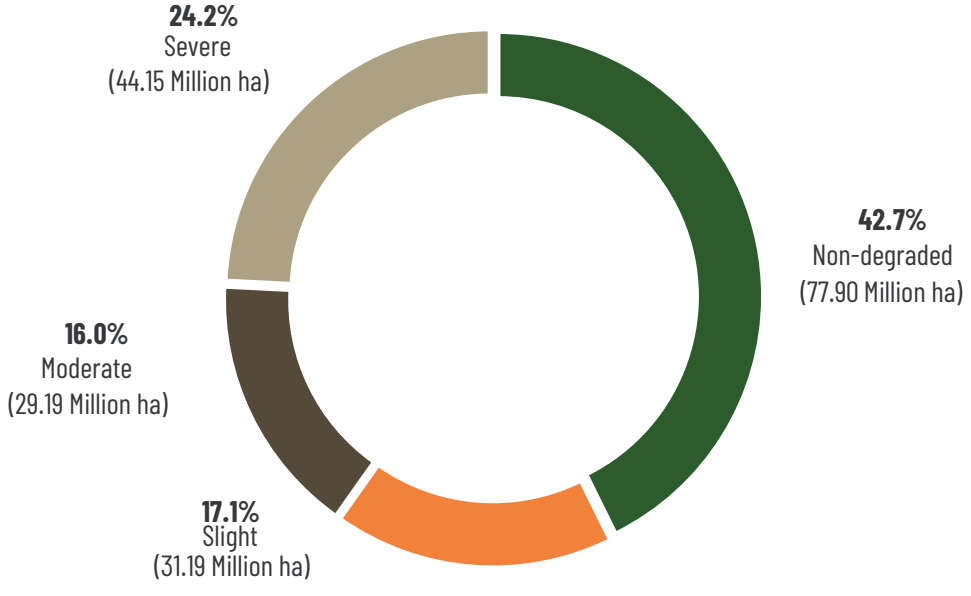
**Figure 10.**
Evolution of the grazing area in Brazil, in millions of hectares.




**Source:** Lapig / **Preparation:** Scot Consultoria

Of the 182.45 million hectares with grazing land, it is estimated that 42.7% or 77.90 million hectares are non-degraded areas; 17.1% (31.19 million hectares) with pastures in light degradation; 16.0% (29.19 million hectares) with moderate degradation; and 24.2% (44.15 million hectares) with pastures in severe degradation conditions (figure 11).

**Figure 11.**
Conditions of grazing areas in Brazil.




**Source:** Lapig / **Preparation:** Scot Consultoria

In the last decades, the cattle herd in Brazil has grown more than the increase in grazing area.

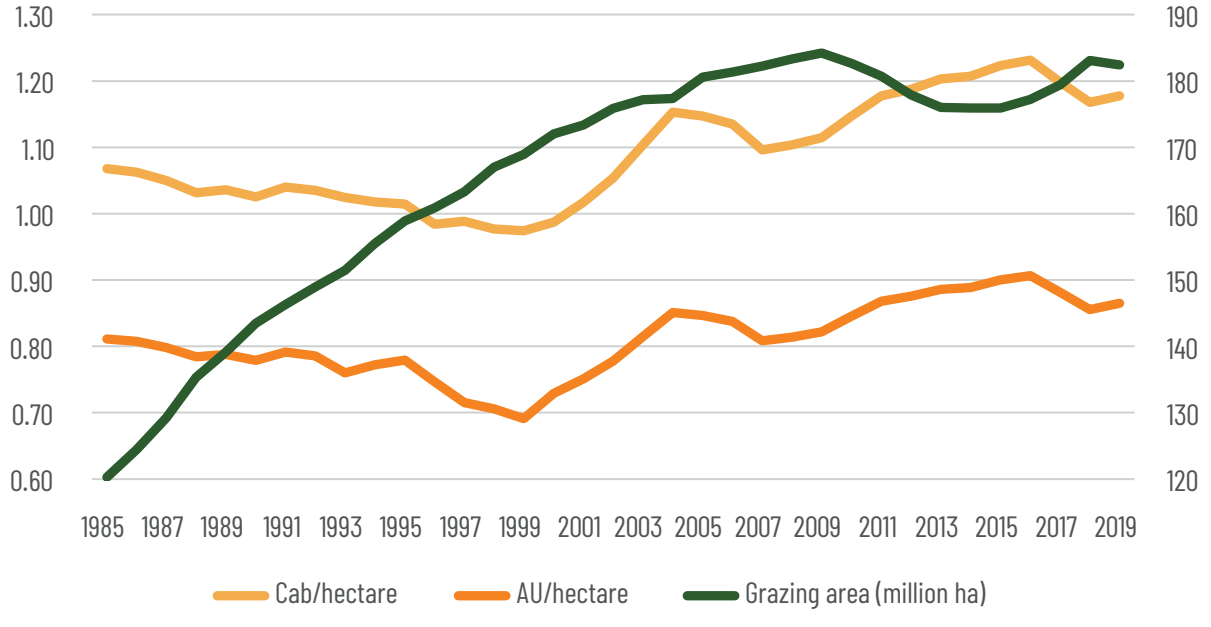
For comparison, since 1985, the grazing area (Lapig) increased 51.7%, and the Brazilian cattle herd (IBGE) grew 67.3%.

