Food and Agriculture Organization of the United Nations

SCALA PRIVATE SECTOR ENGAGEMENT FACILITY REPORT

VALUE CHAIN ASSESSMENT AND EXPLORATORY MARKET ANALYSIS FOR SUSTAINABLE BEEF CATTLE PRODUCTS IN BELIZE

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ACRONYMS AND ABBREVIATIONS

AFOLU	Agriculture Forestry and Other Land Use
AGA	American Grassfed Association
AGW	A Greener World
APAMO	Association of Protected Areas Management Organizations
BAHA	Belize Agricultural Health Authority
BAN	Black Angus
BBS	Belize Bureau of Standards
BCCI	Belize Chamber of Commerce and Industry
BCCU	Blue Creek Credit Union
BELTRAIDE	Belize National Trade and Investment Development Agency
BHA	Belize Hotel Association
BHSA	Belize High School of Agriculture
BLPA	Belize Livestock Producer Association
BLR	Belize Livestock Registry
BMR	Beefmaster
BNBS	Belize National Bureau of Standards
BNCCC	Belize National Climate Change Committee
BR	Brucellosis
BRW	Belize River Watershed
BSE	Bovine Spongiform Encephalopathy Surveillance
BTB	Belize Tourism Board
BTIA	Belize Tourism Industry Association
CARICOM	Caribbean Community
CATIE	Tropical Agricultural Research and Higher Education Center
CCCCC	Caribbean Community Climate Change Centre
CELAC	Comunidad de Estados Latinoamericanos y Caribeños
CRESAP	Climate Resilient and Sustainable Agriculture Project
CSA	Climate Smart Agriculture
DFC	Development Finance Corporation
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field Schools
FIDA	Fondo Internacional de Desarrollo Agrícola
FOLU	Forestry and Other Land Use
FPI	Financial Participating Institutions
GAP	Global Animal Partnership
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEB	Global Environmental Benefits
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GLAD	Global Land Analysis and Discovery
HORECA	Hotels, Restaurants and the Catering Industry
IDB	Inter-American Development Bank
IFAD	International Fund for Agricultural Development
IICA	Inter-American Institute for Cooperation on Agriculture
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
KOICA	Korea International Cooperation Agency
LICU	La Inmaculada Credit Union Ltd.

MAFSE	Ministry of Agriculture, Food Security, and Enterprise
MED	Ministry of Economic and Development
MGF	Matching Grant Facility
MIF (FOMIN)	Multilateral Investment Fund
MOE	Ministry of Environment
MSDCCDRM	Ministry of Sustainable Development, Climate Change and Disaster Risk Management
MSMEs	Micro, Small, and Medium Enterprises
NAFP	National Agriculture and Food Policy
NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plans
NCCO	National Climate Change Office
NDC	Nationally Determined Contribution
NFNSC	National Food and Nutrition Security Commission
NGO	Non-Governmental Organization
OECD	Organización para la Cooperación y el Desarrollo Económico
OIE	World Organization for Animal Health
OIRSA	Organismo Internacional Regional de Sanidad Agropecuaria
PACT	Protected Areas Conservation Trust
PSA	Partial Scope Agreement
RAN	Red Angus
REDD	Reducing Emissions from Deforestation and Forest Degradation
SCALA	Scaling Up Climate Ambition for Land Use and Agriculture Programme
SDG	Sustainable Development Goals
SENASICA	Service for Animal Health and Agriculture Food Safety
SICA	Sistema de la Integración Centroamericana
SIF	Social Investment Funds
UBCFC	University of Belize Central Farm Campus
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
USDA	United States Department of Agriculture
VAB	Veterinary Association of Belize
TB	Tuberculosis
TNC	The Nature Conservancy
WB	World Bank

FOREWORD

Climate change poses significant challenges for Belize, manifesting in rising temperatures, unpredictable rainfall patterns, and heightened vulnerability to extreme weather events such as hurricanes, flooding, and wildfires. These impacts pose critical threats to Belize's agricultural systems and rural livelihoods, which are vital to the country's economy and food security. Recognizing these challenges, Belize's Climate Resilience Plan and Nationally Determined Contributions (NDCs) prioritize enhancing the sustainability of key agricultural value chains and integrating climate adaptation measures into national development strategies.

The sustainable beef cattle value chain holds immense potential for contributing to Belize's climate resilience, rural economic development, and environmental sustainability goals. Exploring market opportunities for sustainable beef products while addressing climate challenges requires multi-stakeholder collaboration and innovative solutions.

The government of Belize, in partnership with the Scaling up Climate Ambition on Land Use and Agriculture (SCALA) programme, is committed to fostering these efforts by engaging with the private sector to co-create transformative climate solutions in the agriculture sector. This report, " Value Chain Assessment and Exploratory National Market Analysis for Sustainable Beef Cattle Value Chain Products in Belize" is a vital output of the SCALA Private Sector Engagement (PSE) Facility, aiming to foster stronger partnerships and dialogue between the public and private sector and catalyze private investment to bridge the financing gap and transform the livestock sector.

The study provides a comprehensive assessment of the sustainable beef cattle value chain in Belize, with a focus on identifying climate adaptation challenges, private sector investment opportunities, and innovative practices. It explores barriers to value chain development, assesses market potential, and develops a roadmap to support the development towards a sustainable beef cattle sector.

The findings and recommendations outlined in this report are intended to inform national policy, support the development of gender-responsive and climate-resilient interventions, and guide investments that align with Belize's NDC and NAP targets. By creating awareness of business opportunities and fostering partnerships, this initiative aims to strengthen Belize's ability to adapt to climate change, reduce vulnerabilities, and drive sustainable development.

This study reflects the commitment of the Government of Belize, the SCALA programme, and private sector partners to build a resilient, sustainable, and inclusive livestock sector that benefits both communities and the environment.

We are confident that the insights from this report will catalyze meaningful action and contribute to a sustainable future for Belize.

Ministry of Agriculture Food, Security and Enterprise

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EXECUTIVE SUMMARY

Belize's agriculture policy places a strong emphasis on climate change adaptation and mitigation activities. This aligns with the Scaling Up Climate Ambition on Land Use and Agriculture (SCALA) programme, which operates through nationally determined contributions (NDCs) and National Adaptation Plans (NAPs). SCALA, via its Private Sector Engagement Facility, collaborates with the Government of Belize to conduct a value chain assessment of the beef cattle value chain, an exploratory national market analysis, a financial analysis to transition from current practices to climate-resilience agriculture, and a roadmap to enhance the climate resilience of livestock farmers.

The consultant team employed a mixed method (primary and secondary data collection) approach to gather the necessary information, which included a mission visit. Interviews and focus group meetings were conducted with key stakeholders across the livestock value chain. This comprehensive approach ensured a thorough understanding of the current state and potential opportunities within the industry. Additionally, a financial analysis was conducted to compare climate-smart agriculture (CSA) practices with those of a more traditional production model.

The value chain assessment highlights a significant divide in cattle ranching operations across Belize. Most cattle farms in the study are relatively small to medium-sized, employing a mix of traditional agricultural techniques and some CSA practices. The study concluded that sustainable practices are already understood and applied by both small and large producers within the cattle-beef value chain in Belize. However, the cost of implementing climate-smart activities presents a considerable challenge that must be addressed. Despite this, significant efforts in capacity building within the industry.

This situation presents a substantial opportunity to expand the existing foundation of a sustainable beef and cattle value chain in Belize and further consolidate a sustainable cattle beef industry. Although small ranchers are more numerous, they can collectively have a significant impact on the industry when equipped with the knowledge and tools for sustainable practices. Focusing on providing financial support to these small ranchers could accelerate the development of a stronger sustainable industry.

One challenge identified in the study, however, is the influence of market dynamics on producers' decision-making processes. The current market structure encourages the sale of young animals which prevents the growth of the herd size. Key players in cattle commercialization channels tend to focus on sourcing animals younger than three years old for short-term gains. The markets are not fully considering the importance of maintaining a diverse age structure and an appropriate stocking rate of replenishment is essential for ensuring a continuous cycle of growth, reproduction, and production of the national herd. This situation could ultimately hinder the development of a truly sustainable cattle industry.

Regarding commercialization channels, the research identifies two main market segments: live cattle markets and local beef markets.

The live cattle market requires animals of specific ages and weights. There are three main channels for live cattle: a) Transporters from Guatemala: Prefer young animals weighing less than 225 kilograms, and b) Intermediaries that sell to Mexican importers: Demand animals weighing at least 225 kilograms for fattening and eventual slaughter in Mexico, c) Local beef processors: Beef processors in Belize focus on fattening cattle up to 400-500 kilograms to maximize carcass yield. These processors typically source younger cattle (under three years old), though some older animals are also used. They provide beef to the local consumer in Belize.

Demand from Guatemalan transporters and Mexico importers significantly influences the local market, creating competition with domestic beef processors. The complexity of this competition is evident in several areas: Those selling outside of Belize often target markets where they can obtain higher prices or where phytosanitary regulations are less strict; slaughterhouses in Belize primarily cater to the

domestic market, providing beef for local consumption; high sales to Mexico and Guatemala can reduce the availability of cattle for local processing, potentially driving up prices.
Facing less supply and high prices, induce transporters and intermediaries to offer higher prices to cattle farmers to secure livestock for their businesses, creating competition with local slaughterhouses that may not be able to match these prices.

The market for beef in Belize is commercialized to local consumers through a retail sector that includes businesses such as supermarkets and specialized beef shops. Another channel of commercialization for beef is the hotel, restaurant, and tourism industry. As Belize is a very small country, the market for beef is correspondingly limited. Furthermore, there is a strong preference for consuming poultry and pork due to cultural reasons and because these meats are less expensive than beef. However, there has been a modest increase in beef demand, calculated over the slaughter of cattle, in the last five years.

Given the small market size and the direct competition from other meats, the retail sector's pricing mechanisms do not offer much information to local consumers. Local consumers neither understand nor are particularly interested in production methods or the distinction between sustainable and traditional production methods. Foreign consumers or high-income consumers, especially those who visit specialized beef shops, may show more interest but are not necessarily willing to pay a differentiated price. Both local and foreign consumers are accustomed to paying higher prices for imported beef in restaurants or hotels.

In the financial analysis conducted, the CSA practices taken into consideration including some Nature-Based Solutions (NbS), comprise the following: Pasture improvement and rotational grazing, live fencing, tree regeneration and planting, mix fodder bank, electric fencing, water harvesting and storage. When comparing the costs of implementing these practices to those of traditional production systems, the cost per pound for a 600-pound animal is found to be 26 percent lower in CSA systems. This indicates that CSA practices are not only more sustainable but also more profitable than conventional methods.

This is relevant because it shows that investment in CSA practices in livestock production generates financial resources for livestock farming families, facilitating competitiveness and business profitability, while reducing the impacts of the activity and adapting to climate change. This investment leads to increased financial resources for farming families, competitiveness and profitability, mitigating environmental impacts because improves the soil quality, a core element of the system, while enhancing the resilience to climate change.

The growth of the cattle herd in Belize can be achieved over a period of seven to eight years, with the potential to double its size by managing adequately the age and weight of the cattle herd. The assumptions for this projection are outlined and presented as an investment opportunity. This is critical to reach international markets (mainly Mexico and Guatemala, but also other potential markets) while assuring the internal supply of meat.

The study includes a roadmap based on six strategic recommendations, including an implementation plan and a budget. The proposed strategic recommendations, along with their respective budgets, are as follows:

1. **Promote herd growth and meat production**: Implement and strengthen good climate-resilient practices in livestock production. This approach enables sustainable intensification of production in the same area and avoids replacing forests with pastures. Total calculated investment needed: USD 26 206 208.
2. **Establish a governance structure by Executive Decree**: Develop governance for the meat industry whereby participants create a climate-resilient production policy aligned with the goals linked to the fulfilment of Belize's GHG emissions reduction. This will help seize market opportunities and increase efficiencies using technological packages like systematic technical assistance. Total calculated investment needed: USD 360 000.
3. **Unify sector positioning**: Position the meat production sector as a unified entity by developing policies that support the industry as a "one big farm" concept. This approach can enhance

coordination and efficiency within the sector. Total calculated investment needed: USD 3 900 000.

4. **Increase cattle production**: Increase cattle production to ensure that the supply meets current and potential demands for live and processed meat. This involves improving breeding practices and ensuring adequate resources for cattle farmers. Total calculated investment needed: USD 370 000.
5. **Secure climate financing**: Identify and concretize climate financing options provided by international and multilateral cooperation agencies for various sustainable beef value chain actors. This financial support is crucial for implementing climate-resilient practices. Total calculated investment needed: USD 3 877 230.
6. **Develop a marketing strategy**: Develop a marketing strategy to promote climate-resilient livestock production and its derived products. This strategy should highlight the benefits of sustainable practices and target niche markets that value environmentally friendly products. Total calculated investment needed: USD 5 180 000.

The total calculated investment required to implement the strategic recommendations within the next ten years is USD 39 893 438.

Additionally, the following recommendations of the study are highlighted:

- At the national level, BLPA should encourage the adoption of standard practices to implement a model to improve efficiency, integrate technology, and CSA practices and provide extension technical services. This model could also support Belize in seeking an international certification to verify the quality and advancement of the country's cattle sector.

- Develop a comprehensive technical package and training programs, supported by systematic extension activities in CSA practices.

- The recommended effort to retain female cattle in the national herd, aimed at expanding the country's production capacity, should be complemented by the introduction of climate-resilient breeds. These breeds must align with potential markets to enhance producers' incomes effectively.

- Develop governance with BLPA that enables stakeholders to transparently utilize existing mechanisms for importing beef cuts. This governance could create systems to regulate the supply and demand of imports within the framework of national production.

- Promote Belize as a country with integrated sustainable practices as a reliable and good quality source of cattle. This would open not only potential markets, but position Belize in terms of quality, not competing with large volumes producers. The country should develop a comprehensive marketing strategy making a business case and show the sustainable practices in the country, like other organizations have done it (i.e. CORFOGA in Costa Rica). Consider the advantages of a national brand backed by international sustainability certification.

- To start an initial phase of the strategy on increasing the livestock inventory through NAMA schemes, to meet domestic demand pressure in local processors that supply beef to the local market. In a subsequent phase, the strategy can then target the development of export markets.

- To formalize the governance proposal for the "Climate-Resilient Beef Value Chain of Belize," it is recommended that it be officially declared a matter of public interest through an Executive Decree. Besides, all organizations represented within the governance structure of Belize's climate-resilient beef value chain must meet the requirement of formal legal recognition.

- The herd's growth must be linked to financing measures allowing producers to adopt sustainable intensification practices, rather than deforestation. A “zero-rate” financial tool could be

developed, offering non-repayable funds to producers in exchange for committing to maintain forest cover on their lands.

- Create educational assistance, extension activities and training programs jointly in collaboration with government agencies and educational institutions in Belize, which have the trust of farmers. These programs should also focus on making modern equipment and technology accessible.

- Design a climate-resilient cattle farming strategy for Belize through a public-private partnership that aligns organizational goals and resources toward its national implementation.

- Implement weather-resilient practices as part of the technological transfer and educational package that must be developed by joint efforts by government agencies, educational institutions, and BLPA. These practices may lead to better pasture management, access to water resources and forest preservation, making specific sectors less vulnerable to climate volatility.

- Limit agricultural frontier expansion to prevent the loss of primary and secondary forests and ecosystem damage and the county's biodiversity. Instead, promote the intensification of production in existing pasture areas using climate-resilient practices. For instance, rotational grazing, improvement of pastures, fodder banks and living fences are activities that allow the intensification without expanding the area of pastures, which will also increase productivity.

The study underscores the potential financial benefits of investing in climate-resilient practices for cattle livestock producers and the industry in Belize. These practices not only help mitigate the impacts of climate change but also enhance the profitability and competitiveness of the livestock sector. By positioning Belize as a distinctive brand for sustainable beef, the country can capitalize on emerging market opportunities and secure a sustainable future for its livestock agricultural sector.

1. INTRODUCTION

Belize is a small country (22 966 square kilometres) located on the northeast coast of Central America. It is considered an upper middle-income country with over 50 percent of the overall population living in rural areas. Its economy is dominated by the service sector (70 percent of output), where tourism occupies an important role. Agriculture has contributed close to 14 percent of the GDP on average in the last few years (CIA, 2024).

The livestock and sustainable beef cattle sector has an important output value in the overall economy, contributing more than USD 100 million to the economy of Belize (Ministry of Agriculture, Food Security and Enterprises, 2023). The country sustains 60 percent of the total land area in forests and 6.9 percent in agriculture. Even with this small area, the agricultural sector, including livestock and sustainable beef cattle and fisheries, is considered a key sector to provide the economic base for enhanced economic growth of the country (Ministry of Agriculture, Food Security and Enterprises, 2023). Most of the population lives in rural areas, therefore, agricultural activity can contribute to poverty alleviation.

As a result of Belize's agriculture policy and its emphasis on climate change adaptation activities, several industries including food crops, livestock, and sustainable beef cattle sub-sector with free-range practices, have developed market-led strategies, increased diversification, and achieved self-reliance for food products as their primary goals (The National Climate Change Office, Ministry of Forestry, Fisheries and Sustainable Development, 2015). The development of these market strategies becomes the context of this project and research.

1.1. Contribution to national goals and the institutional agenda

Belize has a range of public policy instruments and technical frameworks that support the country's involvement in the development of the agricultural sector with climate resilience criteria. This section provides a summary of the key strategies and plans that provide a contextual framework for this study (CIA, 2024).

1.1.1. National Agriculture and Food Policy of Belize (2015-2030)

The National Agriculture and Food Policy of Belize 2015-2030 proposes five key actions to promote climate-smart agriculture in the country: (1) Adopt innovative approaches to develop efficient production systems on small farms; (2) Develop new financing models for the agricultural sector; (3) Improve the incentive system to attract both local and foreign investment; (4) Simplify regulations and bureaucratic procedures to lower the cost of doing business in the country; and (5) Invest in support services and essential infrastructure
(Belize M. o., 2015).

Fulfilment of these actions implies that the Government of Belize should strengthen the capacity of agricultural research, development, and extension services, focusing on adaptive development, robust technical assistance, and technology transfer to agricultural producers. All these areas are addressed in the recommendations of the current study. Additionally, it is essential to strengthen information systems to support evidence-based decision-making for climate change adaptation and mitigation. Furthermore, a national coordination mechanism for climate-smart agriculture should be established to facilitate knowledge sharing, avoid duplication of efforts, and add value to ongoing work (CIAT, 2018).

1.1.2. National Climate Change Adaptation Strategy for the Agricultural Sector

Belize's National Climate Change Adaptation Strategy for the Agricultural Sector (CCCCC, 2015) recommends a set of technical adaptation measures to address the harmful effects of climate change

and climate variability. These measures focus on issues related to precipitation (excess, scarcity, and variability), rising temperatures, changes in pest and disease patterns, and shifts in soil fertility.
Some of the measures linked to beef production activities are the following: Water harvesting during rainy periods for use in water-scarce conditions; selection of heat-tolerant pasture varieties and livestock breeds better suited to rising temperatures caused by climate change, with an emphasis on native genetic diversity. Additionally, silvopastoral systems using economically valuable shade trees help alleviate heat stress in grazing livestock.

Soil management and nutrition practices are also implemented to preserve and improve the physical, chemical, and nutritional properties of soils affected by higher temperatures and altered water regimes resulting from climate change. Selecting nutrient-rich grasses that can withstand both drought and water-logged soils is encouraged, along with grazing management practices to maintain the longevity and fertility of pastures. Improving soil fertility through the use of organic matter such as compost, vermiculture, and bokashi, along with physical and chemical amendments and beneficial microorganisms, is also recommended. Vegetation management, including the use of cover crops, prevents the exposure and subsequent erosion of bare soils, ensuring living ground cover during fallow periods. The majority of producers associated with the Belize Livestock Producers Association (BLPA) adhere to at least one of the measures outlined in the strategy.
The implementation of the strategy requires investments in infrastructure, equipment, technology, research, and training. It also involves education, early warning systems, and matching funds for a basic commodity insurance plan in partnership with both the public and private sectors.

1.1.3. National Climate Finance Strategy of Belize 2021-2026

This document covers various interconnected topics related to the National Climate Finance Strategy of Belize 2021-2026, including a report on climate financing options, studies on mobilizing the private sector, and multilateral development bank financing, to facilitate the implementation of the updated NDC in Belize. It focuses on providing a strategic framework within which financial resources from different sources and channels can be utilized to address the country's climate change issues (Commonwealth, 2021). The strategy does not specify concrete targets, but it describes the estimated gaps in implementing adaptation and mitigation actions in the agriculture sectors. Given its scope and specificity, the current research study could help pinpoint key activities within the livestock sector that should be prioritized for financing options.

The strategy development process focused on leveraging identified strengths and addressing areas for improvement based on findings from the climate finance landscape study. It is also linked to other key outcomes generated alongside the update process of Belize's NDC, including the Resource Requirements Report, the NDC Implementation Plan, the Climate Financing Options Report, and the Study on Utilizing Private Sector Investments and Multilateral Development Banks (MDBs) to leverage climate finance.
The proposed strategy covers five years (2021 to 2026), aligning with the NDC update cycle. Its objective is to effectively access climate finance that will enhance Belize's climate resilience and climate-change mitigation actions.

1.1.4. PLAN BELIZE 2022-2026

The PLAN BELIZE 2022-2026 (Belize G. o., 2023) outlines the implementation of several key actions and projects relevant to climate aspects of the sector:

Sustainable and Climate-Resilient Agriculture Project: This project focuses on increasing food production capacity and adopting climate-smart and ecological agriculture practices. The project includes training 7 000 farmers in climate-smart agricultural practices and providing grants to over 3 700 small-scale farmers to adopt climate-friendly practices. The project is led by the Ministry of Agriculture, Food Security, and Enterprise (MAFSE) in collaboration with producer associations, financial institutions, and the World Bank.

Sembrando Vida Project: This initiative aims to enhance food security and create employment while conserving natural resources and mitigating climate change vulnerability. It provides technologies, inputs, and financing to approximately 2 000 farmers for establishing agro-silvo-pastoral systems throughout Belize. It is supported by MAFSE and the Mexican Ministry of Agriculture and Forestry. Another relevant project involves training in water management for pasture-based livestock and water management as a means of adapting to climate change, which is being carried out by MAFSE.

In addition, the plan seeks to reduce the trade deficit driven by exports in both primary and secondary sectors by expanding value-added production. Therefore, it focuses on promoting investments in the livestock industry, including meat processing and slaughterhouse services for export. It facilitates increased exports of cattle to Mexico and Guatemala through new export protocols, creates markets to improve access to Belizean goods produced by small and medium-sized producers, and promotes and supports Mennonite communities to expand cattle production and processing for export to the Caribbean Community (CARICOM), Guatemala, and Mexico, among other priority actions.

The purpose of this plan is to develop Belize as a climate-resilient country. It also supports the protection, restoration, and sustainable use of natural forest ecosystems to halt soil degradation and biodiversity loss, while promoting climate change mitigation practices through the implementation of a national agroforestry policy.

This current study supports these projects through specific recommendations in training areas to support producers, and specific actions to strengthen silvo-pastoral systems.

1.1.5. Belize's Updated Nationally Determined Contribution

Belize is a small country with a comparably minor contribution to global greenhouse gas (GHG) emissions, and it has limited capacity to contribute to global climate change mitigation. Nevertheless, it is committed to limiting the increase in the global average temperature to 1.5°C above pre-industrial levels. Under the Paris Agreement on Climate Change, the Government of Belize submitted its NDC in 2016 and presented its updated NDC in 2021 (UNFCCC, 2021).
The updated version includes more robust data on land use trends and emission factors, notably the first Greenhouse Gas Inventory for the Forestry and Other Land Use (FOLU) sector in Belize. This inventory provides long-term trends in emissions and sequestration starting from 2001.

As a member of the High Ambition Coalition, Belize has committed to increasing its emission reduction targets in this updated NDC. This includes employing nature-based solutions within the FOLU sector to enhance carbon sequestration while supporting the NDC development process with more robust and realistic data and projections across all sectors.

The primary GHG emitters in Belize are the energy, agriculture, waste, and industrial processes and product use (IPPU) sectors. The FOLU sector, however, acts as a net carbon sink due to carbon sequestration from forest growth. The reported Belize's Fourth National GHG Inventory Report, the total GHG emissions from enteric fermentation and manure management in the beef production sector were approximately 173 920 T CO2e in 2017 (UNFCC, 2017).

Sectoral targets include a 63 percent increase in GHG reductions associated with the agriculture, forestry, and other land use (AFOLU) sector and an expansion of renewable energy projects for grid-connected electricity generation.

In livestock production, the goal stated in Belize's updated NDC is to reduce methane emissions by ten percent by 2030 and to avoid at least 4.5 KtCO2e (including up to 0.07 KtCO2e of N2O emissions) related to land use change driven by agriculture by 2025. Key proposed actions are: 1) Promoting GHG emission reductions through effective livestock management by changing feeding practices and optimizing nutrient levels; 2) Improving agricultural and livestock practices and increasing access to drought-tolerant crops and livestock breeds through partnerships with research institutions; and 3)

Supporting public-private initiatives to implement cost-effective measures that address crop development, livestock production, and soil quality improvement to enhance climate resilience.
The implementation of these NDC targets and actions is coordinated by Belize's National Climate Change Office (NCCO), with guidance from the Belize National Climate Change Committee (BNCCC). These NDC targets include the National Landscape Restoration Strategy, which intends to improve the management of 80 000 hectares of agro-landscape through adequate silvo-pastoral systems. This Restoration Strategy also aims to bring 30 500 hectares under sustainable agriculture systems with biodiversity benefits and 15 000 hectares in production systems under sustainable land management.

The current study proposes specific actions in line with these targets through specific silvo-pastoral systems and sustainable land management practices. At the adaptation level, it contemplates: the development and implementation of an enhanced early warning system for drought and extreme weather events to support farmers in planning for and responding to the impacts of climate change; mobilizing infrastructure investments for CSA; establishing a financing facility for CSA investments through local financial institutions, and adoption of better soil and water management practices.

1.2. Objectives of the study

The SCALA programme, through its Private Sector Engagement Facility, collaborates with the Government of Belize to conduct an exploratory market assessment of sustainable beef cattle value chain products. The objective is to conduct a comprehensive analysis of the beef cattle value chain, identifying opportunities to increase the value of sustainable beef products through market niche exploration. Additionally, the project will develop a roadmap to enhance the value chain's climate resilience while prioritizing environmental and social benefits.

This includes identifying resource needs, investment opportunities, innovation areas, and strategies to improve the value chain's competitiveness and sustainability.

This study considers activities that support reductions in emissions while enhancing the resilience of small livestock and sustainable beef cattle farmers to climate and economic vulnerability.
Consideration of adaptation measures such as increasing forest coverage through tree planting of productive systems, soil recovery, silvo-pastoral practices, and comprehensive water management practices are highlighted.

The scope of the research includes a value chain assessment, a market analysis, and the development of a roadmap with recommendations for the potential sustainable beef cattle sector already existing in Belize. The conclusion and recommended actions are based on the information collected and the lessons learnt from sustainable models in the area. The value chain assessment offers a comprehensive analysis of the current state and potential improvements for sustainability in the livestock and beef sectors. It will evaluate the enabling environment, assess climate risks, map key actors throughout the value chain, and provide an overview of the industry's adaptation challenges and opportunities for enhancement.

The market analysis includes research on niche market national opportunities for sustainable beef and meat products. The main conclusions will identify the opportunities already available that can be strategically implemented by BLPA, through support in productive transformation for both mitigation and adaptation practices.

The research´s main hypothesis is that niche beef markets are increasingly looking for suppliers that can ensure the sustainable use of adaptative practices (e.g., tree coverage, soil decarbonization and recovery, water resource management introducing accountability/traceability systems). In this context, the study aims to provide recommendations for regulatory frameworks and implementation of strategies based on best practices recommendations for Nature-Based Solutions (NBS) that enhance climate resiliency in the beef and meat industry in a way that is compatible with Livestock and sustainable beef cattle producers' reality. In addition, mapping of the value chain will allow the identification of private

sector actors, their adaptation challenges and good practices, barriers faced by the sector to access climate finance, opportunities of investment potential and incentives to participate in climate dialogue, support of climate policy, designing climate-resilient interventions, and strategically contributing to the NAP, the NDCs, and the Belize National REDD+ Strategy (EN-REDD+) and the Green Climate Fund (GCF) Country Programme if in execution.

1.3. Approach and methodology

The consultant team used a mixed methods approach to gather the necessary information. This approach integrated both secondary data and primary data collection, with a focus on conducting interviews and focus group meetings with key stakeholders.

Primary data collection: A targeted survey (specific thematic questions with a menu of potential answers) was applied to a sample of 1 500 of the total 7 000 BLPA members.
This sample size was based on an expected return rate of 24 percent (according to the consultants' prior experience with a population of these characteristics).

For this process, BLPA provided a list of members to define a random sample, considering the number of members per district. Using a random function, the final sample was selected from the list. Then, BLPA applied the survey using the electronic communications channel, mostly using telephone numbers registered in the association.

The survey was designed using Microsoft Forms and distributed through WhatsApp. It was expected to have a response rate of over 365 responses to reach a statistically significant representation of BLPA membership with a 95 percent confidence interval that this sample represents the population in the analysis. A total of 374 responses were received, surpassing expectations and therefore reaching the expected confidence interval.
There were several producers without access to telephone or email (mainly Amish and Mennonites) who were reached and consulted through interviews or group discussions. Raw data and information were collected using Excel data templates. This allowed for a systematic organization and data analysis.

The templates were designed to facilitate data analysis amongst different types of data: qualitative feedback, quantitative metrics, and demographic information. Once collected, the data was processed to provide a descriptive analysis and assessment of the sustainable beef cattle value chain of Belize.

In addition to the survey, there was a one-week scoping mission, where the consultants conducted a series of field observation trips and focused interviews with key stakeholders, such as the BLPA Board, government entities, restaurants, exporters, processors, breeders, traders, for a total of 14 in-depth interviews, This enhanced the comprehensive approach with qualitative information for adequate data interpretation.

Secondary data collection: A comprehensive review of relevant literature was conducted, focusing on final evaluations of value chain development projects; climate change policies and their implications for agriculture; relevant agriculture policies, regulations, and framework; land use and environmental policies; strategic plans or relevant government ministries; trade reports, statistics, and analysis; existing project reports from NGOs, BLPA, government agencies, international development partners and the Belize Chamber of Commerce and multi-stakeholder platforms. This data provided an overlook of the beef cattle livestock sector in Belize.

With this framework, the assessment of the sustainable beef cattle value chain requires a definition of sustainable beef cattle livestock for Belize. This definition provides the framework to identify the relevant aspects of the sustainable beef and meat subsector within the already analyzed overall beef and meat sector of Belize.

It is important to note that specific secondary data on sustainable beef cattle is currently lacking, as this definition has not yet been explored in detail, except through some primary research. For example, the Inter-American Development Bank's (IDB) project on enhancing livestock sector productivity and climate resilience in Belize offers valuable insights into the overall status of the livestock sector in the country (Moreno, Young, & Joseph, Consultancy to carry out an in-depth analysis of an improvement plan implemented on 10 model livestock farms aimed at Improving Livestock Productivity and Climate Resilience in Belize, 2021).

Concurrently, a stakeholder mapping exercise was conducted to identify key active actors within the sustainable beef cattle value chain definition including producers, processors, distributors, retailers, and consumers. These stakeholders were progressively identified, prioritized, and contacted from the moment that they were mapped. This data presents the core actors in the beef cattle livestock sector in Belize.

All the collected information was processed to describe the value chain assessment and perform the market and financial analysis that fed the roadmap and final recommendations of the study.

Financial Analysis: The estimates were based on the data provided by BLPA, as detailed in Annex 2, which includes the most up-to-date information available regarding the costs of implementing CSA practices in Belize. A model farm of 50 acres (20 Hectares) was used to establish estimates, selecting the most relevant CSA practices based on available data and farm-level priorities. The cost adjustments were then made using literature and expert input, mainly from BLPA and information provided by the Ministerio de Agricultura y Ganadería of Costa Rica. A more detailed explanation of this analysis can be found in Section 8.4.1. of this document.

1.4. Governance Structure

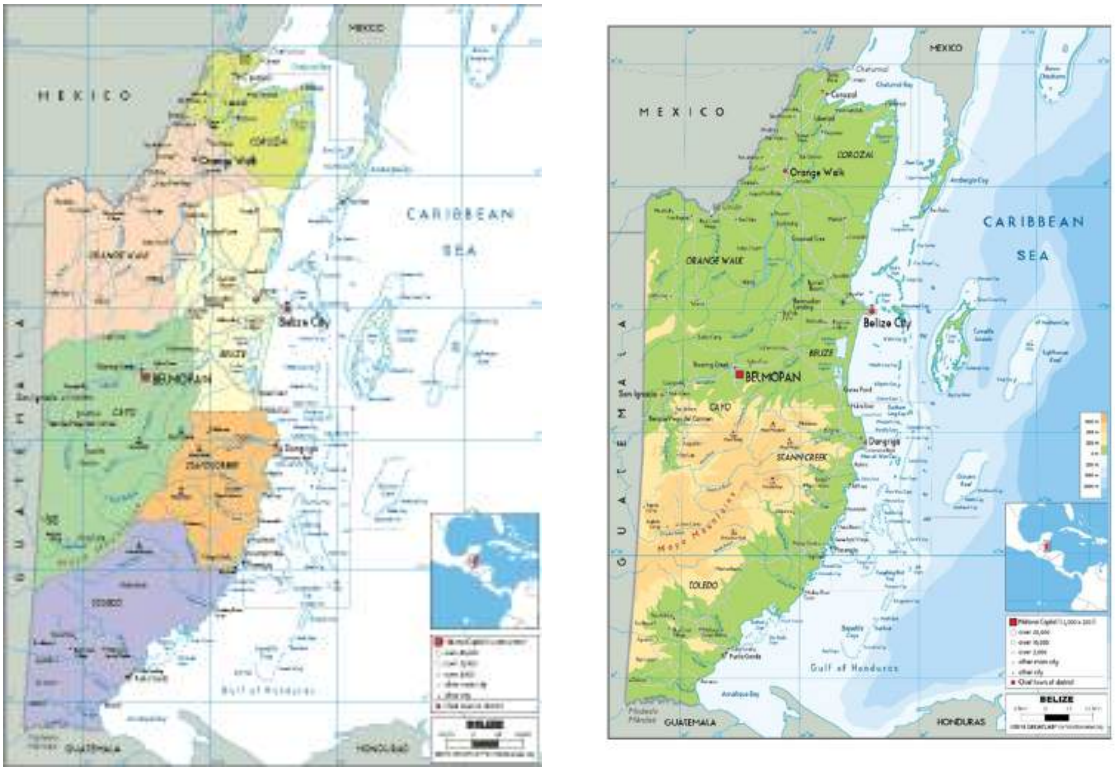
An Advisory Group was established by the International Consultant. Weekly virtual working sessions were scheduled with the International Consultant, the National Consultant, BLPA representatives, the SCALA Private Sector Engagement Facility global team, and specialized staff from FAO and UNDP in Belize. These sessions focused on reviewing and monitoring the work plan, assessing the quality of deliverables, tracking progress, and making strategic, technical, and managerial decisions. To enhance communication, a WhatsApp group was created for these members, and the SCALA global team set up a collaborative platform on Teams. This platform served as a repository for deliverables and facilitated information exchange amongst the incumbents in the governance structure.

2. SOCIO-ECONOMIC AND ENVIRONMENTAL CONTEXT OF BELIZE

2.1. Socioeconomic context

Belize, located on the northeast coast of Central America, borders Mexico to the north, Guatemala to the south and west, and the Caribbean Sea to the east. This diverse landscape features mountains, swamps, tropical jungles, and coastal mangrove forests. Belize´s territory also includes low-lying islands which are part of the Mesoamerican Reef, the world's second-largest barrier reef, teeming with rich marine life. The country spans a total area of 22 970 km², including 1 540 km² of lagoons and approximately 450 small islands covering 690 km² (CIA, 2024).

Figure 1. Map of Belize



Source: Worldometers, 2023.

Note: The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries.

With an estimated population of 417 952, Belize is the least densely populated country in Latin America. (UNITED NATIONS, 2023). The country is politically divided into six districts and the capital is Belmopan, around 50 miles from Belize City former capital.

The population is diverse in cultures such as Creole (Kriol), Garifuna, Caribbean, Maya Keechi, Maya Mopan, Mennonite, and Maya Yucatec. Over half of the population is multilingual.

A declining trend in population growth as well as in the percentage of rural population is identified in the data from World Bank. This decline is impacting the speed of the growth of population in urban areas. By 2022 half of the population lived in the rural areas of Belize.

Table 1. Belize main socioeconomic indicators 2000-2022

Indicators	2000	2010	2020	2022	Comment
Population growth rate (%)	3.43	2.45	1.85	1.43	Declining trend for the last two decades
Rural population (%)	54.6	54.8	54	51.8	In the last 12 years there is a constant declining trend, despite the population growth
Urban population growth rate (%)	3.02	2.41	1.82	1.87	Urban population is slowing the growth compare with the last two decades
GDP/capita (USD millions)	3 364	4 271	2 180	6 385	There has been a rebound on the economy of Belize after COVID-19
Access to electricity (%)	79	89.9	92.7	97.3	Increase of about 17 percent in the last 14 years.
Access to safe drinking water Urban (%) Rural (%)	91.2 84.3	96.6 91.8	98.6 98	98.6 98	Declining disparity. However, UNICEF indicates deteriorating distribution in drinking water supplies in some rural areas and south side of Belize City.
Forest coverage (%)	64	61	56	55	Declining forest cover is slowing
Agricultural land (%)	6.5	6.9	7.6	8.1	Increasing trend of agricultural land

Source: Authors' own elaboration adapted from World Bank, 2024.

Belize's was British colony in 1840 and a Crown colony after 1862. The country achieved independence on September 21, 1981. This historical connection to the British Commonwealth is maintain through its current membership in the Commonwealth of Nations. As part of the Commonwealth, Belize benefits from safety and security support from the British Commonwealth.

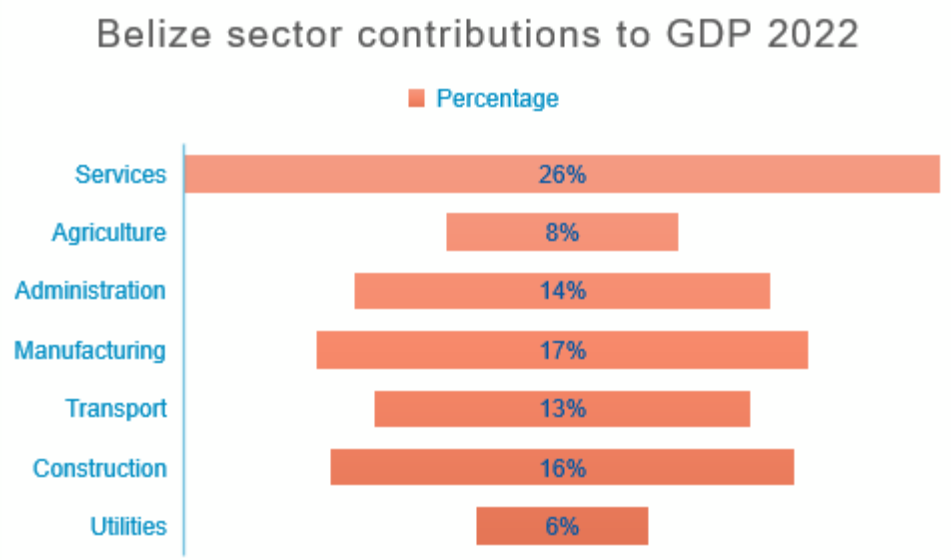
As an independent constitutional monarchy, Belize recognizes King Charles III as its head of state. However, the practical representation lies with the Governor General. The primary executive organ of Belize's government is the Cabinet, led by the Prime Minister. The Cabinet shapes policy, oversees administration, and guides the nation's development trajectory (Angulo, 2020).

The nation's economy is characterized by openness and private-sector leadership. It relies predominantly on agriculture activities, and various services. Over the past two decades, Belize has

experienced substantial economic changes, driven primarily by the flourishing tourism sector consolidating the importance of this industry in the generation of foreign exchange.

In 2022 the World Bank reported Belize as a middle-income economy that relies predominantly on tourism, agriculture, and various services. The country boasted a per capita income of USD 6 385 and achieved GDP growth of 4.5 percent in 2022 (World Bank, 2023).

Figure 2. Sector contributions to GDP 2022

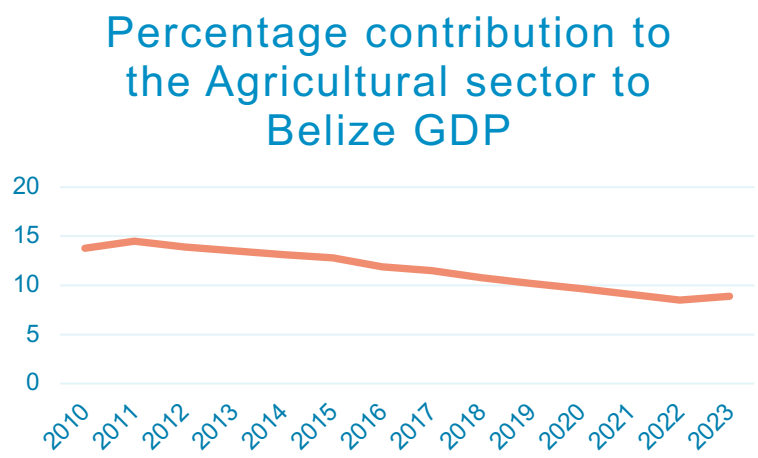


Source: Authors' own elaboration with data from the Statistical Institute of Belize (2024)

The services sector is the major contributor to the GDP of Belize with 26 percent. This sector encompasses finance, real estate, insurance, rental, and leasing services. As the largest contributor to GDP, it reflects the country's economic diversification (Statistical Institute of Belize, 2023). The construction and manufacturing industries have seen significant influence on the GDP with a contribution of 16 percent. After COVID-19, they have experienced significant growth, driven by rising consumer demand and increased tourist arrivals (Statistical Institute of Belize, 2023). In 2022 the Agricultural sector of Belize contributed USD 732 million (8.0 percent) to the national GDP. This figure includes the contribution from various commodities such as crops, livestock, and fisheries (STATISTA, 2023).

However, looking at historical data, a declining trend in the contribution of the agricultural activity can be identified in the last two decades. This is important to underline that despite its importance, agriculture's contribution has suffered of various challenges like rising input costs, labor shortages, and adverse weather conditions.

Figure 3. Contribution of agriculture to the GDP



Source: Author's own elaboration with data from World Bank, 2024.

Note: Data for 2023 is preliminary (World Bank, 2024) (Ministry of Agriculture, Food Security, and Enterprise, 2024)

2.1.1. Agriculture

Belize's agriculture sector is divided into three main subsectors: i) an export-oriented, well-organized commercial subsector focusing primarily on bananas, citrus, and sugar; ii) a vertically integrated, medium and large-scale commercial subsector, predominantly managed by Mennonites, producing cereals and livestock products for both local and export markets; iii) the subsistence smallholder subsector that produces a wide range of food crops, especially vegetables, mainly for local consumption (FAO, EU and CIRAT, 2022).

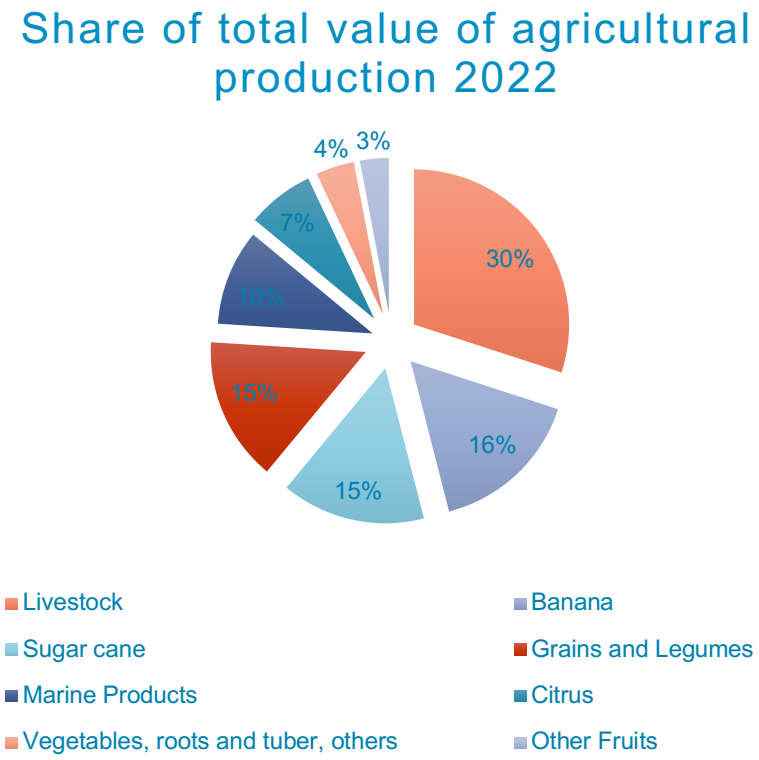
Although 75 percent of farmers belong to a diverse and subsistence smallholder subsector that produces a variety of food crops, particularly vegetables, primarily for local consumption, the primary agricultural production sectors are focused on export.

Based on the 2023 labor forced survey of Belize the country accounts for an estimated work force of 195 596 persons. Males represented 60.1 percent of the total and women 39.9. The agricultural sector in Belize is a significant contributor to the country's economy, employing 11.5 percent or approximately 10 000 individuals in 2023. There are no specific statistics of males or females employed by sector, but the share of employed persons by main occupation indicates that in occupations related to skilled agricultural, forestry and fishery workers, 8.5 percent are male and 1.5 percent are females (Statistical Institute of Belize, 2023),

This sector encompasses a wide range of activities, including crop production, livestock farming, and fisheries. The employment figures highlight the sector's importance in providing livelihoods and supporting rural communities (Statistical Institute of Belize, 2023).

Based on total production value, livestock is the largest contributor to Belize's agricultural output, valued at nearly USD 102 million. This accounts for 30 percent of agriculture's contribution to Belize's GDP. The classification includes output from cattle (carcass weight), beef for export (on the hoof), pigs, pigs for export, sheep, poultry, turkey, milk, spent hens, eggs, and honey(Ministry of Agriculture, Food Security, and Enterprise, 2024).

Figure 4. Contribution of activities to total value of Agricultural Production Value 2022



Source: Authors' own elaboration with data from the Ministry of Agriculture, Food Security and Enterprise, 2024.

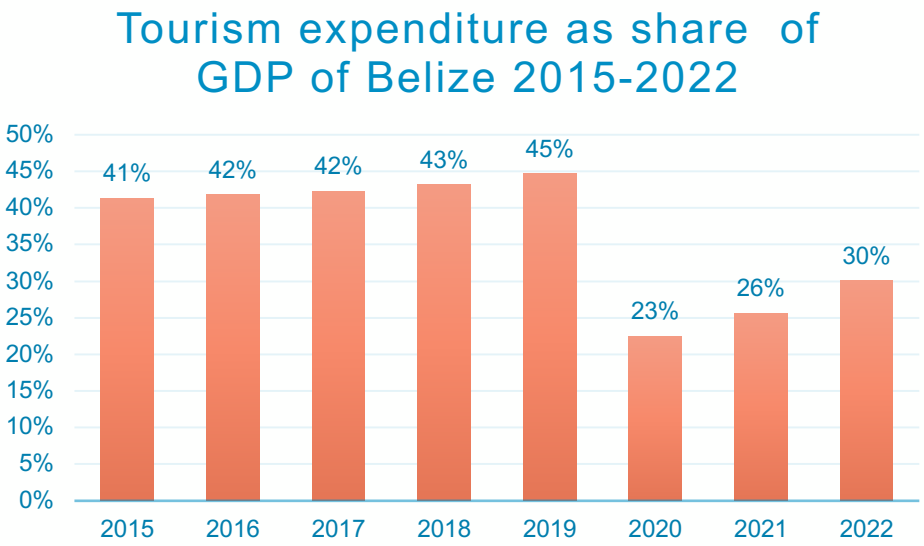
Fruits, vegetables, and other natural products are among the most expensive items in the domestic market of Belize. One impact of the country´s heavy reliance on seasonal agricultural exports like sugarcane, bananas, and citrus products. The export industry motivates the lack of local production for local consumption (CIA, 2024) (FAO, 2023).

a) Tourism

The World Bank considers the country as an upper middle-income country with a unique cultural heritage and significant ecological diversity and recognizes that Belize´s tourism industry is the primary source of foreign exchange (World Bank, 2024). The country's natural beauty, including its barrier reef and rich biodiversity, attracts many visitors. These aspects have driven the industry of Tourism in the last decade. After COVID 19, the industry is experimenting a rebound in the visitation to the country.

In 2022, the expenditures reach USD 400 Million. This represented a share of 30 percent of the GDP of the country (STATISTA, 2023) and (Belize Tourism Board, 2023).

Figure 5. Tourism expenditure as share of GDP of Belize 2015-2022



Source: Authors' own elaboration (2024) with data from (STATISTA, 2023) and (Belize Tourism Board, 2023).

These percentages reflect the significant role tourism plays in Belize's economy, with notable fluctuations due to global events like the COVID-19 pandemic.

The influx of international visitors brings in substantial revenue, which helps stabilize the country's currency and balance of payments. This financial inflow is crucial for a small economy like Belize, providing the necessary funds for imports and reducing the trade deficit. The steady stream of foreign currency also supports the Central Bank's reserves, enhancing the country's financial stability (World Bank, 2023).

b) International relations and trade

Belize maintains strong political and commercial relationships with both, the Latin American and the Caribbean regions. It is the only country that holds full membership in three regional organizations: CARICOM, The Community of Latin American and Caribbean States (CELAC) and The Central American Integration System (SICA). Within CARICOM, Belize actively participates in initiatives aimed at fostering economic integration, social development, and cooperation among Caribbean nations. The organization provides a platform for joint decision-making, trade agreements, and collaborative efforts to address common challenges. As a member of CELAC, Belize engages in broader hemispheric discussions. CELAC represents a commitment to strengthening ties across Latin America and the Caribbean, emphasizing shared values, sustainable development, and regional solidarity. Belize's participation in CELAC underscores its dedication to regional diplomacy and collective action. The country plays an active role in SICA, a regional body focused on promoting cooperation, peace, and development. SICA facilitates dialogue among its member states, addressing issues such as security, disaster management, and economic integration. Belize's engagement in SICA reflects its commitment to regional stability and cross-border collaboration (Angulo, 2020).

Belize and Guatemala have established a Partial Scope Agreement (PSA), which was signed in 2006 and became effective in 2010. This agreement aims to enhance economic and political relations between the two countries by facilitating, promoting, diversifying, and expanding trade in goods that meet the origin criteria specified within the agreement.

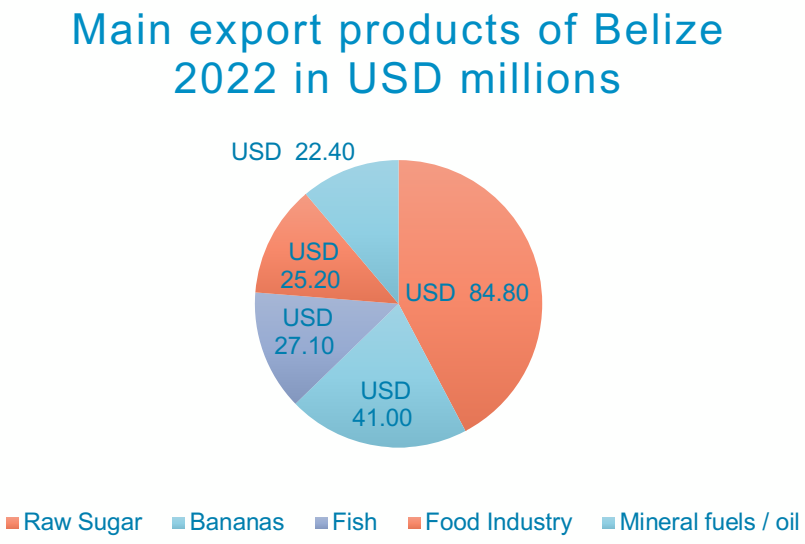
The key elements of the PSA are 1) to provide preferential tariff margins on selected goods, eliminating non-tariff barriers to trade, and setting clear technical regulations and sanitary and phytosanitary measures, 2) to foster investments by providing a legal framework that ensures legal certainty for investors from both countries and 3) to facilitate the land transportation of goods by removing discriminatory transit barriers, thereby improving the efficiency of cross-border trade.

The agreement establishes a transparent and effective system for resolving trade disputes, ensuring smooth commercial relations between the two nations. The agreement covers 72 products originating from Belize, including livestock such as tilapia, yellow maize, black beans, rice, toilet paper, doors, windows, wooden and wicker furniture, among others: A total of 78 products originating from Guatemala are included in the PSA, allowing for reciprocal trade between the two countries with preferential tariff margins.

In May 2022, during an official visit by Mexican President Andres Obrador to Belize, the Mexican government announced the removal of tariffs on agricultural exports from Belize (International Trade Administration USA, 2024). This agreement aims to enhance economic cooperation and facilitate the exportation of Belizean goods, including livestock, to Mexico (Goverment of Belize, 2022) . The key elements of this decision are: 1) the elimination of tariffs on agricultural exports from Belize, making it easier and more cost-effective for Belizean farmers to export their products to Mexico, 2) to enhance actions for cooperation in areas such as tourism, education, and training in agro-silvopastoral production systems, and 3) to provide Belizean farmers improved access to the Mexican market, which can lead to increased sales and economic growth for the agricultural sector in Belize.

These political and international frameworks of relations support the export activities of Belize. In 2022, the top five activities that supported exports where raw sugar, bananas, fish, food industry and animal fodder and mineral fuels including oil. These products accounted for 70 percent of the total value of exports of the country.

Figure 6. Main products exported in 2022

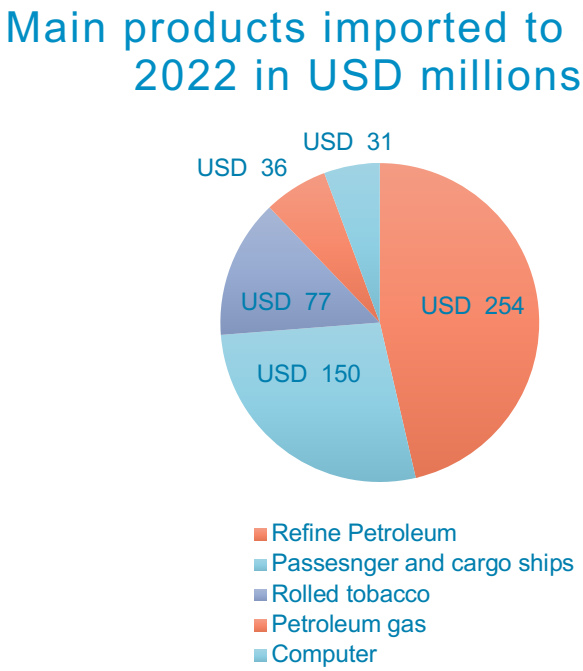


Source: Authors' own elaboration with data from World Bank, 2024.

Belize's trade balance has been structurally in deficit for the last two decades. In 2022 the World Bank, estimated to be negative by 3.2 percent of the GDP. This indicates that Belize imported more goods and services than it exported during that year.

The main products imported in 2022 were refined petroleum, passenger and cargo ships, rolled tobacco, petroleum gas, and computers (World Bank, 2024). These products represented 30 percent of the total value of goods imported to the country.

Figure 7. Main products imported in 2022



Source: Authors' own elaboration with data from World Bank, 2024.

2.2. Environmental context

Belize has a total land area of 22 970 km² (CIA, 2024). Approximately 38 percent of this land is suitable for agriculture. However, only seven percent of the total land area is currently used for farming. Of the total land area, 1.4 percent is planted with permanent crops, 2.2 percent consists of permanent pastures, and 3.3 percent is arable land (FAO, 2018).

Belize is particularly vulnerable to land degradation, as nearly two-thirds of its national territory is classified as marginal land, which should ideally be used for forestry and conservation purposes. Belize is vulnerable to hurricanes, storms and associated flooding, wind damage, and storm surge, especially in Belize City. The country's low-lying terrain exacerbates the effects of flooding and sea level rise. Belize is also at risk of extreme temperature events. According to the World Bank's Natural Disaster Hotspot study, Belize has the 61st highest relative risk of mortality from multiple hazards in the world and ranks eighth out of 167 countries in terms of climate risk (World Bank Group, 2024).

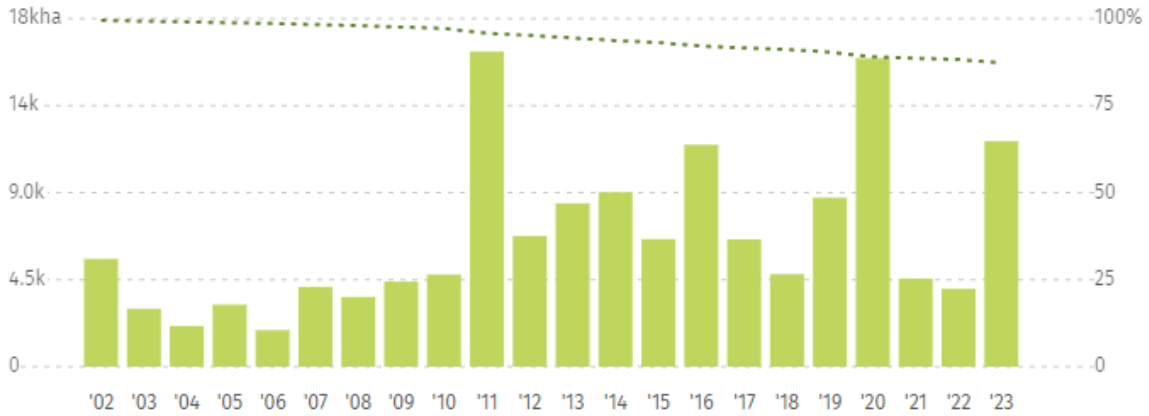
Like many other countries, land degradation in Belize is primarily driven by human activities, notably the expansion of agricultural land through deforestation, combined with unsustainable farming and livestock production practices. Additionally, climate change exacerbates land degradation through rising sea levels, which leads to saltwater intrusion and the salinization of low-lying areas, reducing their agricultural potential.

Changes in temperature and precipitation patterns also promote the spread of invasive species, animals, insects, and pathogens, which further diminish the agricultural viability of certain soils. This, in turn, increases pressure to meet growing food demands by intensifying farming on existing agricultural land and expanding production onto marginal lands that are unsuitable for sustainable agriculture (CIAT, 2018).

Forests cover approximately 62 percent of Belize's territory, making it one of the most forested countries in Central America. However, these forested areas have significantly declined over the past few decades. According to data on forest cover loss collected by Landsat satellites and processed by the Global Land Analysis and Discovery (GLAD) lab at the University of Maryland, Belize lost 3 020 square kilometers (1,170 square miles) of forest cover between 2001 and 2023, a 17 percent reduction (NASA Earth Observatory, 2024).

Regarding forests in Belize (Figure 8), from 2002 to 2023, the country lost 148 000 hectares of primary humid forest, accounting for 50 percent of its total tree cover loss during the same period. The total area of primary humid forest in Belize decreased by 13 percent over this time.

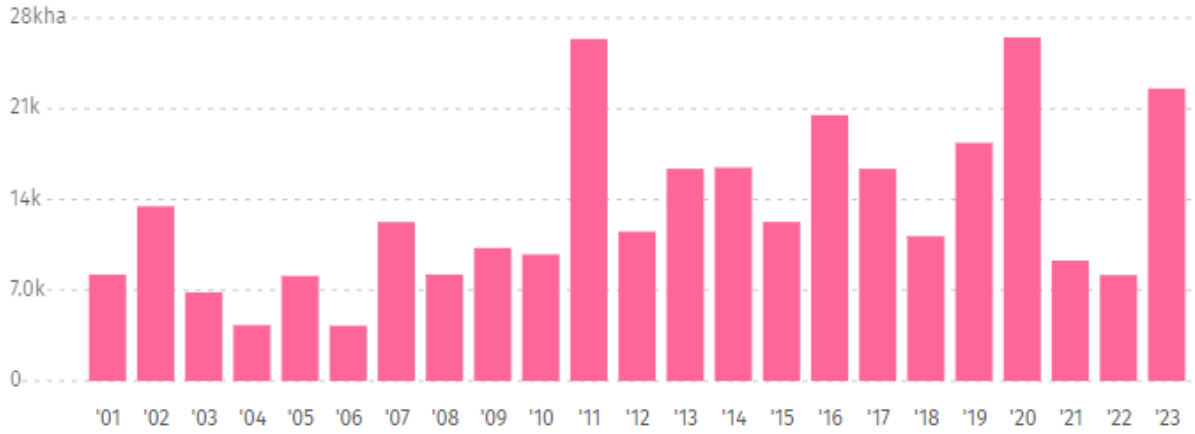
Figure 7. Loss of primary forest in Belize



Source: Forest Global Watch, 2024.

From 2001 to 2023, Belize lost 302 000 hectares, which represents a 17 percent reduction in tree cover since 2000, leading to the release of 145 million tons of CO_2 emissions (Forest Global Watch, 2024).

Figure 8. Tree cover loss in Belize



Source: Forest Global Watch, 2024.

Some of the most significant changes occurred in central and northern Belize, particularly in the Orange Walk District. Most of the forest loss is due to intentional clearing by farmers for crops or livestock. In this region, Mennonite communities' agriculture is a key factor in deforestation, as they often engage in a mix of crop farming and livestock production, including vegetables, fruits, dairy products, poultry, beef, and pork. Forests degraded by other factors, such as fires, insect infestations, or hurricanes, also contribute to tree cover loss. However, there is evidence that the deforestation rate, excluding losses related to wildfires, insects, or other natural causes, is declining in the country (NASA Earth Observatory, 2024).