In this way, the capacity utilization rate of the grazing land has improved.

The average number of cattle heads per hectare went from 0.99 in 2000 (Brazilian average), to 1.18 in 2019, an increase of 19.3%, according to IBGE data (herd) crossed with Lapig's grazing area.

Analyzing the capacity of grazing in animal units (AU = 450 kg live weight), the improvement was 18.6%. According to Lapig, the national average capacity has gone from 0.73UA/ha in 2000, to 0.86UA/ha in 2019, latest data (figure 12).

**Figure 12.**
Capacity rate, in head per hectare and Animal Unit (AU)* per hectare on the left axis and grazing area in Brazil, in millions of hectares, on the right axis.




** corresponds to a cattle's 450kg live weight.*
**Source:** Lapig/IBGE / **Preparation:** Scot Consultoria

This suggests that the increase in the Brazilian cattle herd in the last two decades has been accompanied by the growing use of technologies that have allowed an increase in national cattle production, through gains in productivity, without the need to expand the area of pasture, which in the medium and long term tend to decrease in the country.

The following are examples of technologies and improvements in Brazilian beef cattle breeding.

## CARCASS WEIGHT

Considering the average carcass weight of steers, cows, young steers, and heifers, the reference in 2020 was 261.7kg per carcass, an increase of 9.8% in ten years.

## CONFINEMENT/FEEDLOT

In Brazil, the number of confined cattle is growing, which has collaborated with the adoption of technologies and improved the enjoyment of the herd. By 2020, Scot Consultoria expects 4.57 million cattle to have been confined in the country, an increase of 93.3% since 2010.

For 2021, we estimate a 5% growth in the number of heads confined, in a year-on-year comparison.

## MINERAL SUPPLEMENTS

According to data from the Brazilian Association of Mineral Supplement Industries (Asbram, in portuguese), 2.394 million tons of mineral supplements for cattle were sold in 2020.
Compared to 2019, when 2.149 million tons were sold, there was an increase of 11.4%.

**Integrated Crop-Livestock (ILP, in portuguese) and Integrated Crop-Livestock-Forestry (ILPF, in portuguese)**

In 2015, according to the latest data from the ILPF Network*, Brazil had 11.47 million hectares in integrated crop and livestock production systems, either crop-livestock integration (ILP) or crop-livestock-forest integration (ILPF).

For 2020, through mathematical modeling, Embrapa Agrossilvipastoril estimates that this area will evolve to 17 million hectares, a leap of 48.2% in five years.

## ILP RESULTS

To estimate the results of a Integrated Crop-Livestock system (ILP) we used the corn, soybean, and cattle production costs elaborated by the IMEA (Mato Grosso Institute of Agricultural Economics).

We calculated the estimated results for the last three production cycles, considering the state average. We also present the results specifically for the northern region of the state.

In the average scenario in the state, ILP added 12.4% of output to the system, while in the North the addition was 12.2%.