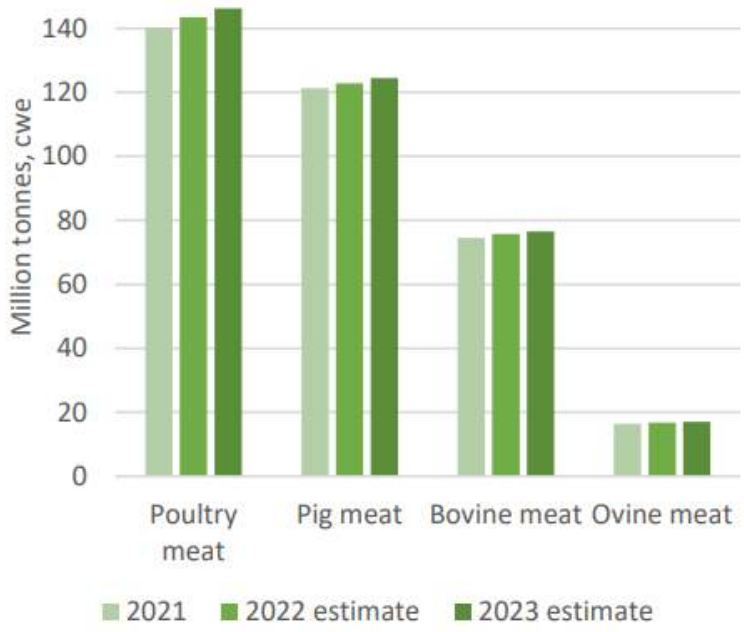
Cattle production in Belize occurs across all six districts, with the highest concentrations in Orange Walk, Cayo, Belize, and Stann Creek. The predominant production system in the country is extensive grazing. Herd sizes vary from as few as two heads to several thousand (CCCCC, 2015). Based on this description, prioritizing the integration of tree planting into cattle systems is essential. This approach aims to increase vegetation coverage on farms, improve soil conditions, protect surface and groundwater sources, and contribute to other ecosystem services.

On the marine and coastal front, Belize has committed to protecting 30 percent of its ocean territory through a participatory marine spatial planning process driven by stakeholders. Additional conservation measures include developing governance frameworks for national and high-seas fisheries and implementing a regulatory framework for coastal blue carbon projects. These actions have the potential to boost local economies and protect resources in the country's coastal areas (TNC, 2024).

3. OVERVIEW OF THE INTERNATIONAL MEAT MARKET

The international meat market is primarily composed of four types of meat: poultry, bovine[1], pig, and ovine. In 2023, bovine meat production accounted for 21 percent of 76.6 million tons (metric tons or mt) of global production (FAO, 2024). Poultry accounts for 40.1 percent, while pig meat makes up 34.2 percent of the total production. The remaining 4.67 percent corresponds to ovine meat production.

Figure 9. Global meat production by type



Source: FAO, 2024.

3.1. Production

The production of bovine meat is distributed among several major countries (see the next table for reference). The leading beef-producing countries globally include the United States, Brazil, China, the European Union, India, Argentina, Pakistan, Australia, Mexico, Russian Federation, and Canada. They account for approximately 71.75 percent of the global estimated production in 2023. This data is consistent[2] with information from the United States Department of Agriculture (USDA, 2024), with minor variations due to the inclusion of some volumes in 2023.

Australia, Brazil, China, and Argentina notably increased their production volumes, between 2022 and 2023. In contrast, Canada, the United States and the European Union saw reductions in their production. Despite having a significant decrease, the United States of America remains the largest beef producer worldwide.

1 The reference of Bovine production is as Beef production, in CWE (Carcass Weight Equivalent) which is the weight of meat cuts and meat products converted to an equivalent weight of a dressed carcass, including bone, fat, tendons and ligaments.
2 Percentage of production is consistent, small variations due to considering 2023 volumes and partial 2024 volumes by country.

Table 2. Production of beef by country (mt 1000) years 2022 and 2023.

Country	2022	2023	Change (%)	% of Global Production (2023)
United States of America	12 890	12 285	-4.69	16.04
Brazil	10 350	10 950	5.80	14.30
China	7 192	7 541	4.85	9.84
European Union	6 722	6 460	-3.90	8.43
India	4 350	4 470	2.76	5.84
Argentina	3 151	3 286	4.28	4.29
Pakistan	2 454	2 544	3.67	3.32
Australia	1 878	2 224	18.42	2.90
Mexico	2 176	2 219	1.98	2.90
Russian Federation	1 621	1 638	1.05	2.14
Canada	1 412	1 341	-5.03	1.75

Source: Authors' own elaboration with data from FAO, 2024.

3.2. Exports

As shown in the table below, in 2022 and 2023, Brazil is the largest exporter of beef globally, followed by Australia, India, and the United States. Notably, the United States of America have reduced its beef exports by 14 percent. The total export volumes from these countries represent 17.2 percent of their overall production.

Table 3. Exports of beef by country (MT) years 2022 and 2023

Country	2022	2023	Change (%)
Brazil	2 726	2 731	0.18
Australia	1 184	1 494	26.18
India	1 378	1 483	7.62
United States of America	1 485	1 273	-14.28
Argentina	827	895	8.22
European Union	580	580	0.00
Canada	556	545	-1.98

Country	2022	2023	Change (%)
Mexico	385	327	-15.06
Pakistan	74	76	2.70
Russian Federation	46	45	-2.17
China	15	13	-13.33

Source: Authors' own elaboration with data from FAO,2024.

3.3. Imports

When examining import data, China emerges as the leading importer of beef, followed by the United States. Additionally, Canada and Mexico are also major importers of beef on a global scale.

Table 4. Imports of beef by country (mt 1000) years 2022 and 2023.

Country	2022	2023	Change (%)
China	3 707	3 757	1.35
United States of America	1 473	1 604	8.89
European Union	349	340	-2.58
Russian Federation	280	261	-6.79
Canada	194	220	13.40
Mexico	158	194	22.78
Brazil	69	53	-23.19
Australia	20	15	-25.00
Argentina	7	3	-57.14
Pakistan	1	1	0.00
India	0	0	0.00

Source: Authors' own elaboration with data from FAO, 2024.

3.4. Consumption

The beef consumption table below indicates that China and the United States of America remain key players in the market.

Table 5. Consumption of beef by country (mt 1000) years 2022 and 2023

Country	2022	2023	Change (%)
China	27 451	28 193	2.70
United States of America	12 858	12 655	-1.58
Brazil	7693	8 272	7.53
European Union	6 491	6 220	-4.18
India	2 972	2 987	0.50
Pakistan	2 381	2 468	3.65
Argentina	2 331	2 394	2.70
Mexico	1 949	2 086	7.03
Russian Federation	1 855	1 854	-0.05
Canada	1 050	1 021	-2.76
Australia	714	745	4.34

Source: Authors' own elaboration with data from FAO, 2024.

3.5. Prices

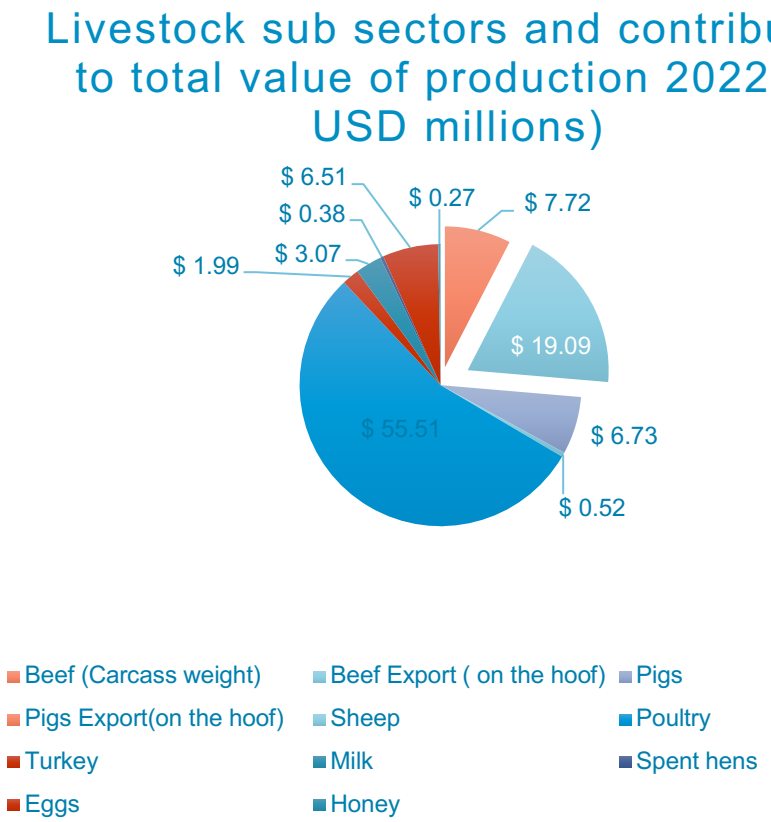
Regarding prices, beef export prices are significantly higher than those of other types of meat. For example, in December of 2023, the export meat value from the United States in USD for beef was USD9 105/ per metric ton (mt), whereas poultry was priced at USD1 225 per mt approximately 13.45 percent of the equivalent weight of beef. A similar trend is observed for Brazil's export prices, although the difference in price between the two products is lower. As of December 2023, beef export price was USD 4 547 per mt while poultry reached USD 1 738 per mt. This price disparity may explain the higher global production of poultry compared to beef. On the other hand, Guatemala, a neighboring country to Belize, produced around 70 000 MT of beef during 2023 (USDA, 2024), while consumption was 84 000 MT for the same year. Guatemala's total beef imports for 2023[3] reached 22 mt, representing a potential market opportunity for Belize. Several major countries produce, consume, and import beef worldwide. Particularly, Mexico, Canada, and the United States of America, which present interesting volumes of imported beef, while Guatemala represents a smaller market for Belize. The price of beef varies widely depending on the destination market, source and consumption trends which can fluctuate annually. Nonetheless, beef remains the most expensive meat in the general meat industry (FAO, 2024).

[3] The difference in numbers may also be due to some exported volume of beef.

4. OVERVIEW OF THE BEEF CATTLE VALUE CHAIN IN BELIZE

The Ministry of Agriculture of Belize outlines the livestock sector as encompassing the following subsectors: cattle, beef (carcass weight), beef for export (on the hoof), pigs, pigs for export, sheep, poultry, turkey, milk, spent hens, eggs, and honey. In 2022, this sector contributed USD 204 million to Belize's total agricultural output (Ministry of Agriculture, Food Security and Enterprise, 2023). This sector contribution represents three percent of the GDP of Belize.

Figure 10. Livestock sub sectors and contribution to total value of production 2022 (in USD millions)



Source: Authors' own elaboration with data from MAFSE (Ministry of Agriculture, Food Security and Enterprise, 2023).

In 2022, the poultry subsector emerged as the primary contributor to the livestock sector's total output value, accounting for over 50 percent of the sector's total production value equivalent to USD 55.5 million. The cattle subsector, including both carcass beef and live cattle for export, generated USD 26.8 million, representing 25 percent of the livestock sector's total output.

4.1. Production, geographical distribution and area of meat production

4.1.1. Cattle, establishments, and producers inventory

Belize's Ministry of Agriculture has developed a comprehensive livestock program focused on promoting, supporting, and facilitating livestock development through advanced technologies. The sustainable and inclusive agriculture program aims to enhance production quality, boost productivity, and expand production through diversification and value addition (Ministry of Agriculture, Food Security and Enterprises, 2024).

In this initiative, BLPA plays a pivotal role as a major collaborator. BLPA is responsible for implementing a livestock farm registry and an Animal Identification System, known as the Belize Livestock Registry. This research utilizes BLPA data as of the 31st December 2023, to provide a foundation for analysis and statistical support of the cattle value chain, including both beef on hoof and beef on carcass (Belize Livestock Producer Association, 2024).

Key data from the Belize Livestock Registry in 2023 includes:

Active members: The registry recorded a total of 6 808 members in the cattle sector. These members include farmers dedicated to breeding, breeding and trading, slaughterhouses (with and without cattle ownership), and other private institutions related to the subsector. Of these members, 77 percent (5 378) reported owning cattle.

Establishments: There were 6 663 reported establishments. An establishment can be a ranch, a slaughterhouse with a cattle care area, or traders maintaining a site where cattle are fed and cared for during trading. These establishments are spread across all districts of Belize.

As of December 2023, the total number of cattle heads reported was 190 483.

Table 6. National Cattle Inventory, Operations and Registrants (December 2023)

DISTRICT	Number cattle heads	Number of operations	Number of registrants
ORANGE WALK	96 629	2 193	2 268
CAYO	55 750	1 968	1 939
TOLEDO	12 323	639	687
COROZAL	10 529	1 251	1 281
BELIZE	8 680	433	463
STANN CREEK	6 527	179	170
TOTAL	190 438	6 663	6 808

Source: Authors' own elaboration with data from BLPA (Belize Livestock Producer Association, 2024).

The districts of Orange Walk and Cayo account for 80 percent of the country's total cattle population and 62 percent of registered operations, as well as 62 percent of the total BLPA members (Belize Livestock Producer Association, 2024).

Figure 11. Districts with most cattle heads in Belize

Source: Authors' own elaboration with data from BLPA (Belize Livestock Producer Association, 2024).

4.1.2. Cattle operations size

BLPA has developed a classification system for producers to better understand their needs and tailor programs accordingly. This system categorizes operations based on the number of cattle owned by each producer, with each category in numerical ranges, covering a range of 50 animals.

Producers are classified by the size (number of animals) of their operations as follows:

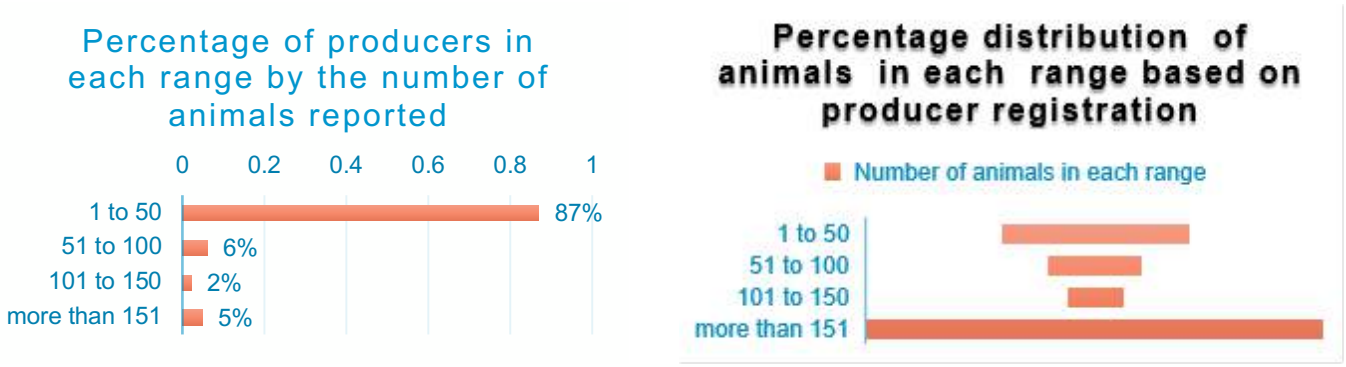
Table 7. Classification of producers according to number of animals

Number of Animals	Classification
1 to 50	Small-scale producers
51 to 100	Medium-scale producers
101 to 150	Large-scale producers
More than 151	Very large-scale producers

Source: BLPA, 2024.

This classification allows for a more precise understanding of the producers' needs and the implementation of appropriate programs (Belize Livestock Producer Association, 2024).

Figure 12. Percent distribution of total producer and animals in each range

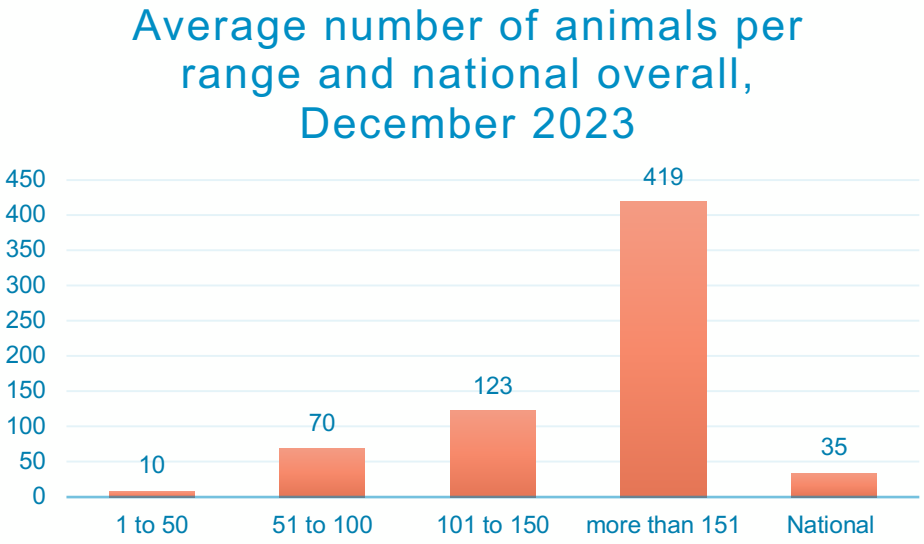


Source: Authors' own elaboration with data from BLPA (Belize Livestock Producer Association, 2024).

As of December 2023, 87 percent registered in the cattle value chain operated with one to 50 animals, collectively owning 23 percent of the total registered cattle inventory in Belize. In contrast, producers with the largest operations, defined as those owning more than 151 animals, represented just five percent of total registered producers yet held over half of the total registered cattle inventory in the country.

The national average, based on the December 2023 registration, was 35 animals per producer. Small-scale producers averaged ten animals per producer, while the largest-scale producers averaged 419 animals per producer.

Figure 13. Average number of animals per range and national overall

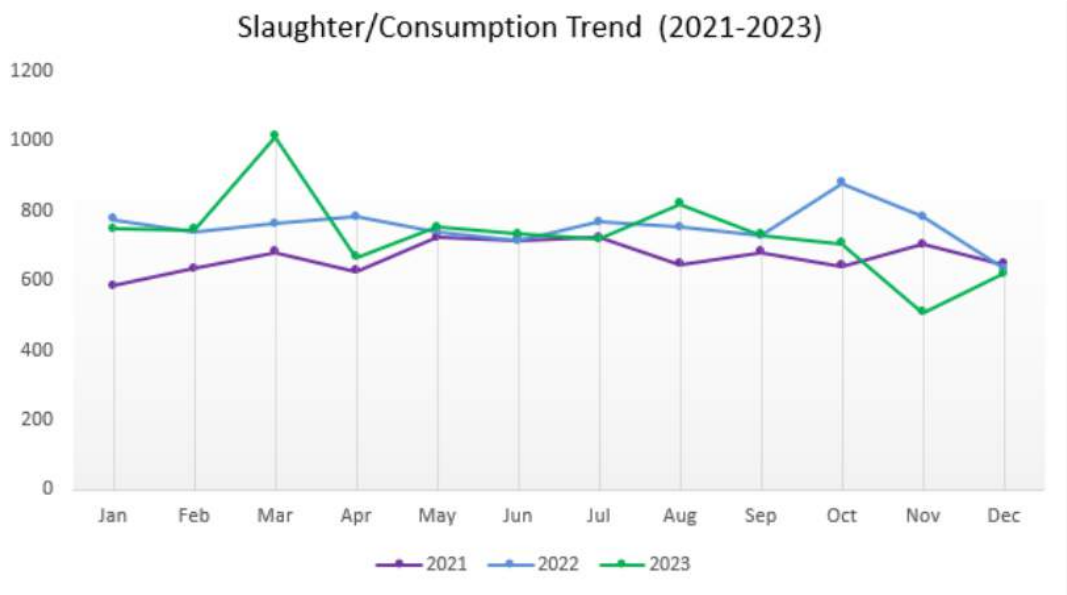


Source: Authors' own elaboration with data from BLPA (Belize Livestock Producer Association, 2024).

4.1.3. Beef production

According to BLPA, a total of 8 765 animals were slaughtered in registered slaughterhouses in 2023 (Belize Livestock Producer Association, 2024). Analyzing the monthly distribution of beef production shows that, aside from some isolated peak production months in 2023, beef production remained consistently stable.

Figure 14. Number of slaughter cattle heads per month 2021, 2022, 2023



Source: BLPA (Belize Livestock Producer Association, 2024).

The Ministry of Agriculture compiles beef production statistics based on carcass weight, measured in pounds. Carcass weight refers to the weight of an animal after it has undergone partial butchering. Measurement includes the bones, cartilage, and other body structures that remain post-initial butchering (University of Nebraska-Lincoln, 2024).

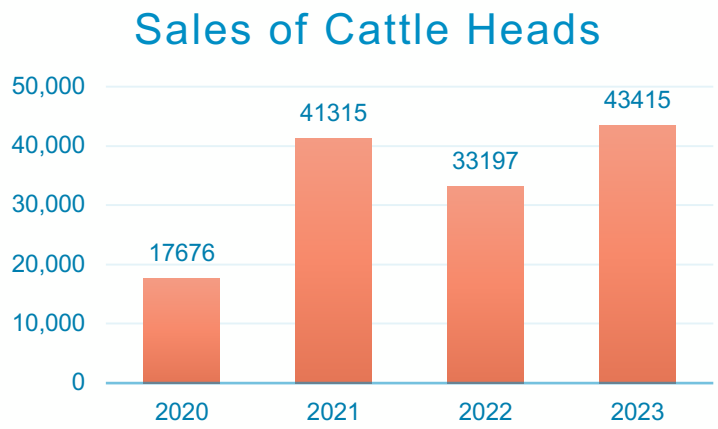
In 2023, Belize agricultural authorities reported a total of 4 169 250 pounds of (carcass weight), equivalent to 1 891 TM. This production was valued at an average price of USD 1.87 pounds resulting in a total output value of USD 7 817 344. (Ministry of Agriculture, Food Security, and Enterprise, 2024).

4.2. Foreign trade

4.2.1. Live Cattle Sales

The majority of the international trade in the cattle value sector is driven by the cross-border sale of live cattle. According to a report from the Ministry of Agriculture, export volumes have now returned to pre-COVID-19 pandemic levels reaching 43 415 cattle heads moving across borders.

Figure 15. Export of cattle from 2020 to 2023



Source: Authors' own elaboration with data from BLPA (Belize Livestock Producer Association, 2024).

In a strategic initiative launched in 2021, the Government of Belize successfully secured access to the Mexican market for the export of Belizean cattle. This achievement, alongside exports to Guatemala, has significantly bolstered Belize's economy. In 2023, Belize exported over 4 655 cattle heads to Mexico, generating revenues exceeding USD 2.8 million. Concurrently, 38 760 head of cattle were exported to Guatemala, yielding over USD 18.6 million in revenue (Ministry of Agriculture, Food Security, and Enterprise, 2024).

4.2.2. Beef exports

Data from the trade software provided by the World Bank, World Integrated Trade Solution (WITS), shows information from several international trade databases. This data indicates that beef exports from Belize have been a very nascent activity, mostly representing sporadic and trial opportunities rather than a continuous business.

Table 8. Beef exports

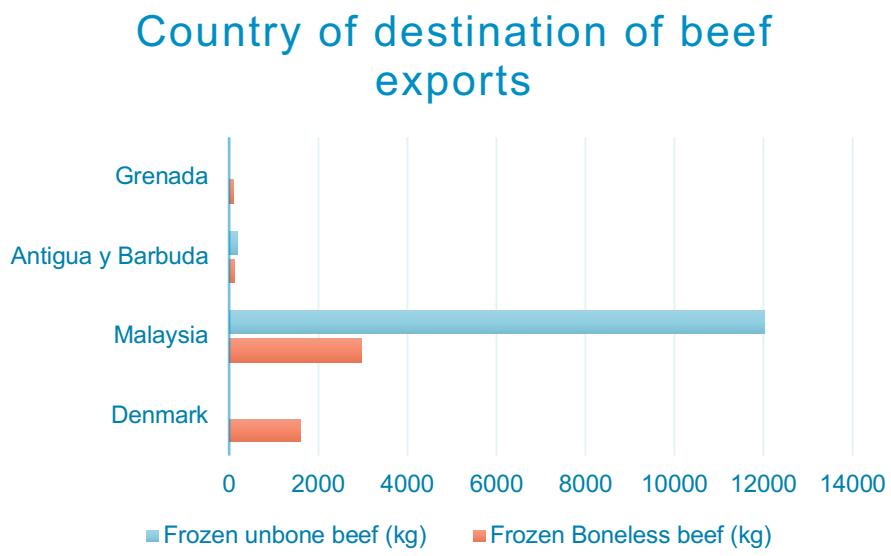
Export Year	Frozen boneless beef (kg)	Frozen unboned beef (kg)	Total kg per year
2022	4 593	12 198	**16 791**
2023	100	0	**400**

Source: Authors' own elaboration with data from World Integrated Trade Solution, 2024.

Over the past two years, Belize engaged in exporting frozen beef, focusing primarily on frozen boneless cuts. In 2022, there was an effort to export frozen bone-in beef, reaching 16 791 kg. However, in 2023, this activity only reached 400 kg reporting no sales of frozen unboned beef during the year in the databases. The interviews in this research could not explain the decline, but some processors indicated that competition from other markets made the activity not profitable enough to continue. Some processors referred to these activities as trials.

WITS also provide information on trading partners. Several of Belize's trading partners are located outside the regional markets. In 2022, Malaysia and Antigua and Barbuda imported both frozen boneless and bone-in beef from Belize. Additionally, Denmark imported frozen boneless beef. In 2023, Grenada also imported frozen boneless beef.

Figure 16. Country of destination of beef exports.



Source: Authors' own elaboration with data from World Integrated Trade Solution,2024.

4.2.3. Cattle imports

According to the World Bank, Belize has imported cattle over the past three years, with the data presented in terms of the number of heads. This trend suggests that the primary purpose is not commercial consumption but rather for the acquisition of breeding stock to improve the quality of the country's cattle inventory (World Integrated Trade Solution, 2024). All reported cattle imports have originated from Mexico.

Table 9. Imports of cattle

Year	Cattle Imports (No. Of heads)	Embryos Imports (item)	Semen Imports (Kg)
2020	18		103
2021	120		86
2022	95	800	
2023	136		99

Source: Authors' own elaboration with data from (World Integrated Trade Solution, 2024).

To support this statement, data on imports of products related to cattle inventory improvement were examined. Reports indicate that over the past three years, Belize has consistently imported bovine semen and embryos, all sourced from the United States (World Integrated Trade Solution,2024).

4.2.4. Beef imports

The trade of frozen beef into Belize remains strong, with the majority of imports coming from the United States of America, and additional shipments from Mexico exclusively in 2022. Belizean markets receive two types of frozen beef, boneless and bone-in. Import volumes exceeded 15 000 pounds in both 2021 and 2023 (World Integrated Trade Solution, 2024).

Table 10. Beef imports

Year	Import Frozen boneless beef (Kg)	Imports Frozen unboned beef (Kg)	Total Kg imported per year (Kg)
2020	8 722	52	**8 774**
2021	14 863	1 067	**15 930**
2022	3 747	40	**3 787**
2023	14 851	1 011	**15 862**

Source: Authors' own elaboration with data from WITS (World Integrated Trade Solution, 2024).

4.3. Competition

Consumption of animal protein in Belize reveals distinct patterns when compared to global averages. In 2022, Belizeans consumed 12.93 kg of beef per capita, significantly lower than the global average of 34.1 kg.

Table 11. Comparison of animal protein consumption in Belize

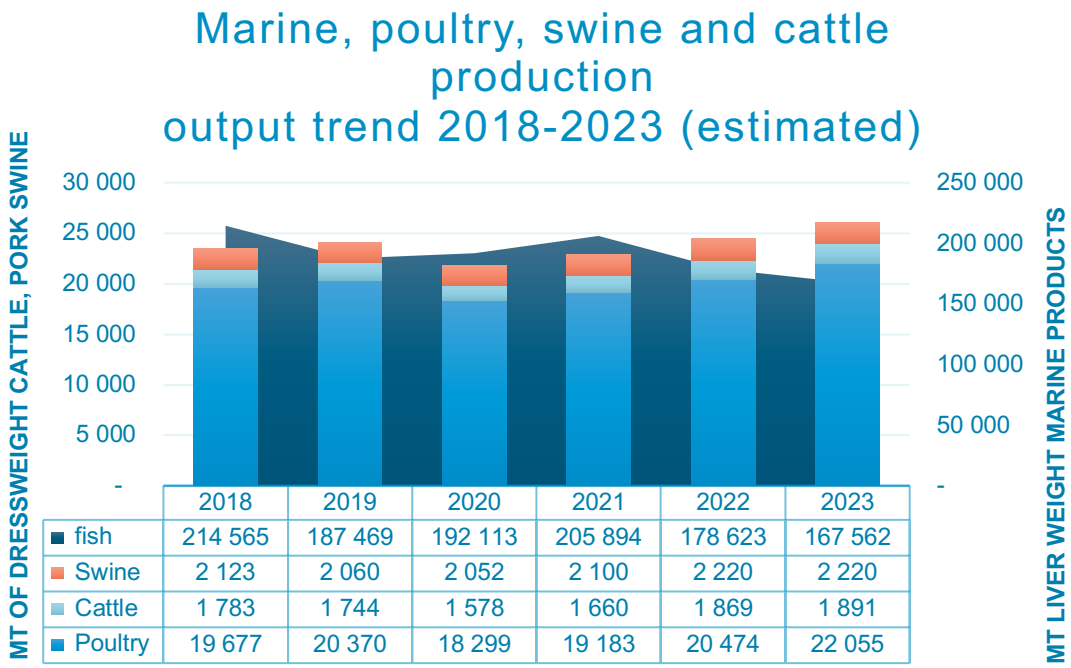
Type of meat	Belize (Kg) 2022	World average (Kg) 2022
Beef	12.93	34.1
Poultry	50.00	34.1
Pork	17.38	15.2
Fish	13.35	20.65

Source: Authors' own elaboration with data from (FAO, 2024).

In contrast, poultry consumption is remarkably high at 50 Kg per capita, compared to the world average of 34.1 Kg, indicating a strong preference for poultry in the local diet. Pork consumption also exceeds the global average, with Belizeans consuming 17.38 Kg per capita, compared to the world average of 15.2 Kg. However, fish consumption in Belize is relatively low at 13.35 Kg per capita, below the global average of 20.65 Kg. This data suggests that while Belizeans favor poultry and pork over beef, their consumption of beef and fish remains relatively modest.

Protein production in Belize reveals significant competition among various productive activities within the livestock sector. The poultry industry leads, demonstrating its leadership in both economic output and production volume, followed by the production and output value of cattle beef, pork, and fish. Each subsector plays a crucial role, contributing to the overall diversity and resilience of Belize's livestock sector.