**Table 4.**
Overall result of the ILP system in Mato Grosso, nominal values and deflated by the IGP-DI (inflation index).

| NOMINAL VALUES | | | |
|---|---|---|---|
| **PARAMETER / ITEM** | **2018/19** | **2019/2020** | **2020/2021** |
| Soybean productivity-sc / ha | 58.4 | 58.9 | 62.5 |
| Corn productivity-sc / ha | 113.0 | 121.3 | 126.6 |
| Soybean price-R$ / sc | R$ 67.09 | R$ 78.06 | R$ 144.33 |
| Corn price-R$ / sc | R$ 22.51 | R$ 31.49 | R$ 59.72 |
| Soybean revenue-R$ / ha | R$ 3,915.69 | R$ 4,595.77 | R$ 9,020.92 |
| Corn revenue - R$ / ha | R$ 2,543.42 | R$ 3,819.17 | R$ 7,562.51 |
| Soybean COT - R$ / ha | R$ 3,078.29 | R$ 3,363.56 | R$ 3,463.70 |
| Soybean COT (R$ / sack) - R$ / ha | R$ 52.74 | R$ 57.13 | R$ 55.42 |
| Corn COT - R$ / ha | R$ 2,353.07 | R$ 2,605.94 | R$ 2,707.76 |
| Corn COT - R$ / ha | R$ 20.82 | R$ 21.49 | R$ 21.38 |
| Soybean result - R$ / ha | R$ 837.40 | R$ 1,232.21 | R$ 5,557.22 |
| Corn result - R$ / ha | R$ 190.35 | R$ 1,213.23 | R$ 4,854.75 |
| Livestock cost (R$ / ha) | R$ 200.97 | R$ 211.41 | R$ 274.28 |
| **Livestock result - R$ / ha** | **R$ 573.53** | **R$ 882.72** | **R$ 1,292.39** |
| **Corn+soybean result - R$ / ha** | **R$ 1,027.75** | **R$ 2,445.44** | **R$ 10,411.96** |
| **Total result - R$ / ha** | **R$ 1,601.29** | **R$ 3,328.16** | **R$ 11,704.35** |
| **DEFLATED VALUES** | | | |
| **PARAMETER / ITEM** | **2018/19** | **2019/2020** | **2020/2021** |
| Soybean productivity-sc / ha | 58.4 | 58.9 | 62.5 |
| Corn productivity-sc / ha | 113.0 | 121.3 | 126.6 |
| Soybean price-R$ / sc | R$ 91.47 | R$ 98.79 | R$ 144.33 |
| Corn price-R$ / sc | R$ 30.68 | R$ 39.85 | R$ 59.72 |
| Soybean revenue-R$ / ha | R$ 5,338.21 | R$ 5,816.19 | R$ 9,020.92 |
| Corn revenue - R$ / ha | R$ 3,467.42 | R$ 4,833.37 | R$ 7,562.51 |
| Soybean COT - R$ / ha | R$ 4,196.59 | R$ 4,256.77 | R$ 3,463.70 |
| Soybean COT - (R$ / sack) | R$ 71.91 | R$ 72.30 | R$ 55.42 |
| Corn COT - R$ / ha | R$ 3,207.91 | R$ 3,297.96 | R$ 2,707.76 |
| Corn COT - R$ / ha | R$ 28.39 | R$ 27.19 | R$ 21.38 |
| Soybean result - R$ / ha | R$ 1,141.62 | R$ 1,559.43 | R$ 5,557.22 |
| Corn result - R$ / ha | R$ 259.51 | R$ 1,535.41 | R$ 4,854.75 |
| Livestock cost (R$ / ha) | R$ 273.98 | R$ 267.56 | R$ 274.28 |
| **Livestock result - R$ / ha** | **R$ 781.89** | **R$ 1,117.13** | **R$ 1,292.39** |
| **Corn+soybean result - R$ / ha** | **R$ 1,401.12** | **R$ 3,094.84** | **R$ 10,411.96** |
| **Total result - R$ / ha** | **R$ 2,183.01** | **R$ 4,211.97** | **R$ 11,704.35** |

** for the correction was used the IGP-DI of January 2019, 2020, and 2021.*
*Note: for the 2020/2021 cycle, the livestock costs refer to the first quarter and prices are the averages up to April. For the other cycles, the prices used for grains were the average from July of one year to June of the following year, while for cattle the average of the year in which they enter the system was used.*
**Source:** IMEA / Scot Consultoria

Besides the added result, compared to agriculture, it is an important option for keeping cattle from other areas in a period of lower forage supply.

## GRAZING LAND RENOVATION COSTS AND ESTIMATES OF FINANCIAL RESOURCES NEEDED TO IMPROVE GRAZING CONDITIONS IN BRAZIL

A Based on interviews with professionals specialized in grazing and Scot Consultoria price research, the costs of grazing land renovation were estimated, considering the mechanized operations and the consumption of inputs.