Figure 17. Poultry, swine and cattle production output trend 2018-2023 (estimated)



	2018	2019	2020	2021	2022	2023
fish	214 565	187 469	192 113	205 894	178 623	167 562
Swine	2 123	2 060	2 052	2 100	2 220	2 220
Cattle	1 783	1 744	1 578	1 660	1 869	1 891
Poultry	19 677	20 370	18 299	19 183	20 474	22 055

Source: Authors' own elaboration with data from (Ministry of Agriculture, Food Security and Enterprise, 2023).

Marine products represent the major production output when compared to poultry, cattle and swine sectors. Since 2021, the poultry subsector in Belize has shown consistent growth. This expansion is largely driven by a well-established poultry industry that maintains a reliable supply chain, meeting both domestic demand and potential export opportunities. Poultry's affordability and perceived health benefits, further contribute to its popularity and consumption over other meats (Ministry of Agriculture, Food Security and Enterprise, 2022).

In contrast, the cattle beef subsector operates on a smaller scale. Poultry's lower production costs and affordability make it more accessible to a broader segment of the population compared to pork and beef (Belize Poultry Association, 2023). Additionally, poultry is frequently regarded as a healthier alternative to red meat, significantly shaping and influencing consumer preferences (Mayo Clinic, 2019).

Pork production has been on the rise, driven by advancements in breeding and farming practices. The total output of the swine production sector surpasses that of the cattle beef subsector. As a popular meat in Belize, pork meets local demand and reduces the need for imports, with its market share of pork exceeding that of beef. Meanwhile, the cattle beef subsector faces competition from poultry due to cultural preferences, lower production costs, and higher consumer demand.

Another sector adding pressure to the beef market is the fish industry, which serves as a significant competitor to the cattle beef subsector. Fish is a preferred protein source for many Belizeans, with the industry striving to meet both local demand and export opportunities.

Belize's domestic fishery produces an average of 5 000 tons of fish annually (FAO, 2022). This sector is vital for the country's economy and food security, contributing significantly to local livelihoods and nutrition. While competition with poultry and pork is evident, fish offers a unique nutritional profile that appeals to health-conscious consumers (American Heart Association, Inc, 2024).

4.4. Meat prices and consumption in Belize

In Belize, the consumption patterns of beef, poultry, and pork display unique characteristics shaped by cultural preferences, economic factors, and availability. The lack of major fast-food chains also play a role in influencing these dietary trends.

In 2022, the meat consumption in Belize was distributed as follows:

- Beef: Belizeans consumed approximately 1 700 MT of beef (Ministry of Agriculture, Food security and Enterprises, 2023).
- Pork: The consumption of pork reached around 5 500 MT (Ministry of Agriculture, Food Security and Enterprise, 2022).
- Poultry: Poultry was the most consumed meat, with about 15 000 MT (FAO-OECD, 2023).

These figures reflect a growing preference for poultry, which is more affordable and widespread availability compared to beef and pork.

In 2022, the average consumer prices for meat in Belize were as follows (AGREPORT NEWS, 2023):

- Beef: Prices varied depending on cut and quality, averaging consumers paid around USD 6.61 to USD 8.82 per kg.
- Pork: The price for pork ranged between USD 3.97 to USD4.94 per kg.
- Poultry: Poultry prices were generally lower, with consumers paying about USD 2.76 to USD 3.04 per kg for dressed chicken.

Table 12. Consumption of Beef, Poultry and Pork and Consumer Prices 2022

2022	Consumption (metric tons)	Higher reported Consumer Price (USD)
Poultry	15 000	3.04
Pork	5 500	4.93
Beef	1 700	8.82

Source: Author's own elaboration with data from (FAO-OECD, 2023), (Ministry of Agriculture, Food Security and Enterprise, 2022) and (AGREPORT NEWS, 2023) (2024).

These prices represent an average calculated from the Consumer Price Index (CPI) in Belize. The CPI includes prices from supermarkets, shops, and various other retail outlets where consumers commonly purchase goods and services (AGREPORT NEWS, 2023). The data collected covers a wide range of items within the CPI basket, which is reflective of typical household expenditures. This ensures that the index accurately represents the average consumer prices for goods and services in the country.

Although the CPI in Belize provides an average measure, there is significant variability in beef prices across the market. To better understand this fluctuation, we conducted direct interactions with sellers and performed online research on September 30, 2024. three included beef prices online. The most common beef products available in shops in Belize include a variety of steaks such as Ribeye, New York Strip, T-Bone, Porterhouse, Filet Mignon, Sirloin, and Flat Iron. Additionally, roasts like Prime Rib, Beef Brisket, Chuck Roast, and Round Roast are popular choices. Ground beef options, including regular and lean ground beef, are widely available. Beef patties, gourmet burgers, and speciality burgers are also commonly found.

Table 13. Most common beef products available in Belize and prices

Beef Product	Lower and higher price (USD per kilogram)	Difference of price range with higher consumer price (USD)
Ground Beef	6.1	-2.72
Beef Steaks	9.8 - 12.3	0.98 - 3.48
Beef Roasts	8.8 - 10.7	-0.02 - 1.88
Beef Short Ribs	10.7 - 13.7	1.88 - 4.88
Baby Back Ribs	11.7 - 14.7	2.88 - 5.88
Spare Ribs	9.8 - 12.7	0.98 - 3.88

Source: Authors' elaboration.

The table indicates noticeable differences between certain beef products and the higher consumer price of USD 8.82 per kilogram. Ground beef, beef steaks, and beef roasts are among the most popular products and remain relatively close to the average reported price. Ground beef is lower at USD 6.1 per kilogram, while beef steaks and roasts range around the higher consumer price, either slightly above or below it. Conversely, premium cuts like beef short ribs, baby back ribs, and spare ribs display significant price differences, ranging from USD 1.88 to USD 5.88 above the higher consumer price. This pattern suggests that while everyday beef products maintain competitive pricing, premium cuts command higher prices in the market.

4.5. Global context of the beef cattle value chain sustainability

In today's consumer landscape, there is a complex relationship between purchasing behavior and sustainability practices. This intersection of taste preferences, ethical considerations, and environmental awareness significantly influences how consumers make choices and production methodologies. The evolving consumer consciousness is apparent across various products and services, including the cattle beef industry of Belize. Studies included in the OECD-FAO Agricultural Outlook 2021-2030 highlight significant shifts in consumer preferences towards sustainable beef. As awareness of environmental issues grows, consumers are increasingly seeking out meat products that are produced in an environmentally friendly manner (OECD, 2021). This trend is driving the beef industry to adopt more sustainable practices, such as reducing greenhouse gas emissions and improving animal welfare standards. The importance of supply chain initiatives in meeting this demand is becoming increasingly important.

Supply chains are looking to implement measures such as silvopastoral farming practices and enhancing feed efficiency so that the industry can provide more sustainable beef products. These efforts not only address environmental concerns but also cater to the evolving preferences of consumers who prioritize sustainability in their food choices.

Several organizations have established frameworks for sustainable beef production around the world. The technical team analysis concludes that these organizations emphazise that a sustainable beef value chain aims to ensure that beef production is environmentally sound, socially responsible, and economically viable. This involves managing natural resources responsibly, promoting animal health and welfare, reducing greenhouse gas emissions, and fostering innovation in food production. The goal is to create a system where beef production contributes positively to nature and society while remaining economically feasible and profitable under a changing climate.

The following frameworks could be relevant points of reference for the Belizean industry:

- **The Global Agenda for Sustainable Livestock (GASL)** supports sustainable livestock development by addressing environmental, social, and economic challenges. GASL's concept of sustainable beef emphasizes the balance between environmental protection, social equity, and economic growth (Global Agenda for Sustainable Livestock, 2024).
- **The Global Roundtable for Sustainable Beef (GRSB)** sets global sustainability goals and fosters collaboration among stakeholders to improve the sustainability of the beef value chain. GRSB's concept of sustainable beef focuses on measurable progress in areas such as animal health and welfare, efficient resource use, and the reduction of greenhouse gas emissions (Global Roundtable for Sustainable Beef, 2024).
- **The SAI Platform's European Roundtable for Beef Sustainability (ERBS)** advances beef sustainability in Europe by aligning with global principles and driving measurable positive impacts within the beef sector. ERBS's concept of sustainable beef includes enhancing production practices, promoting animal welfare, and reducing the environmental footprint of beef production (Sustainable Agriculture Initiative, 2024).

In Belize, sustainable beef production aligns with several fundamental principles that balance environmental, social, and economic factors. These principles have been developed through significant government programs in collaboration with BLPA), including:

1. **Building Resilience and Sustainability in Livestock Farmers Program**: Funded by the GEF/UNDP Small Grants Program, this initiative aims to enhance livestock intensification through climate-smart production practices and green technologies.

2. **Sustainable and Inclusive Belize Program**: This program promotes sustainable agricultural practices, increasing climate resilience, and enhancing overall productivity.

3. **Integrated Management of Production Landscapes Program**: This initiative seeks to empower cattle producers' capabilities by adopting silvopastoral systems that integrate trees and pasture, thereby increasing productivity and resilience to climate change.

Several key aspects of global sustainability are already practiced within the Belizean beef cattle industry:

1. **Environmental stewardship and climate adaptation**: This involves practices that minimize the environmental impact of beef production, including effective grazing management to prevent overgrazing, safeguarding water resources, and reducing greenhouse gas emissions.

2. **Economic viability**: Sustainable beef production must remain economically viable for farmers and producers, ensuring profitability while upholding sustainable practices.

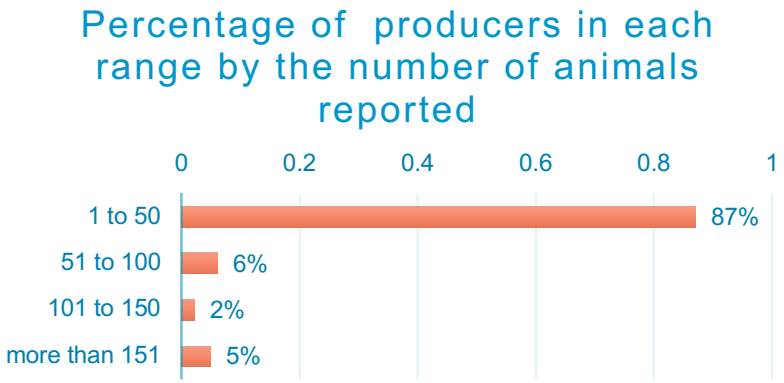
3. **Social responsibility**: This includes fair labor practices, ensuring the well-being of workers, contributing to the local community, and adhering to animal welfare standards.

4. **Traceability and transparency**: Implementing systems that allow consumers to trace the origin of their beef and understand the production practices involved, thereby building trust and ensuring accountability.

4.6. Sustainability in the Belizean beef cattle value chain

A total of 374 stakeholders in the Belizean beef and cattle industry were contacted through an online survey. This represented the sample size necessary to reach a 95 percent confidence level in the statistics to infer that the results of the survey are within the confidence interval. This means there's only a 5 percent chance that the interval does not contain the answer obtained in the survey. The sample included producers, transporters, traders, processors, and buyers from various districts across the country. The survey aimed to gather information on their sustainability practices, climate-smart strategies, and adaptability measures. This data will contribute to a comprehensive market analysis of the sustainable Belizean beef and cattle industry. The value chain assessment highlights a significant divide in cattle ranching operations across Belize. According to the survey with BLPA, 93 percent of producers own between ten and 100 cattle heads, categorizing them as small and medium-sized producers. However, these small to medium operations represent only 35 percent of the total cattle inventory in the country. This suggests that most cattle farms in the study are relatively small to medium-sized, possibly family-owned businesses, with limited acreage, and employing traditional agricultural techniques. On the other hand, just 5 percent of producers hold over 151 cattle heads, yet these large and very large-scale operations account for more than 57 percent of the total cattle inventory in Belize. This represents a dual farming structure, with numerous small to medium-sized contrasted by a small number of larger, more industrialized farms.

Figure 18. Percentages of producers in ranges of operations sizes in Belize 2023



Source: Authors' own elaboration with data from BLPA (BLPA, Belize Livestock Producers Association, 2024).

This dual structure should be considered in the implementation of sustainable practices. In Belize, focusing on small cattle ranchers for the implementation of sustainable practices in cattle ranching is advantageous due to their larger numbers and potential for learning and adopting new methods. Small ranchers are more numerous and can collectively have a significant impact on the industry when equipped with the knowledge and tools for sustainable practices. Additionally, many larger ranchers in Belize are already incorporating sustainable methods into their operations. By targeting small ranchers, efforts can be directed towards those who may not yet have access to or are familiar with sustainable techniques, thereby broadening the overall adoption of environmentally friendly practices across the country. This approach not only supports the sustainability of cattle ranching but also ensures that the benefits of sustainable practices are more widely distributed throughout the agricultural community.

Additionally, the adoption of sustainable agricultural practices by large and very large-scale producers will facilitate faster inclusion and market potential for the Belize cattle industry to be recognized as sustainable. The presence of larger farms suggests potential for industry growth, particularly in increasing production capacity or developing export markets.

4.6.1. Climate-smart agricultural practices

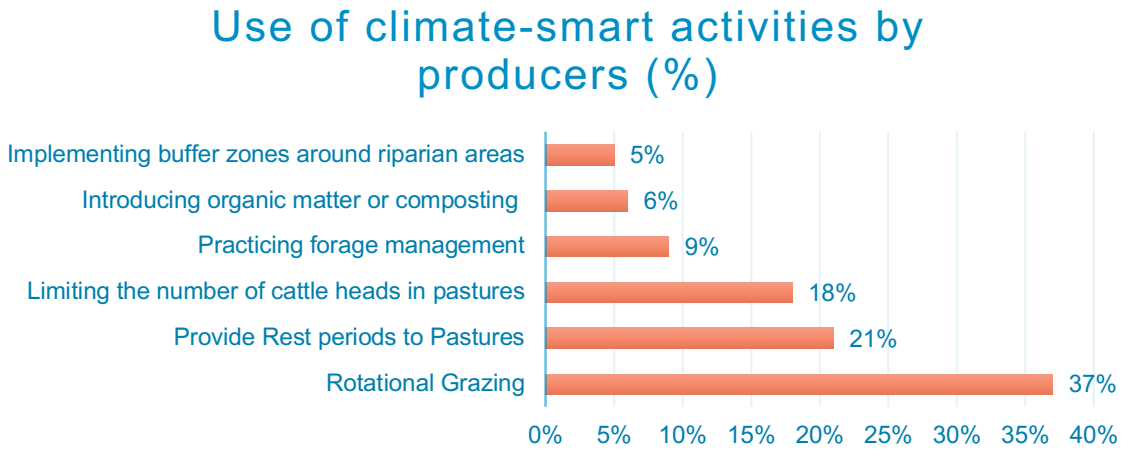
Climate-smart practices in livestock management aim to increase productivity while reducing greenhouse gas emissions and improving resilience to climate change. Some of these practices are, in fact, NbS which are already being implemented by cattle ranchers in Belize, as outlined in this section. By adopting climate-smart practices, livestock farmers can contribute to a more sustainable and resilient agricultural sector.

a) Rotational grazing

Overgrazing and soil erosion reduce the soil's capacity to sequester carbon, degrading land and increasing greenhouse gas emissions (Gustin, 2022). In the collection of direct data with the producers, they were presented with various strategies to prevent overgrazing and were asked whether any of these practices were already implemented in their operations.

Initial findings indicate that 96 percent of producers are already implementing one or more practices to mitigate overgrazing and soil erosion, while only four percent reported they were not engaging in such activities. The most commonly utilized method is rotational grazing, adopted by 37 percent of producers, followed by providing resting periods for pastures (21 percent) and controlling the number of cattle heads in the pastures, including by 18 percent of the producers.

Figure 19. Use of climate-smart activities by producers



Source: Authors' own elaboration.

Notably, more than 37 percent of producers utilize at least rotational grazing, and many implement multiple climate-smart agricultural practices. The graph below shows that more than 34 percent of producers have developed special combinations of several practices based on the soil and resource characteristics of the cattle operations and pastures they manage. For example, rotational grazing is often combined with limiting cattle numbers and implementing rest periods for pastures.

b) Introduction of new grass varieties

Additionally, 69 percent of producers have introduced new grass varieties to improve the quality and reliability of pastures over the past five years. The significant percentage can be attributed to the initiatives undertaken by MAFSA, which has facilitated the availability of eight distinct varieties of grass: Cobra, Camello, Cayman, Mulato, Brizantha, Victoria MG-5, Aries, and Mombasa. These efforts by MAFSE aim to reduce the cost of inputs, which are typically imported, for producers.

Figure 20. Photographs of Camello grass and Cayman grass in Cayo District, Belize

Source: Development Finance Corporation.

One key aspect to consider in the Belize cattle industry is the significant potential for improving pasture management to enhance stocking capacity of pastures per hectare. Official estimates by the Belize BLPA indicate that the sector is currently underutilizing its pastureland, with a current stocking capacity always in 450 kg/ha in terms of live weight (Belize Livestock Producer Association, 2024).

By improving pastures and adopting climate-smart agricultural activities, this capacity could increase to 1000 kg/ha or more. Supporting the policy of introducing better grass varieties in the 121 405 hectares of pastures, could lead to increase productivity using the same or less total land in pastures in Belize.

The data indicates that producers possess an integrated understanding of the logical combinations of smart agricultural activities and their cost-benefit considerations. The strong emphasis on rotational grazing as the primary strategy for preventing overgrazing and soil erosion underscores the advantages of introducing new and improved pasture varieties. This technique not only supports soil health but also maximizes weight gain in cattle, as pastures are given time to rest and recover, leading to a more resilient and diverse plant ecosystem (Mertens, 2023). By allowing forage plants to regrow between grazing periods, rotational grazing ensures both the sustainability of the pasture and the productivity of cattle operations.

Farmers employing these activities show a high level of awareness regarding the need to manage their land sustainably to maintain productivity and protect their capital investments. This also suggests the availability of resources to adopt simpler activities that may require low capital investment. Special attention has been taken to the rainfall variability, as changes in rainfall patterns, including more frequent droughts and floods, can affect pasture availability and quality, leading to inconsistent feed supplies and impacting both rearing and fattening processes.

c) Introduction of organic matter

Generally, more advanced techniques like forage management and the introduction of organic matter, which are more labor- and capital-intensive soil management practices, remain less accessible to small farmers. Data reflects that no more than 15 percent of producers have practiced these lately. This may reflect that the small percentage of producers using these techniques are those with better access to financial resources, more labor, and greater capacity for capital investments.

d) Protection of riparian areas and restricted access to water sources

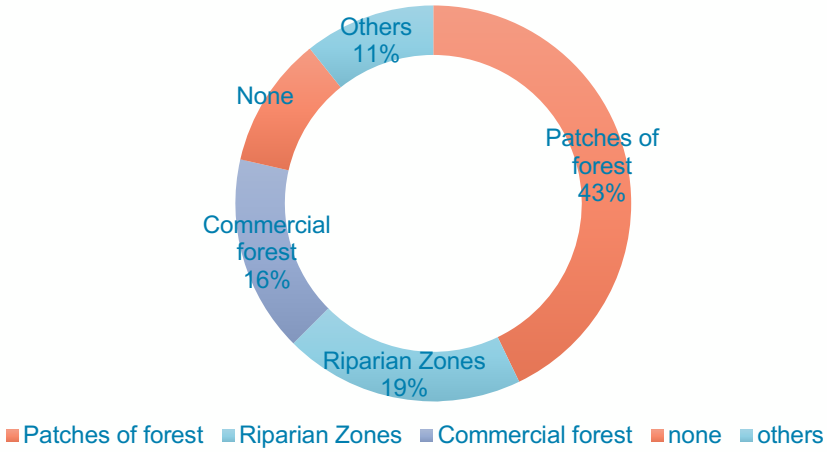
Notably, a small group of five percent reported implementing activities to protect riparian areas and restrict cattle access to water sources. This suggests potential for education and support aimed at introducing basic water-sustainable land management practices. Similarly, farmers already using some preventive measures could be encouraged to adopt more comprehensive approaches through training or access to resources.

A critical aspect of sustainable practices in the Belizean sustainable cattle beef industry involves maintaining a balance between the country's rich biodiversity, agricultural landscape, and its vulnerability to climate hazards. Industries utilizing natural resources must align natural habitats with agricultural areas.

e) Protection of natural habitats

In this context, producers were asked about the preservation of natural habitats on their ranches. Natural habitat preservation is a typical NbS practice within CSA. Only 12 percent reported not having these habitats in their ranches. The majority have learned to balance and protect these natural habitats, with forests and riparian zones being the most significant. The distribution is as follows:

Figure 21. Producers keeping natural habitats



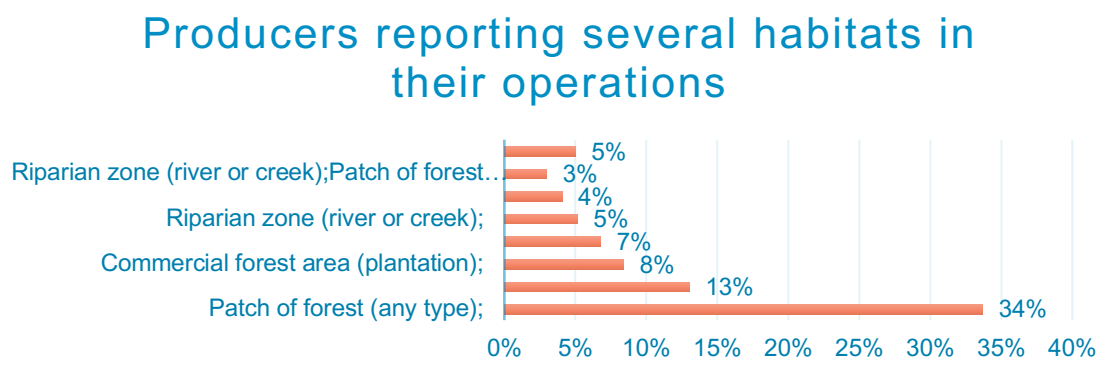
Source: Authors' own elaboration.

Over 60 percent of cattle producers integrate their agricultural practices with the preservation and management of forest patches and riparian zones.

The significance of these forest patches and riparian areas is critical for cattle ranchers, as they play a crucial role in:

- Controlling erosion
- Reducing water contamination
- Contributing to flood mitigation
- Enhancing drought resilience
- Improving overall sustainability of their operations.

Figure 22. Producers reporting several habitats in their operations



Source: Authors' own elaboration.

Forest patches are present in 34 percent of the operations, while 38 percent report multiple forest habitats. Riparian zones are found in 5 percent of the operations, with seven percent indicating the presence of several riparian habitats.

The data clearly indicates that cattle ranching landscapes in Belize hold significant biodiversity. A particularly positive finding is that many ranchers recognize the value of conserving or integrating natural forest ecosystems into their operations. More than half of the respondents maintain forest patches on their land, showing a strong awareness of the importance of forests in sustainable land management.

This practice offers multiple benefits, including supporting biodiversity, sequestering carbon, and enhancing ecosystem services such as water regulation. The prevalence of forest conservation suggests that many ranchers either possess forested areas on their land or have actively taken steps to preserve or restore forest ecosystems. This trend is promising for long-term sustainability and could serve as a foundation for encouraging additional conservation efforts, such as developing financial mechanisms to reward the environmental services provided by biodiversity integrated into cattle operations.

However, further analysis and support is needed for the maintenance of riparian zones and water sources. The percentage of ranchers engaged in these activities is significantly lower than those maintaining forest patches. This gap could be attributed to geographic factors, since not all ranches may have natural watercourses. Still, it also represents missed opportunities to improve water conservation and ecosystem health by prioritizing the protection and restoration of riparian areas.

This should be cross-checked with information on smart agricultural activities, where the protection of riparian areas was the least practiced strategy among ranchers.

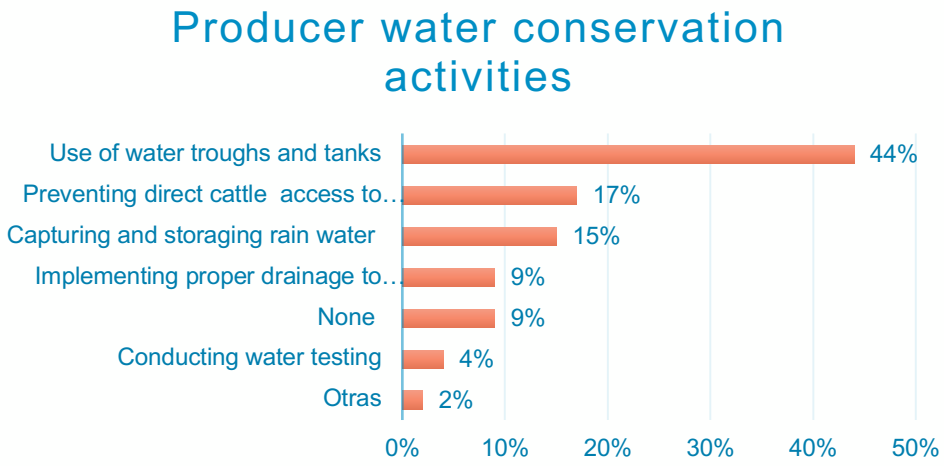
Producers were questioned on their water conservation practices. They included riparian areas or just water sources present in their operations.

f) Water management

A significant proportion of producers (44 percent) are adopting water troughs and tanks to manage water resources efficiently, aligning with climate-smart agricultural practices. This strategy significantly

reduces the environmental impact on natural water sources and local ecosystems, allowing ranchers to monitor and regulate water access for cattle, particularly in regions facing climate variability (University of Georgia Extension Service, 2022).

Figure 23. Producers' water conservation activities



Source: Authors' own elaboration.

The increasing adoption of water troughs and tanks among Belizean cattle producers marks a significant move towards climate-smart agriculture.

This practice helps in efficient water management, crucial for sustainability in agriculture. This is particularly important in regions facing climate variability, as it allows for better monitoring and regulation of water access for cattle. This also shows the level of awareness that producers have developed to become resilient to the main impacts of climate change in Belize, particularly during droughts, when reduced water availability directly impacts cattle health and growth. This shift also reflects the growing awareness among producers of the need to build resilience against the impacts of climate change in Belize.

In line with this awareness, many medium and large-scale ranchers have begun using solar-powered pumps to maintain their water supply.

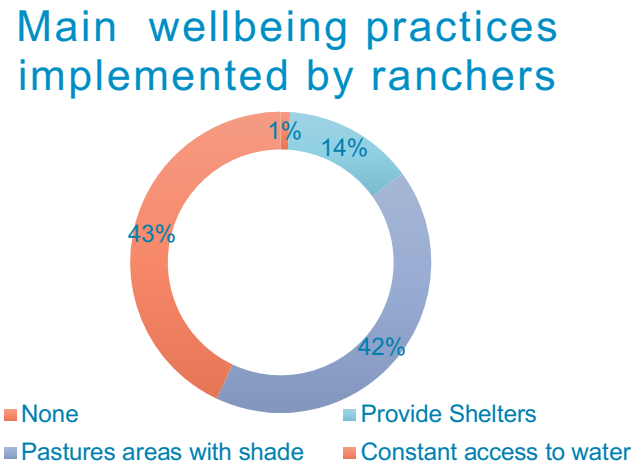
Figure 24. Breeder operation, solar power pump and tank in the Cayo District, Belize

Source: Nolan Quiros, 2024.

4.6.2. Animal wellbeing practices (health and welfare)

The practices employed by Belizean producers reflect a strong commitment to animal welfare. These practices not only safeguard the health and well-being of cattle but also enhance productivity and overall profitability for ranchers. The following chart outlines the key activities implemented by producers in Belize:

Figure 25. Cattle wellbeing practices implemented



Source: Authors' own elaboration.

a) Provision of shade (shelter and trees)

The survey indicates that 99 percent of livestock producers implement animal welfare practices. Specifically, 85 percent of these producers incorporate shade within their pastures, reduce heat stress and improve the productive and reproductive conditions of animals. These practices not only benefit the health of cattle but also positively impact forest patches and support emission reduction efforts. Notably, 43 percent of producers maintain patches of forest within their operations while integrating shade into pastures for the well-being of their cattle.

Figure 26. Patches of forest in cattle operation. El Cayo, District Belize

Source: Nolan Quiros, 2024.

The relatively low percentage of producers providing constructed shelters (14 percent) compared to those relying on natural shade from trees and forest patches (43 percent) suggests a focus on controlling production costs.

Building and maintaining shelters require significant investment, and despite access to financing, shelters tend to be more expensive than arborizing pastures.

One of the processors indicated that they have explored multiple ways to provide shade for their cattle. They are now planting bamboo to create shade tunnels in pastures. Bamboo is a fast-growing, renewable resource that can be harvested sustainably and regenerates quickly, making it an environmentally friendly option for shade structures. Beyond shade, certain species of bamboo can also serve as forage for cattle, offering a dual-purpose benefit that can boost farm productivity.

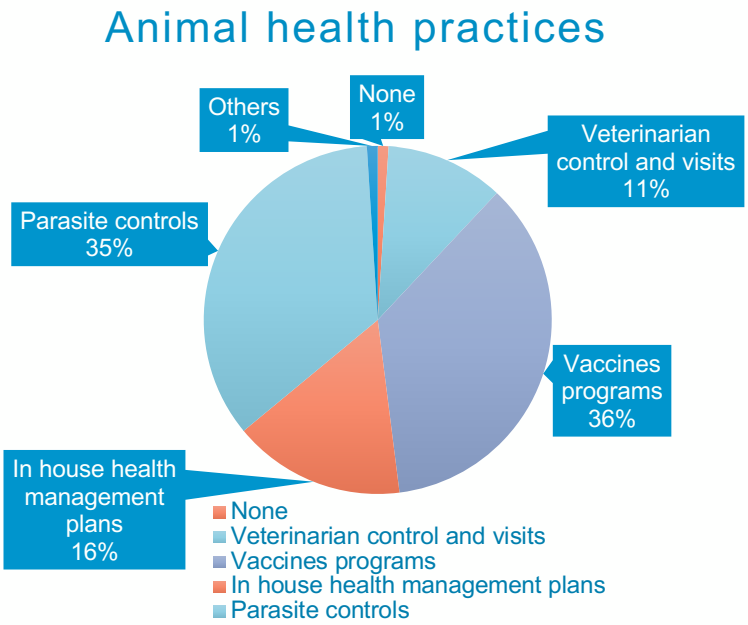
However, there remains a preference among producers for using native tree species to provide shade in pastures, for example Mahogany, Teak lg, Teak sm, Cedar lg, Cedar sm, Zercicote , Neem sm, Cabbage Bark, Moringa, Guanacaste, Poison Wood (Che Chem), Pink May Flower lg, Pink May Flower sm, White May Flower lg, White May Flower sm Shower of Gold.

Figure 27. Bambu tunnels for shade, Cayo District Belize

Source: Nolan Quiros, 2024.

In addition to these welfare practices, 99 percent of producers employ methods to monitor and maintain the health of their animals.

Figure 28. Animal health practices



Source: Authors' own elaboration.

Remarkably, 87 percent of producers maintain a health program that does not require veterinarian visits and focuses more on preventive care. These programs often include a combination of parasite control and vaccination programs (71 percent) along with an overall in-house health management plan that encompasses various controls. Specialized veterinarian visits are the least utilized among the producers.

Belize faces a critical shortage of registered veterinarians, posing a serious challenge to the health and welfare of its cattle herd, according to the Veterinary Association of Belize (VAB), the country's primary professional organization for veterinarians dedicated to promoting animal health and welfare. As of 2022, Belize had only 35 registered veterinarians and 23 veterinary technicians (BELIZE News and Opinion, 2022).

With a national cattle inventory exceeding 199 000 animals, this translates roughly into one veterinarian for every 5 685 animals. However, this ratio assumes that all registered veterinarians are involved in cattle care, which is often not the case, as many prefer to focus on small animals in urban areas.

This shortage of veterinary professionals raises concerns about the ability to adequately support the health and productivity of Belize's cattle industry.

Government phytosanitary authorities of Belize have expressed similar concerns, citing the lack of visits from specialized veterinarians and noting that less than half of producers maintain proper vaccination protocols. As a result, preventable diseases like blackleg have become more frequent, with small producers especially vulnerable due to their reactive rather than preventive approach to outbreaks.

BLPA plays a key role in maintaining cattle health by ensuring access to vaccinations parasite control, and conducting stringent testing for diseases such as tuberculosis (TB) and brucellosis (BR). However,

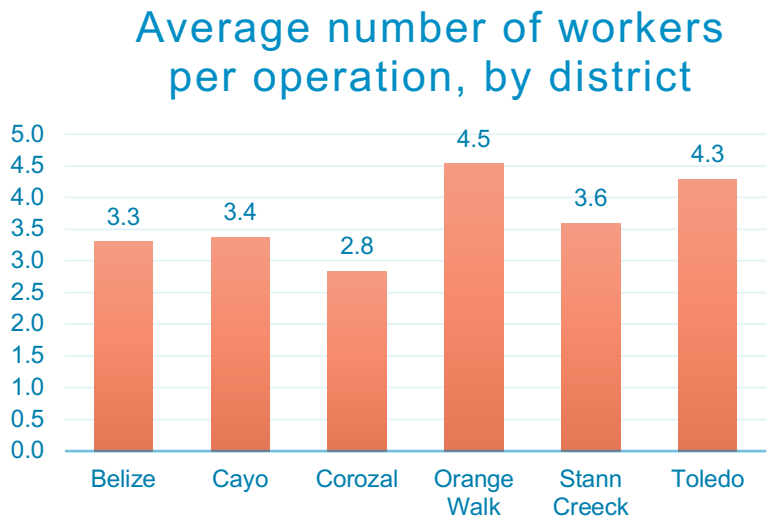
only 11 percent of cattle farmers currently have access to veterinary services, a figure dominated by larger operators. This highlights the need for broader coverage of vaccination programs and improved veterinary support across all producer levels, especially small-scale farmers who are more vulnerable to disease outbreaks.

Increasing access to veterinary care is essential for safeguarding the health of Belize's cattle and ensuring long-term sustainability of the industry.

4.6.3. Labor practices

Cattle operations in Belize operate with a relative low number of workers. The districts' average 3.65 workers per acre Orange Walk district sustains the higher average of labor since the biggest operations in cattle and extension are located there.

Figure 29. Average number of workers per operation by district

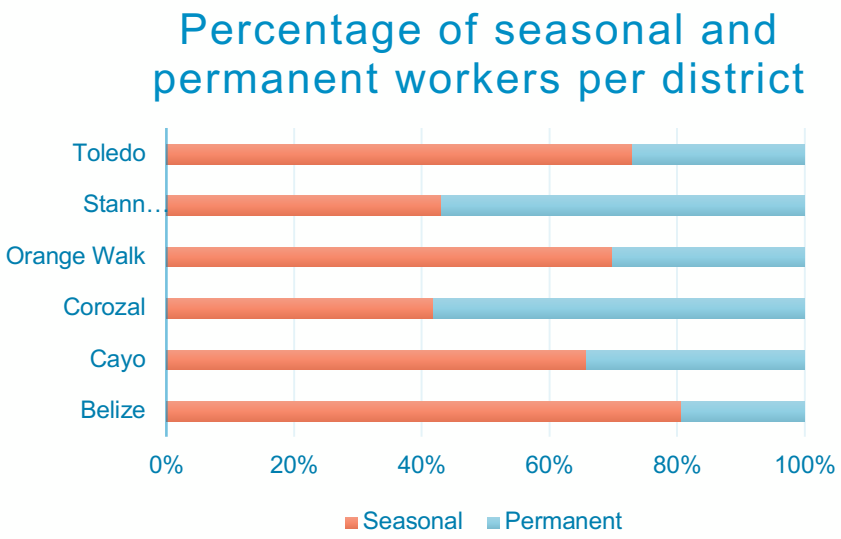


Source: Authors' own elaboration with data from the Statistical Institute of Belize, 2024.

The data in the Belizean cattle industry shows that most operations are run by medium to small-scale producers, managing herds of 100 or fewer animals. These operations primarily rely on family labor, typically requiring only one or two workers. Additionally, the long-standing cultural tradition of cattle farming in Belize has resulted in the development of highly efficient workers capable of handling multiple tasks, honed through years of experience. Interviews reveal that a significant number of producers have been managing their operations for more than two decades, having inherited their farms from their parents.

On average the cattle industry hires nearly two seasonal workers for each permanent worker in their operations. Four districts report hiring 60 percent or more seasonal workers during the production year compared to permanent workers with the Belize district, employing up to 80 percent of seasonal workers in its cattle and beef operations.

Figure 30. Percentage of seasonal and permanent workers per district

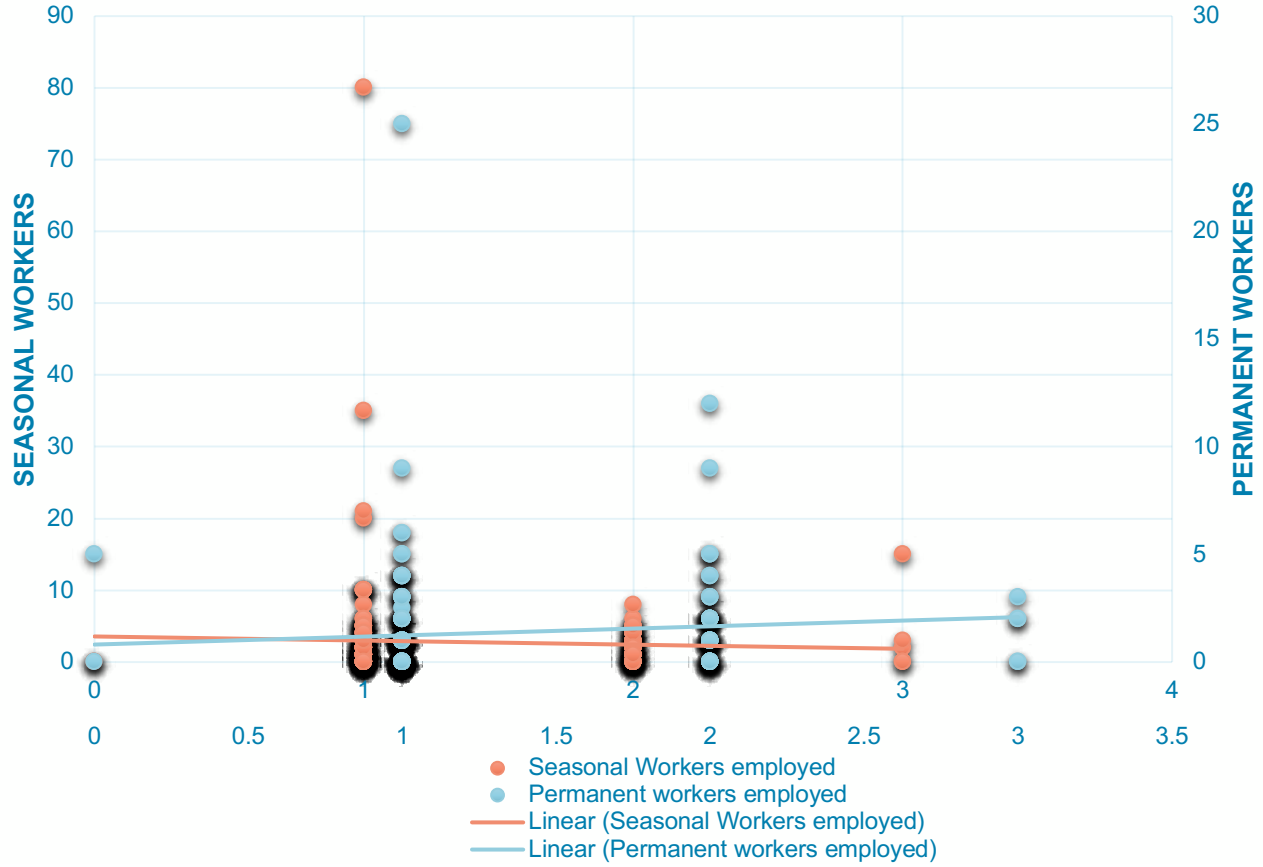


Source: Authors' own elaboration

During the research, producers commonly noted that finding skilled seasonal workers has become increasingly challenging, with many requiring extensive training. Seasonal workers are primarily utilized for simpler tasks, such as pasture management and basic feeding.

A statistical correlation was identified between the adoption of two or more climate-smart agricultural practices and employment patterns concerning permanent versus seasonal workers. As producers incorporate more smart practices, reliance on seasonal workers tends to decrease, while the number of permanent workers increases. Producers who adopt techniques like pasture rotation, silvopastoral systems, integrated pest management, and soil and water conservation are more likely to offer permanent contracts.

Figure 31. Correlation has been identified between producers who implement two or more climate smart agricultural practices and their employment patterns



Source: Authors' own elaboration.

Interviews with larger operations, particularly specialized breeders with integrated systems, confirmed this correlation. As shown in the graph above, adopting climate-smart practices requires a higher level of knowledge, translating into training and knowledge transfer from producers to workers. This fosters strong, lasting employment relationships.

The inclusion of climate-smart activities is crucial for promoting permanent labor in the cattle sector. Many of these practices are labor-intensive and significantly contribute to productivity.

From a sustainability perspective, seasonal employment poses a higher risk of labor and human rights violations. Most seasonal workers are migrants from Honduras, El Salvador, and Guatemala (Statistical Institute of Belize, 2022). While some obtain work permits, many remain undocumented, making them vulnerable to exploitation and hesitant to report violations due to fears of deportation.

The lack of stable labor affects the sector's sustainability. Migrants, especially political refugees from urban areas in their home countries, may prefer to settle in cities rather than rural areas, as was the case for many from El Salvador (Statistical Institute of Belize, 2022).
Statistics show lower unemployment rates in rural areas (4.2%) compared to urban areas (5.2%) in Belize. Additionally, certain nationalities are concentrated in districts leading in cattle operations. The table below highlights that a value of zero indicates no significant data for the analyzed category.

Table 14. Unemployment Rates by Gender, DISTRICT and Selected Characteristics, October 2022

	Gender	District								
Area		Male	Female	Total	Corozal	Orange Walk	Belize	Cayo	Stann Creek	Toledo
	Urban	4 .50%	6 .10%	5 .20%	4 .40%	5 .10%	6 .00%	3 .20%	8 .90%	6 .40%
	Rural	3 .50%	7 .50%	4 .90%	4 .20%	4 .20%	5 .40%	3 .80%	7 .50%	4 .00%
Country of Birth	Belize	4 .30%	7 .10%	5 .40%	3 .80%	4 .30%	6 .10%	4 .30%	8 .70%	4 .90%
	Guatemala	0 .60%	4 .90%	2 .10%	17 .90%	6 .80%	0	1 .10%	0	3 .20%
	Honduras	0	7 .40%	3 .10%	0	0	9 .20%	0	0	0
	El Salvador	3 .20%	1 .90%	2 .80%	0 .00%	15 .40%	0	1 .70%	13 .50%	16 .40%
	Other	5 .50%	5 .20%	5 .40%	9 .80%	5 .00%	7 .30%	0	0	0 .00%
	Total	4 .00%	6 .80%	5 .00%	4 .30%	4 .50%	5 .80%	3 .50%	7 .80%	4 .50%

Source: Authors' own elaboration with data from (Statistical Institute of Belize, 2022).

For instance, unemployment rates for individuals born in El Salvador are disproportionately high in districts like Orange Walk, Stann Creek, and Toledo, which are intensive cattle-producing regions. These rates, all above 13 percent, significantly exceed the national average of five percent, underscoring challenges in labor availability and retention in the industry. This trend highlights a critical issue, where the shortage of workers willing or able to stay in the industry may compel producers to prioritize hiring permanent workers over seasonal ones.

4.7. Policies and regulatory framework

The Government of Belize has established several comprehensive policies, laws, and regulations designed to support and regulate the cattle industry. These policies aim to enhance productivity, ensure sustainability, and improve market access. Key policies include:

- **National Agriculture and Food Policy (2015-2030) NAFP** (Ministry of Agriculture, Food Security and Enterprises, 2015)

This policy outlines the strategic direction for Belize's agriculture sector, with a particular emphasis on the cattle industry. The primary objectives are to improve agricultural production and productivity, establish principles to bolster food security and promote sustainable agricultural practices, including smart agriculture initiatives. This policy also emphasizes improving market access and enhancing competitiveness.

The National Agriculture and Food Policy (NAFP) underscores the importance of enhancing agricultural productivity and efficiency, which directly benefits small cattle producers. These producers are provided with training to improve their skills and knowledge in modern cattle farming practices. Furthermore, the policy advocates for the adoption of new technologies to help small producers increase their productivity and manage their herds more effectively.

- **Sustainable and Inclusive Belize Program** (Ministry of Agriculture, Food Security and Enterprise, 2024)

The Sustainable and Inclusive Belize Program is designed to encourage the adoption of sustainable agricultural practices, enhance climate resilience, and promote environmental sustainability. The program focuses on improving productivity in specific crops and livestock production. Its primary objective is to increase competitiveness and market access for farmers and agribusinesses.

Key components of the program include:

- Technical assistance: Providing support to farmers in developing farm plans or green agri-business Plans.
- Financing and grants: Offering partial financing for sustainable farm plans and green agri-business initiatives.
- Climate Resilient and Sustainable Agriculture Project (CRESAP) (Ministry of Agriculture, Food Security and Enterprise, 2023)

CRESAP is an Investment Financing Project developed by the Government of Belize with financing from the World Bank (WB). The primary objective of the project is to enhance agricultural productivity and build resilience to climate change risks among targeted producers while providing effective responses to any eligible crisis or emergencies.

Project scope and target areas:

- Geographical focus: The project prioritizes the four districts in the Northern region of Belize (Cayo, Orange Walk, Corozal, and Belize) out of the six districts in the country. These regions are expected to experience the most significant impacts of climate change and climate variability on key agricultural value chains.
- Targeted value chains: The main agricultural value chains targeted by the project include sugar cane, rice, maize, soybean, vegetables, livestock, and fruits.
- Additional beneficiaries: Some activities under the project may also benefit other value chains, such as banana and citrus, as well as farmers in the remaining two districts (Stann Creek and Toledo).

- **Meat and Livestock Act**

The Meat and Livestock Act (Chapter 214 of the Laws of Belize) is the cornerstone of Belize's regulatory framework for cattle and beef production (Belize Judiciary, 2011). The Ministry of Agriculture oversees the Meat and Livestock Act (Chapter 214 of the Laws of Belize). The Minister for Agriculture is responsible for the administration and enforcement of this act. It creates a commission with responsibilities that include livestock and meat grading, controlling the sale and export of live cattle, and setting standards for meat production. A critical component of the Act is the establishment of a livestock farm registry and an Animal Identification System. This system is vital for maintaining the integrity of the supply chain and securing access to export markets, thereby supporting Belize's position in the international cattle and beef trade.

This law also establishes and regulates BLPA, which plays a crucial role in the industry. The BLPA's mission is to increase, diversify, and sustain agricultural production, food security, income growth, and employment. It facilitates formal beef cattle exports to neighboring countries such as Guatemala and Mexico, while maintaining sanitary standards, including efforts to secure disease-free status for conditions like Bovine Tuberculosis and Bovine Brucellosis.

- **The Belize Agricultural Health Authority (BAHA) Act of 1999 (Chapter 211 of the Laws of Belize)**

The Act established the Food Safety Department of Belize, allows BAHA to address food safety issues affecting human health (Belize Agricultural Health Authority, 2024). In January 2006 the legislation was updated to align with evolving global food safety regulations, such as traceability requirements. BAHA is the animal and plant health certifying authority for all export commodities. The Animal Health Department conducts inspections resulting in the issuance of a Phytosanitary Certificate ensuring that Belize's animal products meet the importing countries' health and safety standards. BAHA enforces regulations to prevent, control, and eradicate diseases such as Bovine Brucellosis (Belize Agricultural Health Authority, 2024). These regulations are critical for maintaining the health of the national herd and ensuring the safety of beef products.

- **Environmental Protection Act** (Belize Judiciary, 2020)

The Environmental Protection Act is a fundamental piece of legislation that governs environmental management in Belize. It requires cattle producers to: Obtain environmental clearance for large-scale operations, implement measures to prevent pollution and manage waste effectively, and ranchers shall conduct environmental impact assessments (EIAs) for significant projects.

- **Forest Act (Belize Law Chapter 213)** (Belize Judiciary, 2000)

This Act regulates activities that affect forested areas (Belize Judiciary, 2000). Cattle producers are abided by this law to avoid deforestation and degradation of forest lands. In addition, they should obtain permits for land clearing and sustainable land use practices.

- **National Integrated Water Resources Act**

The Act establishes several regulations that cattle producers must comply with to ensure sustainable water use and management (Belize Judiciary, 2011). This Act requires cattle producers to obtain licenses for water abstraction and use. It also outlines the procedures for applying for these licenses and the conditions that must be met and mandates measures to prevent the contamination and pollution of water resources. Cattle producers must ensure that their operations do not lead to the discharge of harmful substances into water bodies. Regulations under the Act include specific provisions for groundwater protection and sustainable use. This includes obtaining consent from the Authority for well-drilling and ensuring that wells are properly maintained to prevent contamination. It also designates certain areas as gathering grounds, which are protected from deforestation and the impact of livestock. Cattle producers must adhere to these protections to prevent the degradation of these critical water recharge areas. Regular monitoring and enforcement are required to ensure compliance with water management regulations. Cattle producers are required to maintain records and may be subject to inspections to verify compliance.

- **Export regulations**

Belize has specific requirements for the exportation of cattle and beef. Including health inspections to ensure the absence of diseases, certifications, and compliance with international standards. BLPA and BAHA work together to guarantee that cattle exports meet the necessary health and safety criteria by the World Organization for Animal Health (OIE). Exporters must be licensed to export cattle and beef. The Meat and Livestock Act specifies the requirements for obtaining an export license, including compliance to all relevant health and safety protocols (Belize Judiciary, 2011).

- **Subsidies**

The Sustainable and Inclusive Belize Program offers financial assistance to farmers, including those involved in cattle production. Participants are eligible for partial funding for their farm plans or green agri-business plans. This funding covers a minimum of 15 percent of the total cost, which can be provided either in cash or as in-kind contributions. Additionally, the program provides technical support to help farmers adopt sustainable practices and enhance productivity (Ministry of Agriculture, Food Security and Enterprise, 2024). Individual farmers must have proof of land tenure, qualify as small farmers with 0.5 to 20 acres of land in production, and be in operation for at least 12 months. Farm groups must have been working together for at least one year and be registered as a cooperative or association.

Additionally, BLPA has implemented programs of support for disease control measures. These measures include testing for Bovine Tuberculosis and Bovine Brucellosis, which are crucial for maintaining herd health and ensuring eligibility for export (Belize Livestock Producer Association, 2024). This model also has been extended to the export of cattle into Mexico. Producers in Belize do not bear all the expenses for exporting cattle to Mexico. BLPA and the Ministry of Agriculture, Food Security, and Enterprise have implemented measures to support cattle farmers. These include lower prices for vaccination and testing for diseases like Bovine Tuberculosis and Bovine Brucellosis, as well as assistance with export requirements (such as veterinarian checks) and coordination with Mexican buyers. This support represents 90 percent of the cost associated with exporting cattle to Mexico. The other ten percent represents transportation cost paid by directly by the exporter (BLPA, 2023).

4.8. Certifications, traceability and quality

Belize has established a unique livestock certification and quality system that reflects its orientation towards food safety and new markets. These activities have contributed to the openness of new markets for the beef cattle export in Mexico.

- **Sanitary status, monitoring**

BLPA in collaboration with the Ministry of Agriculture, Food Security, and Enterprises, plays a key role in facilitating formal exports of beef cattle to neighboring countries like Guatemala and Mexico. It works closely with relevant authorities to monitor the sanitary status of Belize's cattle population. Their goal is to achieve disease-free herd status conditions such as Bovine Tuberculosis and Bovine Brucellosis, ensuring safe trade and maintaining a healthy livestock industry. Producers must obtain a veterinary certificate confirming the health status of their cattle. The cattle must meet the sanitary requirements set by BAHA, which include the following.

- **Sanitary and phytosanitary (SPS) measures**

Implementation of SPS measures to ensure that cattle and other agricultural products are safe for consumption and meet export requirements. This includes inspections, testing, and certification processes.

- **Export certification**

The Belize National Bureau of Standards (BNBS) is responsible for establishing and monitoring export health and safety standards in Belize. They ensure that all exported goods meet the necessary standards for labeling, packaging, and consumer protection. The BBS works in collaboration with other organizations, such as the Belize Agricultural Health Authority (BAHA), to facilitate trade and ensure

compliance with international standards. This certification process ensures that the products meet the importing country's health and safety standards.

- **Bovine Spongiform Encephalopathy Surveillance (BSE)**

Belize aims to establish a comprehensive BSE surveillance program to meet the classification requirements of the World Organization for Animal Health (OIE). This program is supported by a partnership between the government, academic institutions, and BLPA, focusing on educating farmers and securing their participation in this program.

- **Livestock Farm Registry and traceability**

The introduction of a **Livestock Farm Registry** and an **Animal Identification System** (Belize Livestock Registry) has reinforced effective control over cattle movement. Producers are required to register their livestock with the BLR, which guarantees traceability and accountability. Traceability is crucial for gaining access to export markets and maintaining transparency within the industry. Movement control protocols are strictly enforced to mitigate the risk of disease transmission. This includes obtaining permits for transporting cattle. All animals must be properly identified and documented in compliance with OIRSA Regional Traceability Standards.

4.9. Current governance, participation and dialogue mechanisms in the meat production sub-sector

The Ministry of Agriculture, Food Security, and Enterprise (MAFSE) in Belize is primarily responsible for overseeing agricultural and sustainable beef cattle activities. The Ministry's objectives are to advance sustainable agricultural development, including the sustainable beef cattle industry, thereby fostering economic growth, stability, and food security. To achieve its mission, the ministry delivers services through BAHA which plays a crucial role in ensuring food safety, animal health, and the implementation of sanitary measures. BAHA is involved in regulating slaughterhouse practices and meat processing to ensure compliance with health and safety standards. For exportation of cattle, farmers need to comply with a list of requirements that is evaluated and approved by BAHA. Furthermore, MAFSE collaborates closely with BLPA on various initiatives aimed at enhancing livestock production in Belize. A notable success of this partnership was the successful legal exportation of cattle to Guatemala and Mexico. Beyond this, MAFSE and BLPA have jointly undertaken several projects, including capacity-building efforts on sustainable practices such as silvopastoral systems and the development of training and research centers, such as the one in Yo Creek. The sustainable operation of the beef cattle industry in Belize relies heavily on the coordinated efforts and participation of these key stakeholders and cattle farmers, who play a crucial role in advancing the sector.

The sustainable beef cattle sector in Belize has witnessed a surge in strategic dialogues, involving stakeholders ranging from grassroots cattle farmers to high-level government officials. These discussions share the common goal to bolster the sustainability of beef cattle industry in Belize. Recently, a bilateral meeting between Belize and Mexico led to a significant breakthrough. The Mexican government agreed to waive the 15 percent import duty on all cattle imported from Belize, a move that will undoubtedly benefit Belizean cattle farmers.

The MAFSE has also been actively engaged with cattle farmers, fostering productive dialogues for industry growth. For example, MAFSE has supported farmers in implementing artificial insemination (AI) and embryo transfer projects, recently inviting officials to witness the successful outcomes. These initiatives are driving a rapid increase in cattle numbers, positively impacting the overall industry.

Beyond domestic efforts, BLPA has taken the initiative to build international partnerships. They play a significant role in representing and safeguarding the interests of livestock farmers. BLPA works closely with the Ministry of Agriculture, BAHA, and other stakeholders to ensure compliance with regulations and to support farmers in meeting export requirements. By collaborating with organizations like The Nature Conservancy (TNC), the Inter-American Development Bank (IDB), and the United Nations Development Programme (UNDP), BLPA has secured funding for projects that promote sustainable beef cattle production in Belize. These dialogues and collaborations are essential for integrating diverse perspectives and driving systemic change within the meat production subsector. They highlight the importance of raising cattle using sustainable practices and increasing awareness of these methods among both cattle farmers and consumers. Through BLPA, cattle farmers have been able to participate in various government-related instances, such as the National Food and Nutrition Security Commission (NFNSC). This commission coordinates and advocates for food and nutrition security issues. It involves professionals from both government and non-governmental organizations who work collectively to address critical food security concerns and serve as an advisory body to the Cabinet. Notably, cattle farmers engage in both one-on-one and group dialogues, where they exchange valuable knowledge on sustainable cattle-raising practices and market pricing. These interactions are crucial for fostering a community of practice among farmers, enabling them to share insights on effective techniques and strategies for improving cattle health and productivity while maintaining environmental sustainability.

4.10. Public-private partnerships and alliances

The initial vision of exporting cattle to Mexico fostered a strong private-public partnership between the Government of Belize and cattle farmers. The initial export of cattle from Belize to Mexico on October 14, 2021, was a collaborative effort among several organizations. BLPA led the efforts, with support from the Ministry of Agriculture, Food Security and Enterprise, which provided governmental oversight, and the BAHA, which ensured health and safety compliance. Additionally, the private sector, including local cattle producers and the Mexican multinational corporation SuKarne, played crucial roles in facilitating logistics, funding, and processing the cattle for export. This collaboration was organized in an ad hoc commission that led to the successful realization of cattle exports to Mexico, significantly impacting the national economy and the livelihoods of cattle farmers. To sustain this positive relationship, ongoing communication and prompt feedback between government officials and cattle farmers are crucial. The joint effort has also sought to improve phytosanitary measures for cattle export between Mexico and Belize, fostering collaboration between key players such as the Ministry of Agriculture, Food Security and Enterprise of Belize and the Ministry of Agriculture and Livestock (SAGARPA) of Mexico. Additionally, BAHA and Mexican counterparts work together to ensure that health and safety standards are met for the export of cattle.

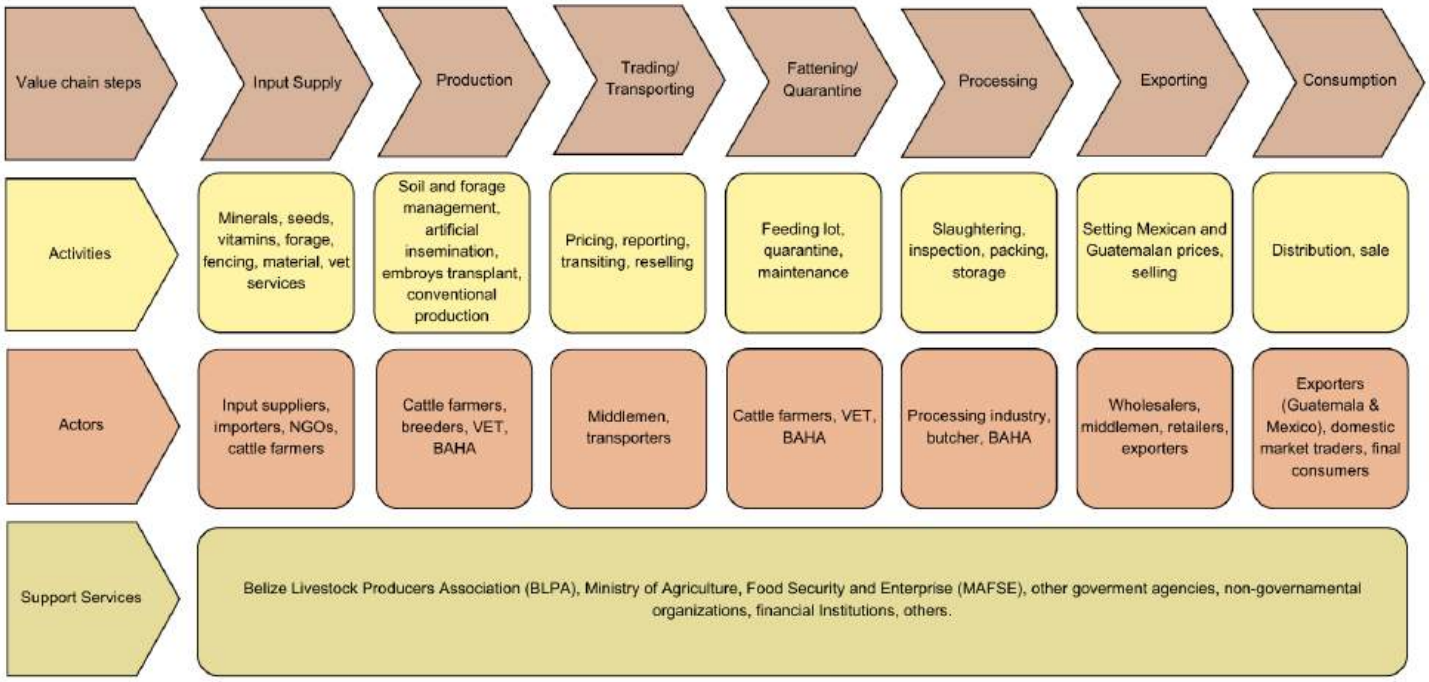
While minor delays in providing technical assistance—particularly regarding exports to Mexico—have occurred, these challenges are addressable. Limited transportation or fuel availability has occasionally hindered government officials' ability to provide timely support to farmers, affecting communication and services. Ensuring that critical messages reach decision-makers promptly is essential. For instance, a recent request from Mexican buyers to increase cattle exports from 16,000 to 25,000 heads annually underscores the need for effective public-private collaboration. Strengthening partnerships between MAFSE and cattle farmers can help address challenges, maintain this valuable trade relationship, and safeguard the economic benefits and livelihoods linked to cattle exports.

5. PRIVATE SECTOR AND ECOSYSTEM MAPPING OF THE BEEF CATTLE VALUE CHAIN IN BELIZE

5.1. Processes

The beef cattle value chain in Belize comprises of myriad actors who perform key activities that are crucial in overall functioning of the value chain. These roles encompass acquiring inputs, production, trading/transporting, fattening, processing, exporting, and consumption. The figure below visually represents the value chain, illustrating each stage from input acquisition to consumption, and highlighting the main actors and activities involved at each stage.