The reference was defined for Mato Grosso, based on June 2021, for three technological levels:

1. **Minimum renovation:** minimum use of operations and inputs;
2. **Conventional renovation:** based on what is current in the experts' view;
3. **Renovation with high technology:** according to the technical recommendations for a high productivity grazing land.

The operations and inputs consumed at each level of reform are described below, with costs presented.

Finally, the average cost for grazing land maintenance was estimated, considering fertilization, and weed control (operations and inputs).

The minimum renovation had an estimated cost of **R$721.01 per hectare.**

The conventional renovation cost an estimated **R$1,890.06 per hectare**.

The high-tech renovation option had an estimated cost of **R$2,982.18 per hectare**.

In the survey with the experts, a reference of grazing life and productive capacity (stocking rate) was obtained for each technological interval.

The results are shown in table 5. These are average values, and are subject to change, as a function of management variation and nutrient replenishment.

| PRODUCTIVE PARAMETERS* | SHELF LIFE (YEARS) | STOCKING (AU * */ HA/YEAR) |
|---|---|---|
| Minimum Renovation | 4.0 | 0.9 |
| Conventional renovation | 7.0 | 1.3 |
| High-tech renovation | 10.0 | 2.3 |

**Table 5.**
Productive parameters for each level of grazing renovation.

** Subject to change due to management variation and nutrient replenishment.*
*** AU= animal unit (450kg liveweight).*
**Source:** Scot Consultoria

Thus, for the estimate of the maintenance cost, average parameters for Mato Grosso were used, researched with key agents.

Mechanized operations and inputs related to fertilizer coverage, herbicide for weed control, and insecticide were considered

The estimated average cost was **R$1,226.55 per hectare**.

## SIMULATIONS: METHODS AND RESULTS

The objective is to estimate the number of financial resources, in Brazilian reais, for the improvement of grazing conditions in Brazil.

For this, the grazing renovation costs presented in this study were considered, with the values being extrapolated to cattle-raising Brazil.

The estimate was based on the amount of degraded grazing land in Brazil, of **104.54 million hectares**, distributed in 31.19 million hectares with mild degradation; 29.19 million hectares with moderate degradation; and 44.15 million hectares in severe degradation conditions (Lapig).

From there, three scenarios were defined considering different combinations of renovations for each degradation situation, starting from a less technified situation and gradually increasing the levels of technology.

In **Scenario 1**, minimal renovation was applied in areas with mild and moderate degradation, and conventional renovation in the case of areas with severe degradation.

In **Scenario 2**, minimal renovation was considered for areas with mild degradation; conventional renovation for areas in moderate stage of degradation; and high-tech renovation for areas in more severe degradation conditions.

Finally, in **Scenario 3**, the conventional renovation was applied to pastures with mild or moderate degradation, and the high-tech renovation was applied to the most degraded areas.

For the non-degraded grazing lands, which total 77.9 million hectares, no renovation was considered.

The next step was to multiply the size of the degraded areas, in hectares, by the cost of the renovation (R$/hectare), according to the level of degradation and the type of renovation established.

Thus, the estimated investments for the renovation of degraded grazing areas in Brazil are R$126.99 billion in Scenario 1; R$209.34 billion in Scenario 2; and R$245.81 billion in Scenario 3, as presented in table 6.

**Table 6.**
Estimates of financial resources for investments in the renovation of degraded grazing areas in Brazil, total volume and by level of degradation of the areas.

| SCENARIOS | ITEMS | GRAZING LANDS NON-DEGRADED | MILD DEGRADATION | MODERATE DEGRADATION | SEVERE DEGRADATION | TOTAL DEGRADED GRAZING LAND |
|---|---|---|---|---|---|---|
| Scenario 1 | Areas (hectares) | 77,905,325 | 31,198,620 | 29,191,691 | 44,152,433 | 104,542,744 |
| | Type of renovation | No renovation | Minimum | Minimum | Conventional | |
| | Renovation cost (R$/ha) | | R$ 721.01 | R$ 721.01 | R$ 1,890.06 | |
| | Total (R$) | | R$ 22,494,494,031.68 | R$ 21,047,479,795.72 | R$ 83,450,527,103.16 | R$ 126,992,500,930.56 |
| Scenario 2 | Type of renovation | No renovation | Minimum | Conventional | High technology | |
| | Renovation cost (R$/ha) | | R$ 721.01 | R$ 1,890.06 | R$ 2,982.18 | |
| | Total (R$) | | R$ 22,494,494,031.68 | R$ 55,173,902,216.96 | R$ 131,670,338,900.16 | R$ 209,338,735,148.80 |
| Scenario 3 | Type of renovation | No renovation | Conventional | Conventional | High technology | |
| | Renovation cost (R$/ha) | | R$ 1,890.06 | R$ 1,890.06 | R$ 2,982.18 | |
| | Total (R$) | | R$ 58,967,107,994.38 | R$ 55,173,902,216.96 | R$ 131,670,338,900.16 | R$ 245,811,349,111.50 |

**Source:** Scot Consultoria

Back to the simulation, if we consider a scenario in which the renovation of the entire degraded grazing area in the country occurs in 10 years, **resources for investments** on the order of R$12.69 billion per year would be required in **Scenario 1**; R$20.93 billion per year in **Scenario 2**; and R$24.58 billion per year in **Scenario 3**, that is, between five and ten times the volume available in the ABC Program, in the last PAP.

## PRODUCTIVE GAINS AND FINAL CONSIDERATIONS

The renovation of grazing land would enable gains in productivity for the cattle-raising activity.

Besides the increase in animal performance (weight gain and fertility), the better quality of the grass and higher forage production allow increases in stocking and birth rates, provided the correct management is done.

Based on Lapig's data, the national herd is estimated at 156.90 million AU (animal unit), considering an average of 0.86 AU/hectare, multiplied by the 182.45 million hectares of grazing land.

If we consider the capacity utilization rates described in chapter 3.1.4 (production parameters) for each type of grazing renovation applied and multiply by the respective areas, we have an increase of 13.9% or 21.84 million AU in Scenario 1, in relation to the current 156.90 million AU.

In this scenario, the stocking utilization goes from 0.86 AU/hectare to 0.98 AU/hectare, considering the weighted average. The grazing area was maintained at 182.45 million hectares.

In Scenario 2, the increase in total AU is 49.5% or 77.67 million AU on the same area, with an average stocking rate of 1.29 AU/hectare.

Finally, in Scenario 3, the amount of AU in the country increases by 59.0% or 92.59 million AU, and the average stocking rate rises to 1.37 AU/hectare. See Table 7.

**Table 7.**
Estimates of gains in stocking and total AU in Brazil.

| GRAZING AREA (HA) | | NON-DEGRADED | MILD | MODERATE | SEVERE | |
|---|---|---|---|---|---|---|
| 182,448,069 | **Parameters** | 77,905,325 | 31,198,620 | 29,191,691 | 44,152,433 | **Results** |
| | Type of renovation | No renovation | Minimum | Minimum | Conventional | - |
| | Stocking rate (AU/ha) | 0.86 | 0.90 | 0.90 | 1.30 | 0.98 |
| **Scenario 1** | AU total | 66,998,580 | 28,078,758 | 26,272,522 | 57,398,163 | 178,748,022 |
| | AU extra (total) | | | | | 21,842,683 |
| | Variation (%) | | | | | 13.9% |
| | Type of renovation | No renovation | Minimum | Conventional | High technology | - |
| | Stocking rate (AU/ha) | 0.86 | 0.90 | 1.30 | 2.30 | 1.29 |
| **Scenario 2** | AU total | 66,998,580 | 28,078,758 | 37,949,198 | 101,550,595 | 234,577,131 |
| | AU extra (total) | | | | | 77,671,792 |
| | Variation (%) | | | | | 49.5% |
| | Type of renovation | No renovation | Conventional | Conventional | High technology | - |
| | Stocking rate (AU/ha) | 0.86 | 1.30 | 1.30 | 2.30 | 1.37 |
| **Scenario 3** | AU total | 66,998,580 | 40,804,013 | 38,179,193 | 103,512,926 | 249,494,712 |
| | AU extra (total) | | | | | 92,589,373 |
| | Variation (%) | | | | | 59.0% |

**Source:** Scot Consultoria

Analyzing in another way, considering the maintenance of the current cattle herd at 156.90 million AU, and considering the increments in higher stocking rates because of grazing renovation, we have that:

In **Scenario 1** (0.98 AU/ha), 22.29 million hectares currently occupied with grazing area could be released for other purposes if the current herd is maintained.