Figure 32. Beef cattle value chain processes in Belize

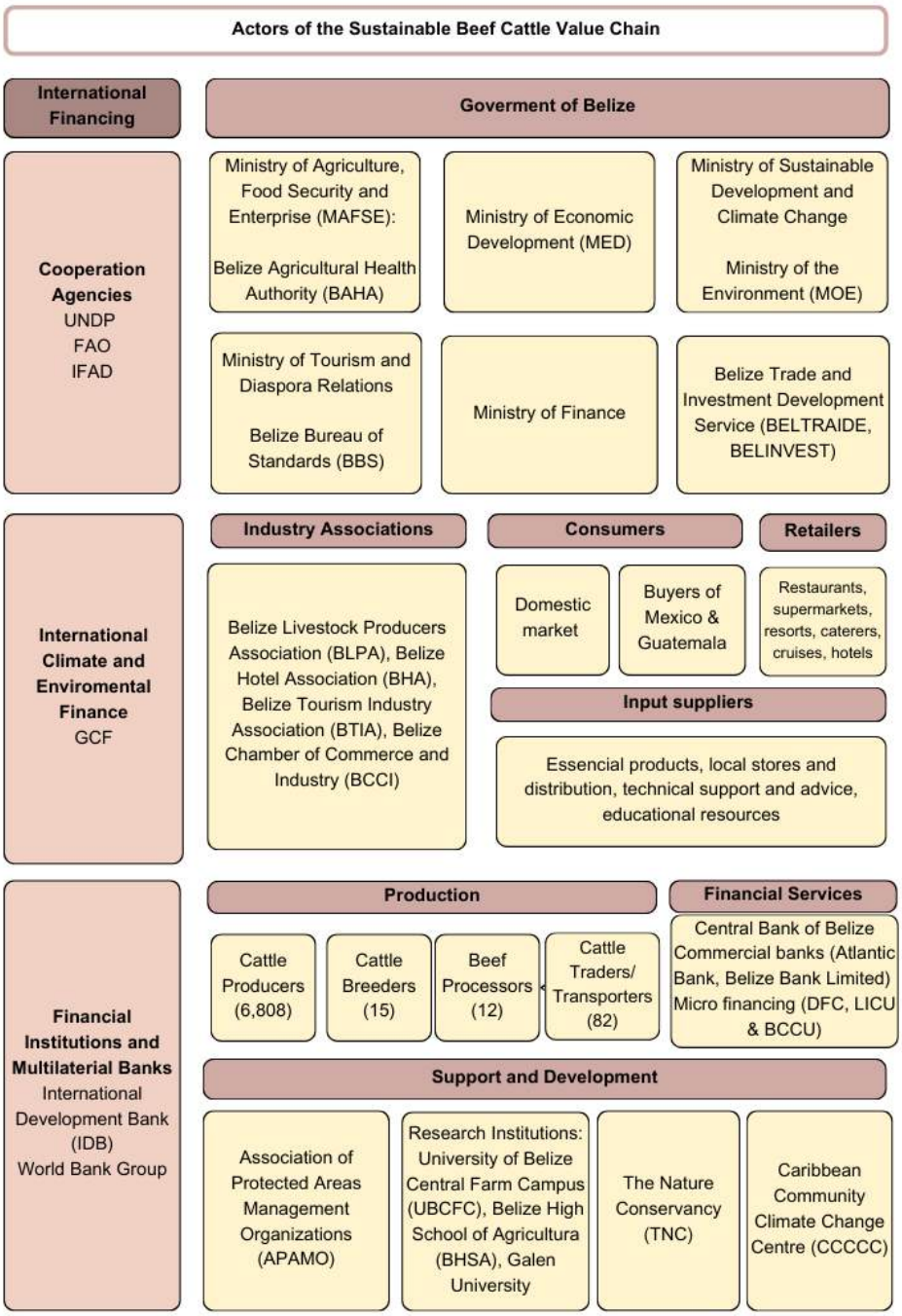


Source: Author's own elaboration

5.2. Value chain actors

A total of 39 actors have been identified in the current sustainable beef cattle value chain in Belize. A comprehensive list of stakeholders and the ecosystem mapping can be found in Annex 1. The key stakeholders in this value chain include cattle farmers, government agencies, BLPA, input suppliers, cattle breeders, transporters/traders, processors, non-governmental organizations, international organizations, and financial institutions. Figure 34 shows a diagram of the organizations that are part of the ecosystem of actors in the beef value chain in Belize, categorized by type of organization or function.

Figure 33. Actors of the beef cattle value chain in Belize



Source: Authors' own elaboration

5.2.1. Cattle producers

Cattle farmers are the core stakeholders in the beef cattle value chain, forming the backbone of Belize's cattle industry. Many of these farmers also take on additional roles, such as trading and transporting cattle. The Belize Livestock Producers Association (BLPA) is the primary representative body for cattle producers in the country. According to BLPA records, there are 6,808 registered cattle farmers in Belize. The Orange Walk and Cayo districts emerge as the leading regions for cattle farming, with 2,268 and 1,939 members, respectively, representing 62 percent of all producers. Following closely behind are the Corozal, Toledo, Belize, and Stann Creek districts. While these regions have fewer members compared to Orange Walk and Cayo, each plays a crucial role in the national cattle farming landscape.

Table 15. Distribution of cattle farmers in Belize

Districts	Orange walk	Cayo	Corozal	Toledo	Belize	Stann Creek	TOTAL
Number of cattle producers	2 268	1 939	1 281	687	463	170	6 808

Source: BLPA

Cattle producers in Belize primarily raise livestock for sale to Guatemalan buyers, Mexican exporters, local buyers, and processors. They play a crucial role in managing livestock, optimizing grazing practices, and ensuring animal health. An estimated 96 percent of producers implement sustainable practices such as rotational grazing, improving pasture quality, and reducing deforestation—contributing to the long-term viability of their operations.

However, many producers face logistical challenges due to limited transportation. As a result, they often sell cattle directly at the ranch gate rather than transporting them to buyers. This limitation affects their ability to negotiate better prices and reduces overall value chain efficiency.

5.2.2. Cattle breeders

Fifteen cattle breeders are pivotal to the beef cattle value chain, focusing on improving herd genetics. These breeders include David Dycke, Abram Frozse, Klassen Cattle Co., Halfcreek D. Ranch, Double Diamond Ranch, Rocky Mountain Ranch, GBB Ranch OWP, Cayo Cattle Company, XR-Ranch, David Dyck Nelore Bulls, KR Ranch, Tree Shade Ranch, Double D. Ranch Brangus, Oak Tree Ranch, and the Ministry of Agriculture (Livestock Section).

Their primary role is to enhance desirable traits—such as growth rate, meat quality, disease resistance, and overall productivity—through selective breeding, including artificial insemination and conventional practices. By supplying high-quality breeding stock, they strengthen the entire value chain, promoting better performance and profitability for cattle farmers. Their efforts advance the sustainability and competitiveness of Belize's beef industry.

Currently, breeders rely on genetics from Mexico and the U.S. but view South American genetics—particularly Brazilian and Argentine—as superior for meat production. However, national protocols established by BAHA present significant obstacles to acquiring these genetics.

5.2.3. Beef processors

Twelve processors are involved in the beef supply chain in Belize: Southside Meats, Running W Meats, Mckesey Meats, Reinland Meats, Campos Smiling Meats, Gillett's Meats, Country Meat Products, Lino's Meats, Joe's Meats Ltd., Chef Meat Market, Meat Supply Butchery, and Sandra's Meat Shop. These processors play a crucial role by transforming livestock into a variety of meat products, including cuts of beef, fully processed goods, and dairy products. Many oversee the entire production process to ensure quality and consistency, from sourcing cattle to final packaging. Some even engage in breeding programs to ensure cattle meet specific genetic and quality standards, while also managing ranch operations to optimize feeding and health care.

Once cattle reach the desired weight and quality, they are slaughtered under BAHA supervision to ensure strict hygiene standards. The meat is then processed and packaged according to industry requirements and customer specifications, ranging from cuts and ground meat to value-added products. Rigorous quality control measures are applied throughout to ensure consistency, safety, and regulatory compliance. The finished products are distributed to supermarkets, hotels, local shops, and restaurants.

Processors also engage in purchasing cattle for meat processing, while local buyers focus on acquiring cattle for fattening and resale. This diversity of market actors supports a dynamic and competitive beef industry in Belize. Meat processors and butchers form essential links in the beef market. Processors handle the initial stages—slaughtering, cutting, and packaging—ensuring that all parts of the animal are used efficiently. Their collaboration with local farmers helps strengthen the supply chain and promote locally sourced beef.

Butchers, operating in supermarkets, specialized shops, and local markets, are the final point of contact before beef reaches consumers. They offer expert advice on cuts, cooking methods, and cater to customer preferences. Sourcing products from local processors, butchers support the regional economy and ensure quality and freshness. Their personalized service is key to promoting the consumption of high-quality Belizean beef, ensuring both locals and tourists have access to fresh, flavorful options.

5.2.4. Cattle traders, intermediaries and transporters

Currently, the beef cattle value chain in Belize features three primary competitive traders: buyers from Guatemala, an exporter to Mexico from the Mennonite community, and 82 local traders and transporters. The local traders handle relationships with farmers, purchasing and transporting cattle to various commercial destinations.

The Mennonite exporter, based in the Shipyard community of Orange Walk District, is known for adhering strictly to both Belizean and Mexican cattle exportation standards. He purchases cattle at a gate price of USD 2.80 per pound. The cattle then undergo a 21-day quarantine period, during which they are closely monitored by staff and BAHA. A Mexican veterinarian conducts thorough health checks and tests to ensure the cattle are free from diseases such as Brucella abortus, tuberculosis, rabies, and other conditions relevant to Mexican requirements. Once the quarantine is complete and all trade conditions are met, Mexican buyers arrange their own transportation to move the cattle to Mexico.

5.2.5. Retailers

The retail sector in Belize plays a crucial role in supporting the beef industry. Supermarkets, convenience stores, and specialized meat shops are key players in distributing beef products to consumers. These retailers ensure a steady demand for locally sourced beef, supporting local farmers and processors. By providing a reliable market, the retail sector helps sustain the agricultural economy and promotes food security in the country.

Additionally, the presence of hotels, resorts, catering services, restaurants, and cruise lines further boosts demand for high-quality beef, contributing to the overall growth and stability of the beef industry in Belize. The retail group includes various subcategories, such as hospitality services like hotels, restaurants, resorts, and catering services; commercial establishments that sell beef and conventional food products; and specialized services catering to cruise ships arriving in Belize.

Some of the main establishments in these sectors include:

Supermarkets:

- Wellworth Supermarket
- New Flags Supermarket
- James Brodie & Co. Ltd
- Publics Supermarket
- DK Market

Convenience and specialized meat stores:

- Joe's Meats Ltd
- Meat Supply Butchery

Hotels and resorts:

- Belizean Shores Resort
- Chabil Mar Resort
- Caye Chapel Resort
- Hamanasi Adventure and Dive Resort
- Catering Services
- Belize Catering Services
- Belize Event Catering
- Belize Gourmet Catering

Restaurants:

- Hanna's Restaurant
- The Reef Restaurant
- Café Caribe
- Belize Restaurant

Cruise lines:

- Norwegian Bliss
- Carnival Vista
- Royal Caribbean

5.2.6. Industry associations

a) The Belize Livestock Producers Association (BLPA)

The Belize Livestock Producers Association (BLPA) plays a crucial role in Belize's cattle industry, representing 1,968 livestock producers (BLPA, 2024). Dedicated to advancing the interests of cattle farmers and other industry stakeholders, BLPA advocates for policies and regulations that benefit the sector and works closely with government agencies to address producers' needs and concerns.

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The association provides its members with technical assistance, training programs, and information on best practices in cattle management. It also organizes events and activities—such as Beef Fest and trade fairs—that promote the cattle industry. Additionally, BLPA develops and implements projects funded by various sponsors to strengthen the sector and plays a role in establishing industry standards and quality assurance measures to enhance competitiveness and sustainability.

BLPA serves as a key intermediary between cattle producers, government bodies, and industry stakeholders, helping drive the growth and success of Belize’s cattle sector. Its services include expert advice on breeding, nutrition, and animal health; organizing training workshops to keep farmers informed of industry advancements; and providing updates on market trends and policy developments. By advocating for favorable regulations and facilitating networking opportunities, BLPA supports farmers in expanding their operations and exploring new business prospects.

The association’s governance structure includes a Board of Directors and a staff led by a Chief Executive Officer. Its operational areas cover human resources, finance and accounting, veterinary care, sales management, and administrative support. Strengthening the technical area presents an opportunity for organizational development. BLPA receives funding from various sources, including:

- Multilateral Investment Fund (MIF): This fund, associated with the IDB, has also supported BLPA projects.
- Inter-American Development Bank (IDB): BLPA received funding from the IDB for projects aimed at improving livestock sector productivity and climate resilience in Belize.
- Government and Local Organizations: BLPA collaborates with the Ministry of Agriculture and other local organizations to support various initiatives and projects.
- Technical Assistance and Grants: BLPA often receives technical assistance and grants from international and regional organizations to implement projects and provide services to livestock farmers.

b) Belize Hotel Association (BHA)

BHA is an association representing the interests of the hotel and tourism industry in Belize. The BHA serves as a key advocate for the sector, working to promote and develop the hospitality industry in the country. The association provides support and resources to its members, which include hotels, resorts, and other tourism-related businesses. BHA is involved in various activities, such as lobbying for industry-friendly policies, providing training and professional development, and organizing events and marketing

initiatives to boost tourism. Its goal is to enhance the overall quality of the hospitality sector in Belize, ensuring that it remains competitive and sustainable while contributing to the country's economic growth. They have three categories of members: 1) 54 hotels and resorts; 2) 48 allied members; and 3) four destination management companies. Among its members, the company Hamanasi Adventure and Dive Resort is of particular interest for the project.

c) Belize Tourism Industry Association (BTIA)

BTIA is a private organization in Belize that represents and supports the interests of businesses within the tourism sector. Its role includes advocating for policies that benefit the tourism industry, providing resources and training for industry professionals, and promoting Belize as a desirable travel destination. The BTIA works to enhance the quality and sustainability of tourism services, foster industry collaboration, and drive growth in Belize's tourism sector. Its membership includes 30 restaurants, 114 hotels and lodges, 20 exploration companies, and 94 businesses providing services related to gastronomy and tourism.

d) Belize Chamber of Commerce and Industry (BCCI)

NBCCI is a private organization representing the business community in Belize. Its role encompasses a variety of functions aimed at supporting and advancing the interests of its members and the broader business environment in the country. The BCCI advocates for business-friendly policies and works closely with government agencies to influence legislation and regulations that impact the business sector. It provides a platform for networking, facilitating connections among business professionals and fostering collaboration within the business community.

Furthermore, the Chamber offers resources and support services to its members, including training programs, business development workshops, and access to market information. It also plays a key role in promoting trade and investment opportunities, both locally and internationally. Notably, BLPA is a member of the BCCI; however, there has yet to be an opportunity for collaboration on initiatives that could assist BLPA members in improving cattle farming practices and enhancing the sustainability of the cattle industry in Belize. The BCCI has around 326 members, with five of them directly linked to the livestock sector, including BLPA.

5.2.7. Input suppliers

In Belize, input suppliers are essential to the cattle industry, providing a range of products and services that are crucial for the health, productivity, and profitability of cattle farming. These suppliers play a multifaceted role in ensuring that farmers have access to the necessary resources, which helps minimize delays and supports smooth and efficient farm operations.

1. **Availability of essential products:** Input suppliers ensure that crucial products such as feed, veterinary supplies, and equipment are consistently available to cattle farmers. This availability is vital for maintaining daily farm operations and preventing disruptions that could impact herd health and productivity.
2. **Local stores and distribution:** Many suppliers operate local stores where farmers can purchase necessary inputs directly. These stores are strategically located to serve farmers across different regions, ensuring easy access to products without long travel times.
3. **Technical support and advice:** Input suppliers often provide technical support and expert advice through their customer service teams. These professionals help farmers choose the right products, offer guidance on best practices, and assist with troubleshooting any issues related

to product use. This support is essential for optimizing farm management and ensuring that farmers make informed decisions.

4. **Educational resources:** In addition to direct support, some suppliers offer informative flyers and pamphlets to help farmers stay updated on the latest advancements in cattle farming and management practices.

The following table lists potential Belizean suppliers and the various inputs needed for successful cattle farming.

Table 16. Potential suppliers and inputs for cattle farming

Supplier name	Brief description	Type of Inputs	Example
Reimers Feed Mill	Supplier of veterinary products	Feed, forage, supplements	Grain, hay, silage, and protein supplements
Quality Feed Mill	Supplier of bovine feed products	Nutritional additives	Mineral mixes, probiotics, and prebiotics
National Treat Mill	Supplier of veterinary products	Veterinary supplies	Vaccines, antibiotics, mineral supplements and dewormers
Mid-west Agro Supplies	Supplier of feeding equipment, watering systems	Feeding equipment, watering systems, fencing and shelter	Mixers, automatic waterers, and tanks, materials required for the construction of fences in pasture rotation systems
Sugar Industry Research and Development Institute (SIRDI)	Sugarcane research and supplier of agricultural inputs	Manure spreaders,composting equipment Entomopathogens	Metarhizium, Bavaria and other entomopathogens Manure spreaders and composting
Midwest Hardware	Information technology provider	Record keeping tools	Software, technology, tags and identifiers
Belagro	Supplier of agricultural inputs	Pasture management	Seed, fertilizer, herbicides and pesticides
Importer (Frank Freizen)	Packaging, materials supplier	Packages	Trays, vacuum bags, pouches, vacuum sealing, crates
Belize Agro Enterprise Ltd (BAEL)	Supplier of agricultural inputs	Soil, Pasture, Waste and Pest management	Biofertilizers, probiotics, odor retardants, biologicals, entomopathogens
BLPA	Genetic improvement service provider	Breeding supplies	Offers artificial insemination tools, semen straws, and embryo transfer supplies

Source: Authors' elaboration.

5.2.8. Support and development

a) Belize Trade and Investment Development Service

The Belize Trade and Investment Development Service (BELTRAIDE) is Belize's National Trade and Investment Development Agency, dedicated to promoting economic growth by supporting trade, investment, and business development initiatives (BELTRAIDE, 2024).

BELTRAIDE focuses on promoting and facilitating trade, assisting business owners in navigating export opportunities, and connecting them with international markets.

Furthermore, it provides essential support through market research and analysis, helping entrepreneurs understand export requirements and identify potential markets for their products. Additionally, BELTRAIDE supports businesses in obtaining the necessary certifications and adhering to international standards required for exporting. Overall, BELTRAIDE plays a significant role in strengthening local business owners and boosting the national economy. While BELTRAIDE is not currently active in the beef cattle industry, its role in trade and investment development presents opportunities for future collaboration that could significantly enhance the beef cattle sector in Belize.

BELTRAIDE operates as a legal entity under the Ministry of Economic Development, Petroleum, Investment, Trade, and Commerce. It is responsible for investment, trade, and commerce matters and functions as both the National Investment Promotion Agency and the Export and Trade Promotion Agency of Belize. Its focus includes the development of micro, small, and medium-sized enterprises (MSMEs), innovation, entrepreneurship, and the provision of industry-specific training. These functions are carried out by BELTRAIDE's four subunits: (1) BelizeINVEST, (2) EXPORTBelize, (3) Small Business Development Centre (SBDCBelize), and (4) Belize Training and Employment Centre (BTEC) (BELTRAIDE, 2024).

Although BELTRAIDE is not directly involved in the cattle industry in Belize, the organization has expressed a strong willingness to collaborate with MAFSE and BLPA to support micro, small, and medium-sized cattle farmers. Its objective is to enhance cattle farming businesses by developing training programs specifically tailored to the farmers' needs. BELTRAIDE has emphasized that its primary role is focused on capacity building, particularly in developing value-added business opportunities.

a) Association of Protected Areas Management Organizations (APAMO)

The Association of Protected Areas Management Organizations (APAMO) is a Belizean non-governmental organization that supports the management and conservation of protected areas through collaboration, capacity-building, and advocacy. It plays a key role in supporting and enhancing the management of protected areas by fostering collaboration among conservation organizations, building capacity for effective management, and advocating for the protection of natural resources and biodiversity.

b) The Nature Conservancy (TNC)

The Nature Conservancy (TNC), a global environmental nonprofit organization, is dedicated to the conservation of land, water, and natural resources. For over 33 years, TNC has been actively involved in Belize, promoting sustainable maritime practices and environmental conservation. Their mission includes protecting forests and promoting sustainable agriculture. As part of their ongoing efforts, TNC has recently launched a regenerative agriculture program aimed at improving the sustainability of grain

production and other agricultural systems. This initiative focuses on organic farming and innovative production techniques, emphasizing sustainable land use and natural resource management.

Recently, a tri-national project worth USD 750 million was approved by the Latin American Council for Belize, Guatemala, and Mexico. The project is designed to support sustainable development across the region, with Mexico focusing on processing, and Belize and Guatemala concentrating on agricultural production. In Belize, TNC is working closely with local partners to implement sustainable farming practices, specifically within the cattle industry. Their goal is to help farmers transition to more sustainable cattle farming methods. To achieve this, TNC plans to provide capacity-building training for 25 extension officers from the Ministry of Agriculture, Food Security, and Enterprise (MAFSE) and the Belize Livestock Producers Association (BLPA). Additionally, they aim to engage 50 cattle producers and establish five model farms in the Cayo and Orange Walk districts, the leading cattle-producing regions in Belize.

These model farms will be selected in consultation with the BLPA to ensure they serve as effective examples of sustainable cattle farming for the rest of the country.

The project is aligned with Belize's National Climate Change Policy, Strategy and Action Plan (CCCCC, 2014), including the government-developed carbon bonus initiative, which incentivizes sustainable agricultural practices. TNC's approach to sustainable cattle farming includes techniques such as rotational grazing, reforestation, and improved water management. By implementing these practices, TNC aims to reduce deforestation and land degradation while increasing farm productivity. The organization's collaboration with local stakeholders, such as the BLPA and the University of Belize (UB), further strengthens its efforts to build resilience against climate change.

A particularly successful partnership between TNC and UB has been their year-long collaboration on a 24.7-acre silvopastoral project, which integrates trees with pastureland for cattle. This system has shown positive results in both environmental benefits and farm productivity. The silvopastoral model is planned to be replicated on a larger scale across Belize, helping to transform cattle farming practices nationwide.

Additionally, TNC has recommended engaging with Dr. Elma from the Belize Maya Forest Trust, who has extensive knowledge of ongoing forest conservation efforts. Dr. Elma has been working closely with Mennonite farmers in Spanish Lookout to halt deforestation caused by traditional farming methods and to encourage the adoption of sustainable practices. Her expertise could provide valuable insights and support for broader conservation initiatives, complementing TNC's mission to promote environmental stewardship across Belize.

Through these collaborative efforts, TNC remains committed to safeguarding Belize's natural resources while advancing sustainable and productive agricultural systems.

c) Caribbean Community Climate Change Centre (CCCCC)

The Caribbean Community Climate Change Centre (CCCCC) is a sub-regional intergovernmental organization responsible for coordinating the Caribbean Community's response to climate change. Its mandate is to contribute to the protection of the climate system for both present and future generations. The organization's objectives are: 1) to protect the climate system of its member states for the benefit of current and future generations; 2) to enhance regional institutional capacities for coordinating national responses to the negative effects of climate change; 3) to coordinate joint policies and provide technical support in climate change-related matters, leading regional initiatives in these areas; and 4) to act as the Executive Agency for regional environmental projects related to climate change (Caribbean Community Climate Change Centre, 2024).

Beef in Belize is predominantly consumed in households and restaurants, where it is enjoyed in a variety of dishes. It is commonly prepared in diverse ways to suit different tastes and preferences, including popular options such as stews, oxtail and cow foot soup, grilled steaks, and ground beef dishes. In households, beef features in traditional recipes and family meals, while restaurants offer a range of beef dishes, from local specialties to international cuisines. This versatility highlights the integral role of beef in Belizean cuisine and dining establishments.

Consumers of beef and processed beef products typically interact with store and restaurant owners or staff, rather than directly with butchers or cattle producers. These interactions usually involve making purchasing decisions based on product quality, price, and availability, without extending to understanding the broader practices involved in beef production. However, the choices consumers make can significantly impact the beef value chain. Although many consumers have not yet expressed concern about whether suppliers adhere to sustainable and ethical practices, processors are proactively educating buyers about their commitment to sustainability. They emphasize that their beef products not only meet these standards but also offer superior health benefits compared to imported beef. This helps consumers make informed decisions and seek out products from sustainable sources.

Guatemalan buyers, who also serve as transporters, play a key role in this market. They purchase cattle from Belize, typically weighing 499 pounds or less, at an average price of USD 2.90 per pound. These buyers are strategically positioned to understand and capitalize on the demand for meat cattle destined for Mexico. Their approach of fattening weaners and selling them to Mexican buyers generates substantial profits in a short period.

Mexican buyers, in turn, transport the cattle to specific destinations, such as Michoacán, where buyers like SuKarne, a major Mexican food processing company, take over (Government of Belize, 2024). These buyers are responsible for further fattening and processing the cattle, preparing them for distribution within Mexico and potentially for export to other countries.

5.2.9. Government entities

a) Ministry of Agriculture, Food Security, and Enterprise (MAFSE)

Ministry of Agriculture, Food Security, and Enterprise (MAFSE) is the primary government entity leading efforts to support Belize's cattle industry. From its inception, MAFSE has played a pivotal role in developing and enhancing the sector, including facilitating the export of Belizean cattle to Mexico. MAFSE works closely with the Belize Livestock Producers Association (BLPA) to implement projects aimed at strengthening the cattle industry. These initiatives focus on increasing productivity and sustainability, recognizing the sector's significant potential to further contribute to the national economy and improve the livelihoods of rural communities. Through collaboration, MAFSE and BLPA aim to leverage this potential to drive economic growth and provide meaningful benefits to local communities across Belize.

Some of these initiatives include:

1. Embryo Transplant System (August 2021): In collaboration with BLPA, MAFSE introduced an embryo transplant system to accelerate Belize's production of higher-quality beef cattle to meet local and international demand. In 2021, cattle farmers were exporting Nelore and Brahman cattle to Guatemala and Mexico. However, the Brangus breed was identified as a more profitable option. In September 2024, MAFSE was invited to witness the results of improved breeding practices, including the Nelore, Brangus, and Brahman breeds, in the Mennonite community of Blue Creek. This visit highlighted advancements in cattle breeding and the potential benefits of incorporating the Brangus breed into Belize's livestock industry.

2. Bilateral Trade with Mexico: Due to the strong relationship between Belize and Mexico, Mexico has removed import taxes on Belizean products, including livestock. This policy change will significantly reduce export costs, facilitating trade between the two countries. As a result, Belizean farmers will benefit from lower export expenses and enhanced market access, boosting profitability for the cattle industry.
3. Capacity-Building Initiatives: MAFSE has been actively advancing capacity-building programs for cattle farmers. For instance, they recently organized a silvopastoral training program for 20 livestock farmers from the More Tomorrow Community and Central Farm. The program focused on sustainable farming practices, including pasture rotation, electric fencing, and integrating fruit trees with cattle and sheep. These training sessions aim to promote environmentally friendly techniques and enhance farm productivity.

Overall, MAFSE plays an integral role in the development and success of Belize's cattle industry. Its contributions to policy-making, technical support, export facilitation, and infrastructure development have been crucial in enabling the industry to thrive both domestically and internationally.

b) Belize Agricultural Health Authority (BAHA)

Belize Agricultural Health Authority (BAHA) has been instrumental in supporting cattle farmers in Belize through a variety of initiatives and services, including facilitating exports to Mexico. The Animal Health Department within BAHA provides preventive care and implements disease control programs, ensuring the overall health of livestock across the country.

BAHA's support extends throughout the entire cattle farming process—from initial care to the export of live animals. Their services include animal health management, disease surveillance, knowledge transfer, and collaboration with key partners such as BLPA and MAFSE to prevent, control, and eradicate diseases. Additionally, BAHA oversees slaughterhouses to ensure quality assurance in meat processing.

The Authority's efforts in facilitating cattle exports to Mexico have been highly appreciated by local farmers. BAHA works closely with international organizations like the International Regional Organization for Agricultural Health (OIRSA), the Inter-American Institute for Cooperation on Agriculture (IICA), and the Mexican National Service for Animal Health and Agricultural Food Safety (SENASICA) to maintain high standards and expand market access for Belizean cattle.

BAHA also provides essential support to cattle farmers by ensuring the health and safety of livestock through regulatory oversight and veterinary services. The authority offers technical guidance on disease prevention and control, helping farmers adopt best practices to maintain animal health. It conducts regular inspections and health checks to monitor and manage livestock diseases, ensuring compliance with both national and international standards. Moreover, BAHA provides vaccination programs and emergency response services during disease outbreaks, which are critical for protecting the cattle population. Additionally, the authority assists farmers with the necessary documentation and certification required for the movement and export of cattle, ensuring that all health and safety standards are met.

Through these comprehensive efforts, BAHA plays a vital role in promoting the overall health of the cattle industry in Belize and ensuring the smooth operation of cattle farming and export processes.

c) Ministry of Sustainable Development, Climate Change and Disaster Risk Management

The Ministry of Sustainable Development comprises seven departments, six of which play crucial roles in safeguarding natural resources and fostering community resilience to climate change impacts. These departments are:

- **Department of the Environment (DOE):** Focuses on enforcing environmental regulations and promoting sustainable practices to protect Belize's natural resources. The DOE, in collaboration with the Ministries of Sustainable Development, Rural Transformation, and Agriculture, has combined their expertise to support BLPA in enhancing the cattle livestock sector.

  Together, these ministries have engaged in detailed discussions with BLPA to develop and implement climate change adaptation strategies tailored for the cattle industry. These strategies align with Belize's NDCs under the Paris Agreement, ensuring that the industry meets its environmental and sustainability goals.
  This collaborative effort represents a key aspect of the ministries' commitment to supporting BLPA and the broader cattle livestock industry. By integrating climate adaptation measures, these ministries aim to improve resilience and sustainability within the sector, addressing both current and future environmental challenges. This approach not only strengthens the cattle industry but also contributes to Belize's overarching climate goals and sustainable development objectives.

- **Sustainable Development Unit:** Works on integrating sustainable development principles into national policies and programs to ensure long-term environmental and socio-economic sustainability.
- **National Biodiversity Office:** Dedicated to conserving Belize's rich biodiversity through research, monitoring, and the implementation of conservation strategies.
- **National Climate Change Office:** Manages climate change adaptation and mitigation efforts, ensuring that national strategies align with international climate agreements and frameworks.
- **Forest Department:** Responsible for the management and conservation of forest resources, combating deforestation, and promoting reforestation initiatives.
- **Protected Areas Conservation Trust (PACT):** Focuses on funding and supporting the management of protected areas and conservation projects to preserve Belize's natural heritage.