In **Scenarios 2** (1.9 AU/ha) and 3 (1.37 AU/ha), the areas that can be released for other purposes are 60.41 million and 67.71 million hectares, respectively. See table 8.

**Table 8.**
Estimates of grazing areas to be released with gains in stocking rates and maintenance of total AU in Brazil.

| SCENARIOS | AU TOTAL | STOCKING (AU/HA) | REQUIRED AREA (HA) | CURRENT GRAZING AREA (HA) | DIFFERENCE IN AREAS (HA) | % OF CURRENT GRAZING AREA |
|---|---|---|---|---|---|---|
| Scenario 1 | 156,905,339 | 0.98 | 160,153,247.19 | 182,448,069 | 22,294,821.81 | 87.8% |
| Scenario 2 | 156,905,339 | 1.29 | 122,036,943.77 | 182,448,069 | 60,411,125.23 | 66.9% |
| Scenario 3 | 156,905,339 | 1.37 | 114,740,212.13 | 182,448,069 | 67,707,856.87 | 62.9% |

**Source:** Scot Consultoria

Lastly, the grazing land is the pillar of national livestock production and the improvements in agronomic conditions, given the situation of degradation in much of the country, would represent important productive gains for the activity (intensification), in addition to issues related to sustainability.

As determined in the study, the investments to renovate grazing land and the resources to maintain the conditions of the areas are high, which would require volumes above those made available by the government, through the financing lines of the Agricultural Cattle Raising Plan, in addition to the cattle raiser's own resources.

Therefore, the time in which this technology adoption will take place will reflect directly on the evolution of the zootechnical indicators of Brazilian livestock.

Highlighting that, in addition to grazing, the technological package for improving livestock indicators and results involves practices and issues related to health, genetics, nutrition (mineral supplementation), among other factors that will be discussed in the next chapter.

## COST ESTIMATES AND RESULTS IN TWO TECHNOLOGICAL LEVELS OF BEEF CATTLE RANCHING

To demonstrate the effects of a production system with greater use of technology and higher productivity, results were simulated in two systems.

We simulated two hypothetical farms, in **Mato Grosso**, of the same area, with a **rebreeding and fattening system**. The zootechnical parameters were defined through consultation with key agents, technicians, and reference researchers in the sector.

The objective was to define a system with high productivity (**system A**) and a system with low technology adoption (**system B**). We emphasize that neither system represents the limits of productivity.

**Table 9.**
Parameters used in the simulated (general) rebreeding/fattening systems.

| PARAMETERS | SYSTEM A | SYSTEM B |
|---|---|---|
| Grazing area | 2,000 | 2,000 |
| Herd | 7,080 | 1,716 |
| Stocking (AU/ha) | 3.0 | 0.7 |
| Stocking (head/ha) | 3.5 | 0.9 |
| Entry weight (kg) | 225 | 225 |
| Weight gain (kg/day) | 0.60 | 0.30 |
| Mortality | 0.5% | 1.0% |
| Annual sales (heads) | 4,855 | 635 |
| Deaths (head/year) | 35.0 | 17.0 |
| Farm time (months) | 17.4 | 31.6 |
| Output weight (@) | 19.0 | 18.0 |
| Output age (months) | 29.4 | 43.6 |

**Source:** Scot Consultoria

Based on the parameters presented, the results shown in table 10 were obtained.

| ITEM | SYSTEM A | % TOC | SYSTEM B | % TOC |
|---|---|---|---|---|
| Acquisition of animals | R$ 159.61 | 61.6% | R$ 171.75 | 67.6% |
| Nutrition | R$ 75.47 | 29.1% | R$ 13.99 | 5.5% |
| Grazing area | R$ 8.33 | 3.2% | R$ 0.00 | 0.0% |
| Taxes and fees | R$ 4.79 | 1.8% | R$ 11.09 | 4.4% |
| Manpower | R$ 2.34 | 0.9% | R$ 5.49 | 2.2% |
| Maintenance and vehicles | R$ 1.84 | 0.7% | R$ 6.31 | 2.5% |
| Administrative | R$ 1.38 | 0.5% | R$ 11.15 | 4.4% |
| Sanity | R$ 0.95 | 0.4% | R$ 0.98 | 0.4% |
| Other | R$ 1.03 | 0.4% | R$ 2.04 | 0.8% |
| **EOC** | **R$ 255.75** | **98.6%** | **R$ 222.80** | **87.7%** |
| Depreciations | R$ 3.57 | 1.4% | R$ 31.14 | 12.3% |
| **TOC** | **R$ 259.32** | **100.0%** | **R$ 253.94** | **100.0%** |

**Table 10.**
Estimate of costs with beef cattle (rearing/fattening) in two technological levels, high (A) and low (B) technologies.