These departments are involved in a range of projects aimed at enhancing environmental protection and community resilience. They collaborate on initiatives such as reforestation programs, biodiversity conservation, climate adaptation strategies, and sustainable land management. By working together, these departments contribute to building a more resilient and sustainable future for Belize.

d) Ministry of Economic and Development (MED)

The Ministry of Economic Development (MED) is responsible for promoting economic and social development in the country. Its mission is to promote macroeconomic stability, sustainable socioeconomic development, and poverty reduction. Currently, MED implements several projects, including the Road Safety Project, the Belize Integral Security Project, and the Resilient Rural Belize Project (Ministry of Economic and Development, 2024).

e) Ministry of Finance

The Ministry of Finance is responsible for advising on, coordinating, and implementing the Government's economic and fiscal policies and programs, including the generation and allocation of financial resources to provide public services and contribute to the overall development of Belize. Additionally, it provides critical financial guidance and policy support, which will be essential in driving forward a sustainable cattle industry and securing necessary funding for long-term development initiatives.

f) Ministry of Tourism and Diaspora Relations

The Ministry of Tourism and Diaspora Relations in Belize focuses on engaging with Belizeans living abroad, often referred to as the diaspora.

Its role includes fostering connections between Belizeans overseas and their home country, promoting cultural ties, and encouraging diaspora contributions to national development. The Ministry works on various initiatives to involve the diaspora in areas such as investment, tourism, and community support, leveraging their global presence for the benefit of Belize.

- **Belize Tourism Board (BTB):** A statutory body established to oversee and promote the tourism sector in Belize. It operates under the Ministry of Tourism and is responsible for spearheading the development and implementation of tourism policies and strategies. The BTB works to strengthen the country's reputation as a leading travel destination by managing marketing and promotional efforts, supporting the growth of tourism infrastructure, and ensuring high standards within the industry. Through its various initiatives, the BTB aims to attract visitors, improve the overall tourism experience, and contribute to the sustainable development of Belize's tourism sector.

The Ministry and the BTB are related in their efforts to enhance Belize's profile internationally. While the BTB is primarily responsible for promoting Belize as a travel destination and developing the tourism sector, the Ministry of Diaspora Affairs can play a supportive role by leveraging the diaspora's networks and influence to attract visitors, investments, and positive publicity. Both entities are not currently active in the beef cattle value chain; however, there is potential for them to start promoting Belize's sustainable beef cattle to tourists. This collaboration could open new avenues for showcasing Belize's commitment to sustainability and enhancing the country's agricultural profile among visitors.

g) Belize Bureau of Standards (BBS)

The Belize Bureau of Standards (Belize Bureau of Standards, 2024) is a government agency responsible for setting and enforcing quality standards and regulations for products and services in Belize. In the context of cattle farming, the BBS plays a crucial role by ensuring that slaughter facilities are properly calibrated and adhere to quality standards. They certify in ISO 9001 quality management systems and other food sector standards, though none are directly related to meat production.

5.2.10. Financial sector organizations

a) Central Bank of Belize

The Central Bank of Belize was established under the Central Bank Act of 1982. The objectives are to promote stability in the monetary system and in the exchange rate. The Central Bank must ensure that money supply does not expand rapidly since this would lead to increased spending, higher inflation, and a higher demand for foreign reserves. The Central Bank may increase or decrease commercial bank liquidity requirements, or it may influence the interest rate to ensure that the growth in money supply level can promote credit and exchange conditions that are conducive to economic growth (Central Bank of Belize, 2024).

b) Commercial banking

Belize has a robust banking sector with four primary commercial banks: Belize Bank, Belize National Bank, Heritage Bank, and Atlantic Bank. Despite their critical role in the financial system, cattle farmers in Belize face significant challenges when seeking loans. Currently, they do not benefit from specialized

loan interest rates tailored to the agricultural sector. Instead, agricultural loan interest rates typically range from eight to ten percent, applied uniformly across the board.

High interest rates pose a considerable challenge for farmers, particularly since cattle farming is a long-term investment requiring substantial capital and time to yield returns. Additionally, many cattle farmers face obstacles due to inadequate land documentation. The lack of formal land documents often impedes their ability to obtain loans, as banks generally require proof of land ownership or long-term lease agreements as collateral. This bureaucratic hurdle makes it difficult for many farmers to access the financing needed to expand or sustain their operations.

c) Multilateral banking

Multilateral banks, such as the Inter-American Development Bank (IDB), play a pivotal role in supporting Belize's cattle industry by providing tailored financial services and facilitating access to capital for both small and large-scale farmers. Their involvement is crucial in addressing the unique challenges faced by the sector and fostering its growth and sustainability.

i. Inter-American Development Bank (IDB)

In 2018, BLPA received significant support from the IDB and its Multilateral Investment Fund (MIF) for the implementation of the project titled "Improving Livestock Sector Productivity and Climate Resilience in Belize." This initiative exemplifies the critical role of multilateral banks in the sustainable beef cattle industry sector. The project aimed to enhance the productivity of the livestock sector while simultaneously addressing climate resilience. IDB's engagement in Belize's cattle industry through initiative like "Improving Livestock Sector Productivity and Climate Resilience in Belize" project underscores the significant role that multilateral banks can play in supporting micro, small, and medium-sized enterprises (MSMEs) within the livestock sector. The total cost is USD 875 700 (Country Counterpart Financing of USD 325 200 and Original Amount Approved of USD 550 500).

ii. World Bank Group

The World Bank is an organization comprising 189 member countries, known as shareholders. These shareholders are represented by a Board of Governors, typically the countries' ministers of finance or development, who serve as the ultimate policymakers. The governors convene annually at the Meetings of the Boards of Governors of the World Bank Group and the International Monetary Fund(World Bank Group, 2024).

CRESAP is an Investment Financing Project initiated by the Government of Belize with funding support from the World Bank. The project aims to enhance agricultural productivity and strengthen resilience to climate change risks among targeted producers, while also providing effective responses to eligible crises or emergencies. The total project cost is USD 45.70 million, funded by the World Bank and additional non-bank sources.

The project focuses on the four districts in Belize's Northern region—Cayo, Orange Walk, Corozal, and Belize—identified as the most vulnerable to climate change impacts affecting key agricultural value chains. Targeted value chains include sugar cane, rice, maize, soybean, vegetables, livestock, and fruits. Some activities may also benefit other sectors, such as banana and citrus, and extend support to farmers in the remaining two districts, Stann Creek and Toledo.

d) Microfinance

- **Development Finance Corporation (DFC):**

DFC and credit unions are prominent financial service providers offering microfinancing solutions to farmers, including cattle producers, often with greater flexibility than commercial banks. Currently, DFC is leading a project focused on expanding Belize's sustainable cattle industry. Resources will be used to establish collaborative assistance that promotes climate-smart practices among small, medium, and large producers to enhance resilience and sustainability. This includes capacity development and technical assistance to educate farmers on climate-smart practices and modern herd management techniques (DFC, 2024). The applicable interest rate is seven percent.

- **La Inmaculada Credit Union Ltd. (LICU):**

LICU provides specialized loan products for micro, small, and medium-sized enterprises (MSMEs) to support their financial needs. These loans help MSMEs manage risks, navigate temporary cash flow constraints, and facilitate growth, contributing to job creation and increased income. LICU offers loans at an interest rate of nine percent on a reducing balance basis. These loans can be used for working capital, purchasing plant and machinery, acquiring equipment, expanding businesses, investing in climate-resilient technology, and improving energy efficiency through fixtures, among other purposes. To qualify, applicants must meet eleven specific requirements. Key documentation includes a copy of the trade license (if applicable) and proof of business, which may include letters from relevant associations, BLPA, or a Memorandum of Agreement (MOA) with the required registration.

e) **Blue Creek Credit Union (BCCU):**

In partnership with the Social Investment Fund (SIF), DFC, and credit unions such as LICU and BCCU have signed a Memorandum of Agreement to become Financial Participating Institutions (FPIs) under the Climate Resilience and Sustainable Agriculture Project (CRESAP). A key component of CRESAP is the Matching Grant Facility (MGF), designed to encourage the adoption of climate-smart agriculture (CSA) technologies, approaches, and practices among Belizean farmers vulnerable to climate change. The MGF aims to enhance agricultural productivity and build resilience to climate change risks. Participating financial institutions, such as LICU and BCCU, will co-finance the MGF.

To qualify as FPIs, these institutions must implement an Environmental and Social Management System (ESMS) and an Environmental and Social Management Plan (ESMP). These frameworks outline environmental and social policies, procedures, and capacities for assessing, managing, and monitoring risks and impacts associated with CSA investments. Additionally, the project targets a 10 percent increase in beef cattle yield for beneficiaries, underscoring its potential to enhance productivity and resilience within the cattle industry. Currently, the cattle farmers in Belize are not subject to agricultural insurance.

5.2.11. Research institutions

- **University of Belize Central Farm Campus (UBCFC)**

The University of Belize plays a significant role in the cattle industry through its Central Farm Campus, which is dedicated to agricultural education and research. UBCFC collaborates with government agencies, industry associations, and international organizations to support and enhance the cattle sector. These partnerships enable joint research projects, facilitate knowledge exchange, and foster the development of new technologies and practices that benefit local farmers.

The University of Belize is actively involved in a regenerative agriculture program implemented in partnership with TNC and other key stakeholders. This program is a crucial component of the initial

phase of the livestock project. The primary goal is to establish a model farm utilizing silvopastoral systems, which will serve as a showcase for sustainable cattle farming practices. The University of Belize is at the forefront of coordinating this phase, focusing on collecting and analyzing data to validate the effectiveness of silvopastoral systems in improving cattle production. By leading these efforts, the University is contributing to the advancement of sustainable and innovative practices within the Belizean cattle industry.

- **Belize High School of Agriculture (BHSA)**

BHSA is strategically situated near Mennonite communities, such as Little Belize and Blue Creek. Leveraging this proximity, the school engages in various agricultural activities and research in collaboration with local Mennonite ranches. Recently, students at BHSA conducted research on tick and fly infestations affecting cattle, utilizing the resources and expertise available in these nearby ranches. This hands-on approach enriches their learning experience and provides valuable insights into managing livestock health challenges.

- **Galen University**

Founded in September 2003, Galen University was established as Belize's first independent university, offering degree programs in Archaeology, Anthropology, Business Administration, and Tourism Management. Galen has contributed to national growth and development by offering a range of unique undergraduate and graduate degrees through a hybrid online and face-to-face learning approach.

The university offers a Bachelor's degree program in Environmental Science (ESCI), combining theory and skill development with practical field experience and on-the-job training. This program aims to improve policy and practice in addressing local and global challenges such as climate change, pollution, land use change, water and energy sustainability, and biodiversity loss. Galen also offers a Veterinary Technician program where students apply knowledge and clinical skills as part of the veterinary team to provide routine and emergency nursing care to animals. Responsibilities include collecting samples, performing diagnostic tests and x-rays, administering medications, facilitating well-check exams, preparing animals for surgery, assisting veterinarians during procedures, and educating pet owners (Galen University, 2024).

5.2.12. International cooperation agencies and climate funding agencies

Food and Agriculture Organization of the United Nations (FAO)

FAO in Belize has been a cornerstone of the agricultural sector, successfully implementing projects that enhance agricultural practices, protect the environment, and improve the livelihoods of farmers. Key interventions include:

- In 2022, FAO's "Belize Builds Climate Resilience from the Ground Up" project aimed to strengthen climate resilience in agriculture, benefiting over 7,000 farmers. By providing grants, vital weather data, and technical expertise, the project improved crop and livestock yields. It also focused on climate-smart agriculture techniques, including integrated crop-livestock systems and improved water use.

- In 2022, FAO, in collaboration with Procasur, facilitated dialogue and policy development through the "Learning Route" program. This initiative, titled "Moving Up the Value Chain: Enhancing the Business and Associative Capacities of Small Rural Producers' Organizations," aimed to strengthen the associative and entrepreneurial skills of farmer organizations. Participants engaged in activities that emphasized agro-industrialization, with a focus on involving youth, women, and farming communities.

United Nations Development Programme (UNDP)

UNDP is actively engaged in agricultural projects in Belize, supporting sustainable economic growth and improving rural livelihoods. Key initiatives include:

- In collaboration with Solutions for Environment and Development, executed by Tropical Agriculture and Higher Education Center (CATIE), UNDP developed a curriculum for farmer field schools focused on climate-smart agriculture. This curriculum equips farmers with practical tools to boost productivity, adapt to climate change, and reduce the agricultural sector's carbon footprint.
- In May 2024, UNDP Belize, in partnership with MAFSE and Belize Enterprise for Technology, supported the Cayo Rural Alliance Farmers Pre-Cooperative in Succotz village. This support included equipment such as meat grinders, a band saw, a power washer, and freezers to facilitate sheep and goat meat processing.
- UNDP also supported climate-smart agriculture through the GEF-funded "Integrated Management of Production Landscapes to Deliver Multiple Environmental Benefits" project (GEF Project Grant: USD 5,108,933). The project aimed to mainstream biodiversity conservation and sustainable land and water management into production landscapes. This included improving market access for sustainable livestock products from small producers and systematizing best practices for biodiversity and resource management. Additionally, UNDP and the Korea International Cooperation Agency (KOICA) signed a USD 3.4 million arrangement to boost Belize’s statistical capacity.

- **International Fund for Agricultural Development (IFAD)**

  IFAD is supporting the Resilient Rural Belize Program, designed to enhance the resilience of small-scale farmers against climatic and economic shocks. Managed by the Ministry of Economic Development, the program focuses on cooperative value chain business plans that incorporate climate-smart practices and promote the involvement of women and youth. It targets eight key agricultural commodities but does not include cattle farming. The initiative is crucial for protecting Belize's agricultural sector, a cornerstone of the nation's economy.

- **Green Climate Fund (GCF)**

The GCF is a financial mechanism designed to assist developing countries in implementing climate change adaptation and mitigation practices. It offers concessional loans (resource transfers under more favorable conditions than market rates), guarantees (activated if the borrower defaults), equity investments (capital injections to leverage additional resources and mitigate risks), and grants (funds provided without expectation of repayment). The GCF provides resources to accredited national and subnational organizations nominated by recipient countries. The nomination process is open to public, private, and non-governmental entities with actionable, detailed projects that meet the GCF's financial, environmental, social, and gender inclusion standards. Entities seeking accreditation through the direct access modality must first be nominated by the National Authority. Additionally, the GCF funds projects through accredited international organizations, including United Nations agencies, multilateral development banks, and regional institutions.

6. CLIMATE ANALYSIS

6.1. Climate change in Belize's agricultural context

In Belize, agriculture's contribution to GHG emissions is relatively modest compared to other countries. According to Belize's NDC Report presented in 2021 (Government of Belize, 2021), the agricultural sector contributed 6 864 Gg CO_2e to the national GHG inventory in 2017.

However, despite Belize's minimal contribution to climate variability, the country is increasingly experiencing the impacts of climate change, including more frequent prolonged droughts, floods, rising coastal erosion, and changes in precipitation patterns. These effects are expected to worsen in the coming years (UNFCCC, 2021). Despite Belize's minimal contribution to global climate variability, the country is increasingly experiencing severe effects of climate change.

Evidence of these adverse impacts is seen in the increased frequency of natural disasters that have led to the loss of lives, livelihoods, and damage to productive sectors and natural assets (Government of Belize, 2023). It also affects agricultural yields which are sensitive to changes in precipitation, temperature, and extreme weather conditions (UNFCCC, 2021).

In terms of production, Belize has achieved food security regarding staple grains, livestock, seasonal fruits, and vegetables. However, this security is threatened by episodes of excessive rainfall and flooding. Additionally, climate change impacts agricultural systems and practices, affecting soil fertility, soil preparation, pest and disease control, and water requirements (both excess and deficit). Higher temperatures are expected to cause greater stress on current livestock breeds and crop types and varieties. Additionally, less rainfall is likely to occur, with variation in seasonal distribution leading to more periodic droughts and floods (CCCCC, 2015).

During the preparation of the National Adaptation Agriculture Strategy to Address Climate Change in the Agriculture Sector (CCCCC, 2015) two key aspects emerged from the process: 1) the majority of respondents have observed the effects of climate change and variability on agricultural systems,and 2) pest/disease management and soil nutrition were identified as the most critical adaptation needs. This Strategy recommends technical adaptation measures to address the adverse effects of climate change and climate variability in the agricultural sector. These measures focus on issues related to precipitation (excess, scarcity, and variability), rising temperatures, changes in pest and disease dynamics, and changes in soil fertility.

Belize is implementing initiatives based on the CSA approach to address the challenges affecting the agricultural sector due to climate change. Actions have been developed to promote sustainable agriculture and encourage the adoption of risk management strategies to mitigate climate change impacts. Additionally, practices for the sustainable management of natural resources have been introduced, including the use of cover crops, agroforestry, conservation tillage, and row cropping with Inga trees (Inga spp.) (CIAT, 2018).

On the other hand, Belize´s National Climate Finance Strategy (2021-2206), includes interconnected elements such as the Climate Financing Strategy, a report on climate financing options, and studies on mobilizing private sector funding and resources from multilateral development banks to support the implementation of Belize's updated NDC. The strategy provides a strategic framework for leveraging financial resources from various sources and channels to address Belize's climate change challenges, including the implementation of adaptation practices (Commonwealth, 2021).

Additionally, the Plan Belize 2022-2206 initiative aims to integrate resilience and adaptation into national planning processes, emphasizing that reducing the impacts of climate change is a high priority and essential for achieving sustainable development. This focus is particularly crucial because Belize's economy relies on climate-sensitive sectors such as agriculture and tourism.

6.2. Vulnerability to climate change: challenges and needs for adaptation and mitigation in the green/sustainable meat value chain

According to UNDP (UNDP, 2024), Belize ranks 114th on the Climate Vulnerability Index and 123rd on the Human Development Index globally. This section outlines the main challenges and needs related to adaptation and mitigation identified within the country's beef value chain.

Changes in climate condition: Belize is experiencing shifts in temperature patterns, with an average increase of 0.1°C per decade since 1960, and changes in precipitation, with a decreasing trend of 3.1 mm per decade. The country's geographic location makes it vulnerable to rising sea levels and more frequent and intense tropical storms, leading to significant flooding that impacts the agricultural sector. Smallholder farmers, who often lack protective mechanisms, are particularly susceptible to these climate changes (CIAT, 2018). These shifts directly affect established pastures and livestock management conditions.

Soil and pasture degradation: Technical intervention in the management and operation of livestock farms is crucial. This includes intensifying and improving pasture management through the adoption of climate-smart production practices and green technologies. Practices such as rational Voisin grazing, rotational grazing, and pasture improvement should be implemented to increase forage production and contribute to soil recarbonization. These measures will enhance the resilience and sustainability of the country's livestock farms.

Lack of vegetative cover on farms: Extensive livestock farming practices have led to the loss of tree and shrub cover in productive areas. This lack of cover exposes grazing animals to harsh weather conditions, particularly thermal stress from sun exposure, and results in soil moisture loss. Increasing tree and shrub cover on farms through agro-silvopastoral and silvopastoral practices is essential. These practices not only help mitigate greenhouse gas emissions and adapt to climate change but also support broader ecosystem services.

Water availability limitations: Due to climatic variability, prolonged drought periods are becoming increasingly frequent, leading to limitations in water resources for animal consumption and daily farm operations. Implementing measures and systems for water harvesting, storage, and distribution on farms is essential to ensure functionality and animal well-being. Additionally, increasing tree cover on farms helps protect available surface and groundwater resources.

Scarcity of feed sources for livestock. Climatic variability and the use of low-tech feeding practices directly impact the ability to maintain and produce livestock on farms. This affects farmers' ability to optimize profits from their activities. Identifying and implementing innovative feeding practices, such as protein and energy forage banks, linked to climate adaptation and mitigation strategies, help ensure feed availability throughout the year.

While this practice requires additional management efforts and daily labor, it increases feed biomass and allows for the use of less productive or sloped areas of the farm, making them more intensive and sustainable.

Infrastructure: Severe climatic conditions, including flooding risks, threaten farm infrastructure, roads, and industry. These issues can cause continuous and prolonged disruptions to the commercial activities within the meat value chain. The government must ensure the maintenance and functionality of roadworks to support regular commercial operations in livestock-rearing regions across the country. In terms of transportation, land transport related to livestock commerce is frequently affected by flooding and storms associated with climate change. Any disruptions to transportation infrastructure directly impact the technical management, processing, and commercialization of meat production in Belize.

Vulnerability of livestock farmers: The described effects of climatic variability have heightened the vulnerability of livestock farmers due to deteriorating productive conditions, impacting commercial capacity and socioeconomic stability. Belize currently lacks regulations and subsidies to help farmers recover from the impacts of climate change on their activities.

6.3. Definition of climate-resilient livestock farming

Belize has expressed interest in understanding the process developed by Costa Rica in implementing the Low-Carbon Livestock Strategy and the Livestock Nationally Appropriate Mitigation Actions (NAMA). The aim is to learn from Costa Rica's experiences, including key lessons and relevant strategic, technical, and operational recommendations, to establish a roadmap for developing climate-resilient beef cattle farming in Belize.

According to the Tropical Agricultural Research and Higher Education Center (CATIE), climate-resilient livestock farming aims to enhance productivity per unit area through the incorporation of silvopastoral systems and best practices that improve management efficiency without expanding pasture areas (CATIE, 2024). Benefits include rehabilitating and restoring unproductive areas, reducing environmental degradation, increasing tree cover and biodiversity, enhancing carbon sequestration, managing, and conserving water resources, lowering emissions, and promoting the adaptation of livestock farming to climate change.

The 13th United Nations Conference on Climate Change held in Bali in 2007 introduced the concept of NAMAs. This concept provides a framework for developing countries to outline the mitigation actions they are willing to implement as part of their contribution to the global effort against climate change. It was agreed that the impact of these actions would be measured through a Monitoring, Reporting, and Verification (MRV) system, ensuring that the measures implemented effectively and efficiently contributed to the global climate response.

Regarding decarbonization, the NAMA Livestock program in Costa Rica defines the mitigation of GHG emissions as "anthropogenic interventions to reduce emission sources or enhance GHG sinks" (Quesada & Chacón, 2015). This concept aligns with the guidelines established by the Intergovernmental Panel on Climate Change (IPCC).

Regarding adaptation measures, the Costa Rica NAMA Livestock defines adaptation to climate change as "adjustments in human or natural systems in response to projected or real climatic stimuli or their effects, which can moderate harm or exploit beneficial aspects" (this definition was adapted from the IPCC definition) (CATIE, 2024). This concept encompasses the use of green cover and landscape-level services to promote agricultural sector resilience. It includes efficient water harvesting and usage systems to combat drought and desertification, tree planting in pastures and water source protection to enhance biodiversity and reduce temperatures during heatwaves, soil protection and recarbonization, as well as the use of improved pastures to increase carbon sequestration and better withstand droughts and pest outbreaks.

6.4. Climate resilience practices: adaptation and mitigation in Belize

The National Adaptation Strategy to Address Climate Change in the Agriculture Sector in Belize (CCCCC, 2015), proposes a series of recommendations, including technical and cross-cutting adaptation measures, strengthening of regulatory, legal, and institutional frameworks, and programs for education, early warning, and stakeholder awareness. This strategy has enabled the agricultural sector to prepare for the implementation of the proposed adaptation measures in terms of technical capacity, institutional environment, policies, and stakeholder engagement.

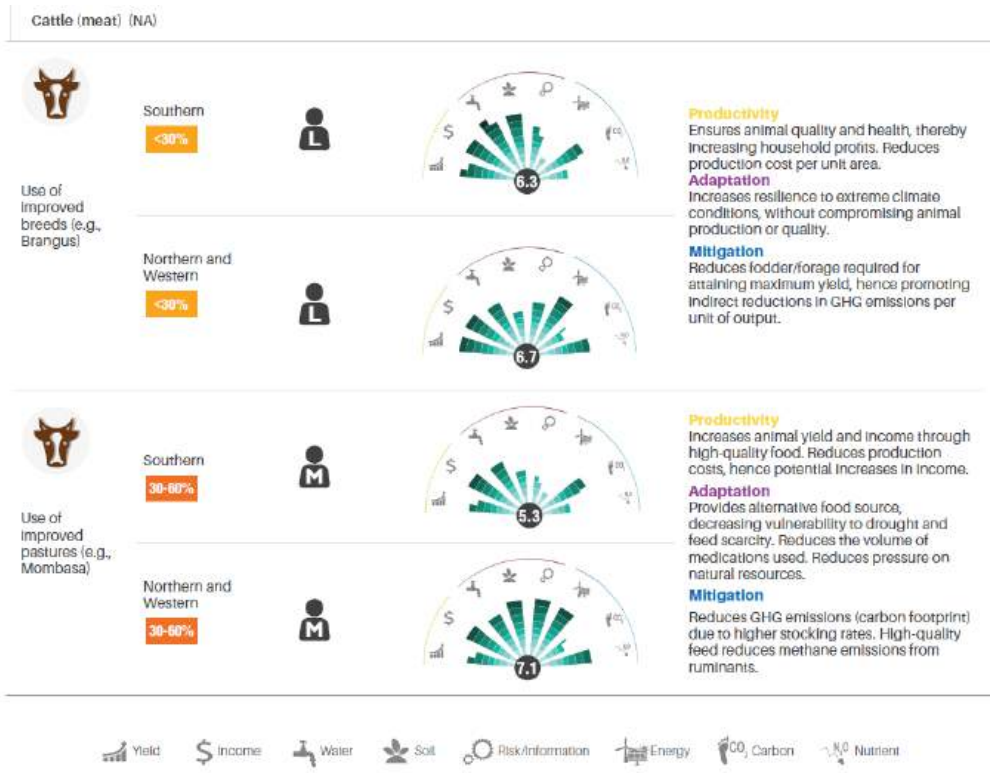
However, continued investment in research, training, and formal education is essential to provide the country's agricultural industry with specialized knowledge for the effective and efficient implementation of climate adaptation measures.

As part of the process, policies have been enacted to promote CSA, which encourages the adoption of risk management strategies to mitigate the effects of climate change and the introduction of sustainable natural resource management practices. These practices include incorporating vegetation cover species in crop and livestock production systems through agroforestry systems. This approach significantly reduces the carbon footprint of agriculture by mitigating GHG emissions, as well as implementing conservation tillage (CIAT, 2018).

CSA refers to technologies and agricultural practices that enhance food security, sustainably increase agricultural productivity and farmer incomes, facilitate adaptation and resilience to climate change, and mitigate (reduce and/or eliminate) greenhouse gas emissions (CIAT, 2018).

Practices recommended as part of CSA for Belize include the construction of drainage and irrigation infrastructure, increasing vegetation cover, using improved varieties and certified planting material, fertigation, crop rotation, intercropping, integrated soil and land management, agroforestry, and rational water use in farm operations. In the livestock sector, efforts are focused on promoting the adoption of improved breeds (e.g., Brangus), enhancing pastures (e.g., Mombasa), establishing forage banks, adopting forage conservation techniques for animal feed (such as silage and hay), and implementing agroforestry systems and other farm arborization practices (CIAT, 2018).

Figure 34. Examples of climate-smart agriculture practices in Belizean livestock systems



Source: CIAT, 2018

CSA practices help curb and reverse soil erosion and land degradation by focusing on soil and water conservation measures. These practices aim to increase vegetation cover, enhance the soil's water retention capacity, improve soil structure and health, and boost soil fertility (CIAT, 2018), as long as the animal load is not increasing beyond the capacity of the production area under the assumption of CSA practices.

Initiatives to promote the adoption of CSA practices at the farm level are being complemented by efforts to introduce early warning systems. These systems enable producers to receive advanced information about climate irregularities, allowing them to take measures to reduce the risk of losses from natural events (CIAT, 2018).

6.5. CSA practices implemented in the beef cattle value chain

BLPA has proposed as part of its Mission (BLPA, 2023):

"*BLPA will encourage a green livestock industry by promoting agroforestry and Agro-Silvopastoral systems, will offer transformational technical services aimed at improving access to high-value markets*".

BLPA is implementing its five-year strategic plan, which is based on three strategic objectives focused on developing a green livestock industry in Belize (BLPA, 2023):

- To strengthen the governance structure of the organization.
- To strengthen the technical and administrative capacity of BLPA, and offer technical assistance to other livestock associations.
- To strengthen trade cooperation and coordination for improved market access and marketing of livestock and cattle products nationally and internationally.

The implementation of BLPA's strategy has facilitated the development of projects centred on adopting CSA practices, as summarized in the following table (BLPA, 2023).

Table 17. BLPA projects focused on CSA practices

Name of the project	Start date	Funding	Description	Budget USD
Improvement of Livestock Sector Productivity and Climate Resilience in Belize (Moreno, Young, & Joseph, Consultancy to carry out an In-depth analysis of an improvement plan implemented on 10 model livestock farms aimed at Improving Livestock Productivity and Climate Resilience in Belize, 2021)	2018	Inter-American Development Bank (IDB) / Multilateral Investment Fund (MIF)	**Technical Support**: Tropical Agricultural Research and Higher Education Center (CATIE) **Objectives:** To reduce the vulnerability of small and medium-sized livestock farmers in Belize to climate change. To promote the adoption of climate-resilient practices and green financial products to increase livestock production in Belize. **Results:** Six out of seven participating livestock farmers recorded an increase in the number of animals sold in 2021 compared to 2018. In the evaluated farms (IPCC Level 1 Methodology), the largest proportion of emissions comes from enteric fermentation and the lack of manure management on pastures, where manure decomposes naturally, contributing to the release of methane and nitrous oxide with greater global warming potential compared to carbon dioxide. GHG emissions reductions achieved with CSA practices such as improved pastures and rotational grazing result in an overall reduction of about 12-20 percent in emissions, depending on diet quality. Higher GHG emissions per unit of livestock occur when animals are primarily fed fresh grass, compared to alternative feeds such as corn, hay, or silage of fresh grass and legumes. Shifting from the current monoculture of grass in Belize can significantly reduce emission intensities per livestock unit. With alternative feeding, animals can reach market weight sooner due to dietary changes, which reduces total GHG emissions per year, as the time to slaughter or export is shortened, and fewer animals are needed to achieve the same production goal.	