*Note: Sorted according to participation in scenario A.*
*Effective operating cost (EOC) refers to expenditures and total operating cost (TOC) is the EOC plus depreciation.*
**Source:** Scot Consultoria

The results are in table 23, considering the average prices of 2021. As the cost per arroba was a little higher in system A (+2.1%), the result per cow slaughtered was 10.6% lower. See Table 11.

| ITEM | SYSTEM A | SYSTEM B | AT/BT |
|---|---|---|---|
| TOC | R$ 259.32 | R$ 253.94 | 2.1% |
| Average price | R$ 289.11 | R$ 289.11 | 0.0% |
| Result per arroba | R$ 29.80 | R$ 35.17 | -15.3% |
| Result per head | R$ 566.16 | R$ 633.14 | -10.6% |
| Result per hectare of grazing area | R$ 1,374.35 | R$ 201.02 | 583.7% |
| Profitability | 10.3% | 12.2% | - |
| Return | 3.8% | 0.6% | - |

**Table 11.**
Estimate of costs and results with beef cattle ranching (rebreeding/fattening) in two technological levels, high (A) and low (B) technologies.

**Source:** Scot Consultoria

Profitability is the ratio between profit and revenue. That is, how much of the revenue is profit. In this aspect, as the cost per arroba was higher in system A, profitability was lower, at 10.3%, compared to 12.2% in system B.

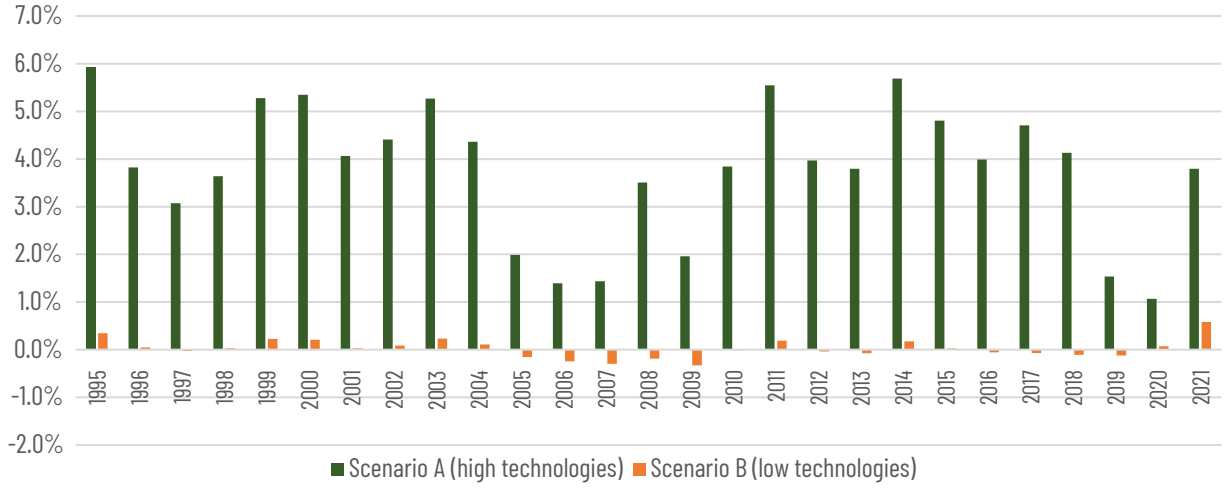
When we analyze the return on invested capital, we have the return. It shows the relationship between profit and the capital invested in land, improvements, and vehicles.

While in system A, the annual profit equals 3.8% of the capital, in the low-tech system (B), the rate was 0.6%. This shows that, of the fixed capital, the profit is equivalent to 3.8% and 0.6%, respectively.

To evaluate beyond the scenario of commodity valuations observed in recent years on the results, we made a historical simulation.

Figure 13 shows the evolution of estimated return for the two systems.

**Figure 13.**
Evolution of estimated return for the two systems.




**Source:** Scot Consultoria

While system A had an average return of 3.8%, system B averaged 0.02% between 1995 and 2021.

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