Name of the project	Start date	Funding	Description	Budget USD
			Besides improving pastures and pasture rotation, altering the diet composition is also a key factor in enhancing digestibility and reducing GHGs in livestock production, which helps mitigate the sector's contribution to climate change. Lessons learned from model farms can be used as key messages for other farms in similar situations. **Recommendations:** Develop and implement a structured data collection mechanism that can be used to gather farm data as needed for future GHG emissions estimates. Create a data collection form that is easily accessible to farmers, available in either physical or electronic format. Develop a protocol for data collection and reporting that BLPA can use for ongoing processing and presentation of reports. Establish a GHG classification system for farms to categorize farmers. Develop and implement a GHG reduction strategy for the sector.	
Generation of resilience and sustainability in livestock farming	2022	GEF (Global Environmental Facility)	**General Objective:** Promote livestock intensification through the adoption of climate-smart production practices and green technologies that enhance resilience, productivity, and promote GHG reduction in the livestock industry. **Specific Objectives:** Improve farmers' knowledge in the proper management of pastures and livestock while enhancing productivity. Increase farmers' resilience through the adoption of alternative feeding techniques and improved genetics. Reduce land degradation and improve pasture management through the adoption of green technologies. **Achieved/Expected Results:** Purchase of four black Brangus breeding bulls. Development and execution of nine modules of Farmer Field Schools. Training of 60 BLPA farmers, including 15 women.	49 200

Name of the project	Start date	Funding	Description	Budget USD
			Development of a farm plan for each livestock producer (totalling 60 plans developed and in execution). Implementation of a Voisin pasture rotation management system in BLPA model farm, using solar-powered electric fencing. Construction of four water troughs on BLPA model farm.	
Integrated Landscape Management for Generating Multiple Global Environmental Benefits (BLPA, 2023)	2023	Ministry of Sustainable Development, Climate Change, and Disaster Risk Management (MSDCCDRM)	**Component 2:** Generation of multiple global environmental benefits (GEBs) through sustainable production and improved value chains for key agricultural and forestry products in the Belize River Watershed (BRW). **Achieved/expected results:** Utilization of landscape management tools in priority areas for biodiversity conservation, including the implementation of riparian forest rehabilitation and management strategies, alongside a participatory soil management program to reduce erosion and improve water quality. **Activities:** Training in Voisin pasture management systems (technical assistance and videoconference courses for 100 farmers per district). Farmer Field School extension program (silvopastoral, agroforestry, nutrition, genetics, pasture management). Installation of an agroforestry nursery (land preparation, seed purchase, materials and supplies, labor).	34 500
Promotion of silvopastoral systems for Livestock Intensification and climate resilience. (BLPA, 2023)	2024	UNDP Funds (United Nations Development Programme - AFCIA Project)	**General Objective:** Enhance the capacity of livestock producers in two target communities to adapt silvopastoral systems that contribute to increasing productivity and improving resilience to climate change effects. **Specific objectives:** Adapt target farmers' silvopastoral systems as a new livestock production system to increase agricultural productivity. Facilitate the restoration of degraded lands/pastures. Establish model farms that demonstrate the transformation of the livestock industry from an extensive production system to an intensive, sustainable, ecological, and efficient production system. **Achieved/expected results:** Livestock producers from four communities trained in CSA practices (pasture management, preparation and use of supplemental feed).	125 000

Name of the project	Start date	Funding	Description	Budget USD
			Forage banks (energy and protein) were established and utilized as part of a resilience program for use during the dry season. Farmer Field Schools (FFS) established, with the FFS methodology used as a key element for the successful adaptation of CSA practices and silvopastoral systems. Degraded pastures to be rehabilitated on farms of farmers involved in training. BLPA staff trained in field data collection, customer service, and office procedures.	

Source: Authors' own elaboration with BLPA data (2024)

7. EXPLORATORY MARKET ANALYSIS FOR BEEF CATTLE PRODUCTS FOR THE DOMESTIC MARKET

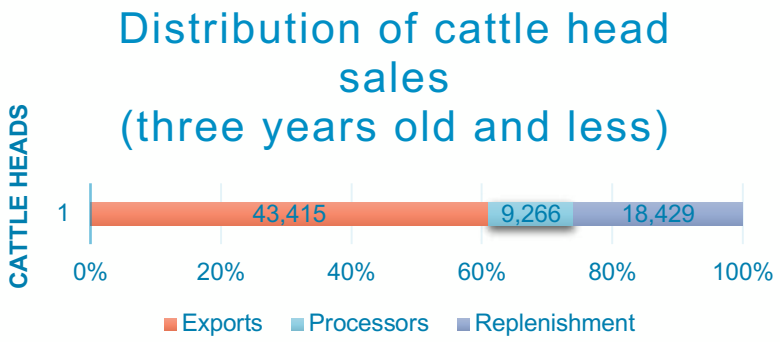
7.1. Overview

The beef and cattle market of Belize is concentrated into two main channels or submarkets:

1. **Live cattle markets:** Sale of live cattle to markets in Guatemala and Mexico and Belizean processors for local beef consumption. The Guatemalan market prefers young animals weighing less than 225 kg. In contrast, the Mexican export market demands animals weighing at least 225 kg for fattening and eventual slaughter outside of Belize. Beef processors focus on fattening cattle up to 400-500 kg to maximize carcass yield. These processors typically source younger cattle (under three years old), though some older animals are also used.
2. **Beef processing:** The national market corresponds to the already live cattle slaughter processing for local consumption. In Belize, exporters influence national markets, creating competition with local processors.
    - Slaughterhouses in Belize primarily cater to the domestic market, providing beef for local consumption. High export demand can reduce the availability of cattle for local processing, potentially driving up prices. Exporters might offer higher prices to cattle farmers to secure livestock for sale to intermediaries that sell into Guatemala and Mexico, creating competition with local slaughterhouses that may not be able to match these prices.

Therefore, all key players in the cattle commercialization channels focus on sourcing animals less than three years old. The following graph illustrates the data from 2023, showing the percentages of young cattle sourced by different actors and the remaining proportion of cattle available for herd replenishment.

Figure 35. Distribution of three year old animals

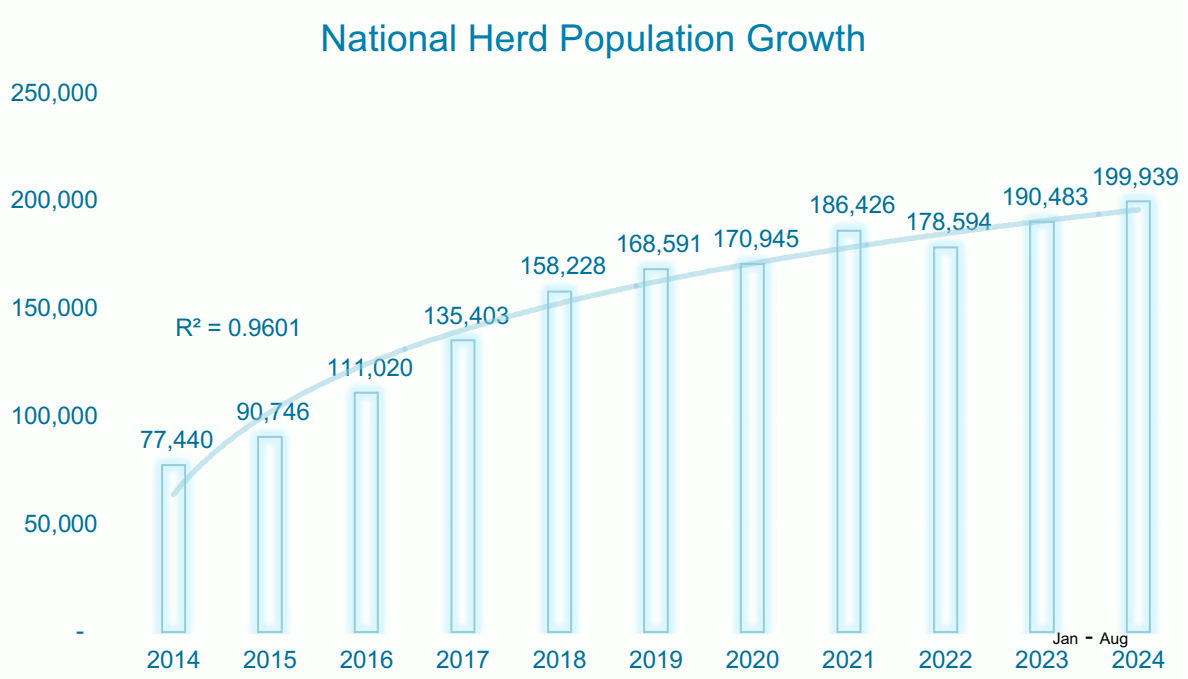


Source: Authors' own elaboration with BLPA data (2024)

Data reveals that over 75 percent of animals aged three years or less are sold to export or local markets, leaving just over 18 000 animals to sustain the genetic stock and replenish the herd. This figure represents less than ten percent of the national herd, which is insufficient to support policies aimed at increasing the national inventory.

The limited availability of young animals available for restocking may explain the modest growth of ten to 12 percent reported in the national inventory in recent years. The graph below illustrates how the inventory has been behaving historically.

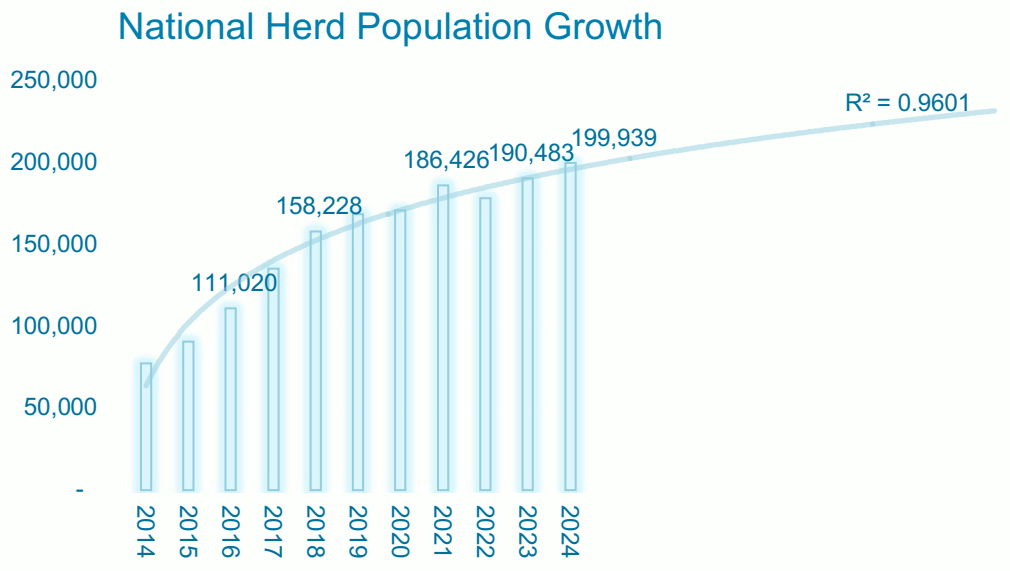
Figure 36. National herd population growth



Source: Authors' own elaboration with BLPA data (2024)

Based on data analysis, the following model was developed to illustrate the impact of slow growth. This model is not intended to calculate the time required to reach a specific market demand level. Instead, it aims to demonstrate the deterioration in the replenishment of the national herd. By replicating herd growth rates in a straightforward model and using a logarithmic equation to normalize these rates, it becomes evident that, under current reproduction conditions, herd replenishment is significantly impaired. It could take over ten years for Belize's national cattle inventory to reach 50 000 more animals (Figure 38). Before the current market conditions, it took from 2017 to 2024 (five years) to increase the herd by 65 000 animals (Figure 40). This model replicates only the current conditions, and the conclusion is based on the assumption that these conditions remain unchanged.

Figure 37. National herd inventory projection



Source: Authors' own elaboration

Maintaining a diverse age structure and an appropriate stocking rate of replenishment is essential for ensuring a continuous cycle of growth, reproduction, and production of the national herd. This approach is crucial for the sustainability and profitability of the industry and to establish and control policies to enhance the climate-smart agricultural practices of the industry.

Breeding, rearing, and fattening activities are key components in managing Belize's national herd size. These activities are closely tied to the restocking factor, which ensures livestock numbers recovery following reductions caused by events such as drought, disease, or market fluctuations. This factor is vital for maintaining the economic viability and sustainability of the national herd.

It is challenging to develop policies that assume productivity increases when the resources within the national herd do not support such assumptions. Maintaining the quality of the national cattle herd in Belize requires a range of resources: Effective breeding programs focusing on genetic improvement and disease resistance are essential; Investments in veterinary services and regular health screenings are crucial to ensure herd health; Nutritional support through high-quality feed and pasture management plays a significant role in maintaining cattle condition and productivity; Implementing sustainable farming practices, such as rotational grazing and soil conservation, can enhance pasture quality and support long-term cattle health.

To increase the amount of cattle population at a national level, additional resources are required for expanded breeding programs and infrastructure development. This entails building new facilities and upgrading existing ones to accommodate larger herds. Financial resources, such as government subsidies and loans, can aid farmers in scaling up their operations. Training and education programs for farmers on best practices in cattle management, breeding, and nutrition can help maximize productivity, ensuring that herd expansion does not compromise quality.

7.2. Live cattle market analysis

7.2.1. Market size

The live market for live cattle primarily serves sales into Guatemala and Mexico, providing vital source of income for Belizean farmers. The demand for live cattle in neighbouring countries bolsters the local agricultural economy and creates employment opportunities within the livestock sector.

In 2023 the national herd size was approximately 190 438 heads. Even though no significant growth has been shown, the Belize beef and cattle market has seen significant growth in recent years. The market for life cattle has been expanding, with cattle exports increasing from 22 713 heads in 2020 to 43 415 heads in 2023, marking a 91.1 percent increase. (Ministry of Agriculture, Food Security and Enterprise, 2023)The live cattle market in Belize has experienced significant growth over the past few years. From 2022 to 2023, the sector generated over USD 15 million more, bringing its overall valuation to approximately USD 45 million (Ministry of Agriculture, Food Security, and Enterprise, 2024). The two main destinations of this market are Mexico and Guatemala. In 2023 Belize exported 4 655 cattle heads to Mexico and 38 760 cattle heads to Guatemala.

7.2.2. Market trends and buyer's preferences

In 2023, Belize's live cattle industry saw substantial exports, with 43 415 animals sold to Mexico and Guatemala. These sales generated earnings of approximately USD 35.2 million. (BLPA, 2023)

This financial influx has been especially beneficial for small farmers, who find the sector attractive due to its lower entry costs and higher returns. The growth of the live cattle market has supported the livelihoods of many, contributing significantly to the country's overall economic health (Ministry of Agriculture, Food Security and Enterprise, 2024).

Looking ahead, the live cattle market in Belize is expected to continue its upward trajectory. This growth will be driven by the adoption of advanced technologies and sustainable practices within the industry. By embracing these innovations, the sector aims to enhance productivity, ensure ethical practices, and maintain a steady supply of high-quality cattle for both local and international markets (Ministry of Agriculture, Food Security and Enterprises, 2024).

The buyers in the markets for live cattle are diverse. In Guatemala, the majority of cattle buyers from Belize are informal purchasers. These transactions are typically conducted through by transporters who act as intermediaries crossing the border, arriving to cattle farms and purchasing livestock with cash. A transportation and salespermit from the Belize Livestock Producers Association (BLPA) is required for this process, as mandated by the Belize Livestock Registry.

Cattle are often traded across the border avoiding checkpoints, without formal export documentation or taxes, catering to local demand in Guatemala. Although this informal trade has been ongoing for some time, efforts are being made to formalize these transactions to ensure better regulation and control.

Figure 38. Transporter crossing checkpoint in Belize before arriving at Guatemalan Border. El Cayo District, Belize

Source: Nolan Quiros (2024)

The price received by the seller is determined by the weight of the animal sold. Cattle weighing less than 225 kg are typically targeted by transporters who will sell them to Guatemala. Animals weighing more than 225 kg are sold to intermediaries who will later sell them to intermediaries for the Mexican market. Formal purchases are typically handled through established channels and involve collaboration between the Ministry of Food and Agriculture, livestock farmers, and associations such BLPA (Breaking Belize News, 2023).

Figure 39. Fattening operation for Mexico Market. Orange Walk District, Belize

Source: Nolan Quiros (2024)

The sale of cattle from Belize to Mexico involves a series of well-coordinated steps to ensure compliance with the health and quality standards of both countries. Initially, cattle must meet specific pre-export requirements determined by Mexico importers and importing regulations, which include veterinary inspections and health certifications to confirm that the animals are free from diseases. This step is crucial to maintaining the health standards set by Mexico.

Following the initial inspections, the cattle are placed in quarantine and undergo further examinations by veterinarians from the BAHA and Mexico's National Service of Health, Safety and Agrifood Quality (SENASICA). Once the cattle pass these inspections, they receive health certificates from both BAHA and SENASICA, confirming they are fit for export.

Transportation of the cattle to the border follows, with all measures in place to comply with animal welfare regulations, ensuring the safety and well-being of the animals during transit. At the border, customs officials from both Belize and Mexico conduct additional checks to verify documentation and health certificates. Once cleared, the cattle are allowed to enter Mexico.

Upon entry into Mexico, the cattle are transported to specific destinations, such as Michoacán, where buyers like SuKarne, a major Mexican food processing company, take over (Government of Belize, 2024). These buyers are responsible for further fattening and processing the cattle, preparing them for distribution within Mexico and potentially for export to other countries.

Buyers' preferences are very well defined by the different buyers. Mexican buyers are interested in young animals male and female with a weight of at least 225 kg of weight. On the other hand, Guatemalan buyers are interested in young animals, males or females, of less than 225 kg of weight. Various interviews have also determined that both buyers are highly interested in the level of health and care that Belizean ranchers provide to their animals, as well as the quality of health control that Belizean cities implement for the national herd.

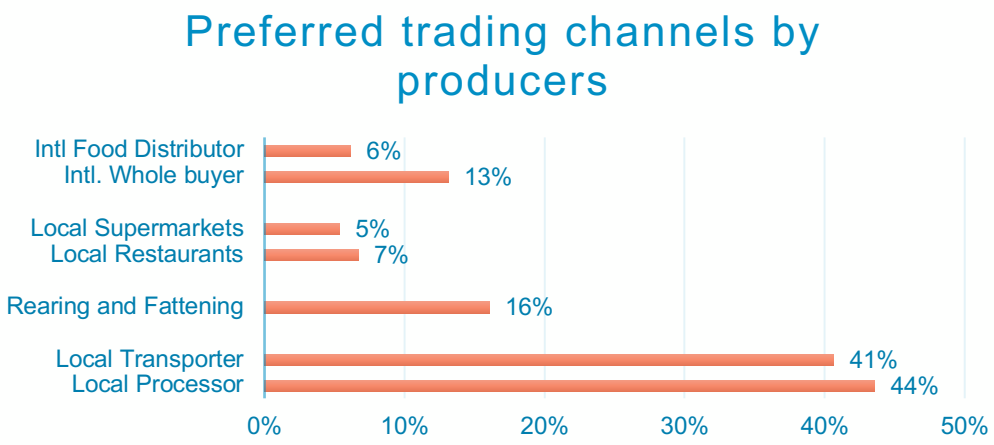
7.2.3. Market channels and products available

The markets for transporters and processors in Belize are heavily influenced by buyers from Guatemala and Mexico. In economic terms, this situation can be classified as a duopoly, where two dominant buyers hold significant market power. These buyers—primarily from Guatemala and Mexico—compete against each other for cattle, which can significantly impact the prices and terms they offer to sellers.

The cattle and beef cattle industries offer different channels for the commercialization of cattle in Belize, from farmers' local markets to some intermediaries and businesses' international sales. In this research, producers were asked to identify all the channels through which they commercialize their cattle. The graph below illustrates the flow of cattle through various commercialization channels.[4] It shows how producers utilize transporters and processors, as well as local cattle farmers. Processors supply beef to local retail and food businesses, while transporters facilitate sales to international buyers.

[4] Participants were allowed to answer multiple questions, therefore the percentages do not add up to 100 percent.

Figure 40. Preferred channels of commercialization used by producers to sell cattle



Source: Authors' own elaboration

Survey data highlights the preferred commercialization channels used by producers, including selling to transporters (41 percent) and processors (44 percent). A smaller portion (16 percent) sells directly to other farmers for rearing and fattening.

Transporters supply cattle to intermediaries who sell to international buyers or food distributors. These final buyers, particularly in Mexico, may process the cattle and later sell the beef to markets in Mexico, the U.S., or Canada.

Producers face asymmetric information before the buyers in the markets. Buyers in a transaction have more or better information than others, leading to market inefficiencies and volatility. This disparity often results in an unfair advantage, affecting competition and decision-making processes. This translates into price volatility in these markets, making restocking herds expensive, especially for small and medium-scale farmers.

In addition, there are different entry barriers to the markets in Guatemala and Mexico. Exporting cattle to Mexico involves additional costs such as shipping, tariffs, and meeting international standards. These costs can be significant and may only be justified if international market prices are substantially higher. According to BLPA, the cost of preparing cattle to be imported into Mexico is estimated to be around USD 22 per head (Belize Livestock Producer Association, 2024). This is only the cost of preparation (veterinarian visits, certifications of health and vaccinations) and does not include the sale price of the animal. Informal sales to intermediaries that sell into Guatemala avoid these costs, as there are no such health and phytosanitary requirements and extra costs from Guatemalan buyers.

This dynamic lowers the barriers to entry for producers selling to Guatemala, as transporters typically seek younger, lighter animals with fewer requirements. This makes it easier for producers in need of quick cash to participate. However, this results in commercial channels with a highly unstable price mechanism.

In contrast, Mexican buyers use a more stable pricing mechanism due to their non-negotiable requirement for higher-weight cattle. This stability requires producers or intermediaries to fatten cattle longer, which increases production costs before the cattle can enter the Mexican market.

Under normal market conditions, these pricing systems of both markets will work perfectly to discriminate the markets and avoid difficult negotiations. The market with more requirements on weight (Mexican) will price cattle at a constant higher price. The Guatemalan market is typically more volatile with lower prices.

The following prices are reported by the Ministry of Agriculture, and supplied by BLPA. BLPA faces a significant challenge in capturing accurate price information, as prices are directly negotiated between farmers and buyers at the farm level. It is difficult to obtain this information from the farmers, and when requested from processors, they often provide the lowest possible prices, which do not accurately reflect the true negotiations with the farmers. The processors prefer to keep this information undisclosed to maintain their negotiating leverage. Addressing this issue represents a valuable opportunity for improvement. This is another consequence of the market information asymmetry. One way to limit the issues of this asymmetry is to organize industry actions. Auctions can effectively address market information asymmetry by providing a transparent platform where prices are determined through competitive bidding. This ensures that all participants have access to the same information, thereby eliminating the unfair advantages associated with hidden negotiations and promoting a fairer market environment.

Table 18. Cattle prices in USD per kg in 2024

GUATEMALA	January	February	March	April	May
<225 kg	2.77	2.77	2.76	2.68	2.64
Heifers	1.26	1.26	1.25	1.22	1.20
MEXICO	**January**	**February**	**March**	**April**	**May**
>220 kg	2.87	2.87	2.87	2.87	2.87
Heifers	2.37	2.37	2.37	2.37	2.37

Source: MAFSE, 2024

During June, July, August, and September of 2024, the market experienced significant competition, eliminating price differentiation. This situation has happened before, as a price war developed between international markets, eliminating price seasonality or market differentiation in 2022 (The Reporter, 2022). At times, prices of the transporters to Guatemalan commercialization channels are higher than or equal to those in Mexico, which is generally considered to offer higher prices. When this occurs, the market collapses and supply goes to the low market entry destination.

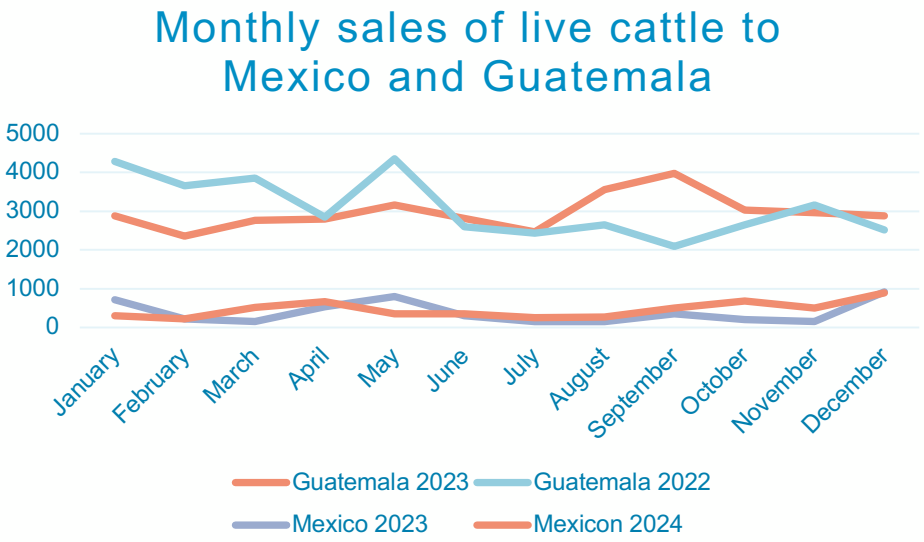
During this time, for transporters, the primary concern shifted from pricing to the availability of finding animals with weight requirements. This situation led the forces of demand and supply to act, supporting a price system for all participants, resulting in a uniform price ranging from USD 2.75 to USD 3.00, compressing the margins of buyers, and limiting processor participation in the cattle market, especially for animals under three years old.

7.2.4. Purchase frequency

Historically, Guatemalan buyers have employed a volatile and seasonal pricing system. Prices tend to decline during the dry season (December to May) due to a lack for demand of cattle from Guatemalan buyers. This can be seen in the graph below. During this period, cattle farmers are often more willing to sell their livestock quickly to avoid the costs associated with forages and supplements of the dry season. Conversely, prices rise during the rainy season (June to November) when the demand for cattle increases but supply is less as cattle ranchers focus on rearing their cattle.

In contrast, Mexican purchases are more influenced by the availability of cattle, which can be affected by the seasonality of exports to Guatemala. This relationship is clearly illustrated in the graph below, where the seasonal trends are less volatile than those of Mexico.

Figure 41. Monthly sales of live cattle to Mexico and Guatemala 2022-2024



Source: Authors' own elaboration

7.2.5. Certifications, quality and traceability

The quality and traceability of the live cattle market of Belize are governed by the need to provide the market health and safe animals. With this objective, Belize has implemented a National Bovine Traceability System designed to ensure the health and safety of its cattle industry. This system, managed by BLPA, involves identifying all cattle by international standards, incorporating the registration of all establishments involved in cattle farming. Each animal is assigned a unique identifier, typically through ear tags or Radio Frequency Identification technology - RFID, which allows for accurate tracking of their movements and health status (Belize Livestock Producer Association, 2024).

Additionally, the system includes an animal movement control component, ensuring that all cattle movements are recorded and monitored to prevent the spread of diseases. The traceability system supports various surveillance programs, including those for bovine tuberculosis, brucellosis, and Bovine Spongiform Encephalopathy (BSE).

By maintaining a real-time central information bank, the system provides essential data for disease control and ensures that cattle meet the health standards required for export. This comprehensive approach helps maintain the integrity of the livestock supply chain and supports the country's efforts to access international markets in Mexico and Guatemala. This system is complemented by a record of the physical movement of animals travelling outside of the country, known as the Export Movement Permit from BLPA. This export permit includes a detailed registration of all animals crossing borders from Belize. To sell cattle, producers must obtain this permit, which ensures that all cattle movements are recorded and monitored for traceability and disease control. This permit system helps maintain the health and safety standards required for international trade and supports the integrity of the livestock supply chain.

Currently, aside from the health and sanitary certifications provided by Belizean authorities, there are no cattle farmers in Belize holding third-party certification for sustainable production[5]. One reason for this may be that current live cattle markets do not recognize the value of such certifications. Balancing the costs of obtaining certifications with potential market access is essential, as local markets often lack awareness of product differentiation based on production methods.

For cattle, certifications can focus on different programs and production methods for instance, A Greener World and Food Alliance, offer certifications for Animal Welfare and non-genetically Modify Organism GMO products, which provides recognition in the US and Canadian markets. These organizations provide certification that ensures humane treatment of animals, promotes sustainable farming practices, and supports the well-being of local communities. Below are some examples of grass-fed certifications. Cost-related information on certification is not offered because it will always depend on the size of the operation, the location and current practices in the area.

The Certified Grassfed by A Greener World (AGW)

The Grassfed AGW certification is an optional, additional accreditation to the Certified Animal Welfare Approved by AGW. This certification guarantees that food products come from animals fed a 100 percent grass and forage diet, raised outdoors on pasture or range, and managed according to the highest welfare and environmental standards on an independent farm. This certification is recognized for its comprehensive standards, which include requirements for animal management, health care, pasture management, housing, and shelter. The certification also supports farmers by offering tools to meet market demands and maintain high welfare and environmental practices.

The Grassfed AGW certification involves an annual audit cycle to ensure ongoing compliance with the standards. Audits are conducted at least once a year, and the organization aims to schedule these audits as efficiently as possible, often grouping nearby farms to maximize the audit time.

Once the audit is completed, the certification review process typically takes four to six weeks. During this time, the certifier reviews the audit findings and determines whether the farm meets the required standards.

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[5]. A voluntary third-party certification is a process by which an independent organization assesses and verifies that a product, process, or service meets certain predefined standards. This certification is not mandated by law but is sought by businesses to demonstrate their commitment to quality, safety, sustainability, or other values. While larger producers with standardized systems may find it easier to obtain certifications, small producers need support to navigate the certification process and standardize value chain data for market opportunities.

If any non-compliance issues are identified, the farm is given guidance on how to address them. Once all requirements are met, the farm receives certification and can begin using the AGW logo on its products.

These certifications require farmers to adhere to rigorous standards that include providing animals with access to pasture, ensuring proper animal care, and maintaining detailed records of farm practices and bans deforestation. By meeting these standards, farmers demonstrate their commitment to ethical and sustainable livestock production, which is verified through annual audits by AGW staff or agents (A Greener World, 2024).

The American Grassfed Association (AGA) Certification

The American Grassfed Association (AGA) Certification also focuses on grass-fed cattle. The AGA certification ensures that animals are fed a 100 percent grass and forage diet, raised on pasture without confinement, and never treated with antibiotics or added growth hormones. AGA-certified producers are inspected at least every 15 months by independent third parties to ensure compliance with these standards. The time required to obtain the AGA Certification varies, but it generally takes several months to complete. This timeframe includes the initial application, preparation for the audit, and the audit itself. After the audit, the review and approval process can take an additional six to eight weeks, depending on the specific circumstances and any corrective actions that may be needed. Once certified, producers can use the AGA label to market their products, signalling their commitment to high standards of grass-fed production (American Grassfed Association, 2024).

Board Bia Grass Fed Standard

Ireland has a globally recognized certification for grass-fed cattle called the Board Bia Grass Fed Standard. This is a national standard that can be used as an example for Belize. It was launched by Board Bia (the Irish Food Board) and is the world's first scientifically supported grass-fed standard for beef on a national scale. It allows Irish processors to provide verifiable proof that their beef comes from grass-fed cows. To qualify, grass must constitute at least 90 percent of the feed intake throughout each animal's lifetime.

The certification process involves an initial application, followed by an on-farm audit conducted by an independent third party. The audit assesses compliance with the standard's requirements, including grass-fed verification, animal welfare, and environmental management. The entire certification process typically takes two to three months from application to final approval. Once certified, farms are subject to annual audits to maintain their certification status. The certification supports market differentiation by providing verifiable proof that beef products come from grass-fed cows, meeting consumer demand for sustainable and high-quality products (Irish Food Board, 2024).

Global Animal Partnership (GAP)

GAP is a non-profit organization dedicated to improving farm animal welfare standards worldwide. This program focuses on animal welfare and sustainable farming practices, offering different levels of certification based on compliance with their standards. GAP's primary objective is to create a more humane and sustainable food system by developing and promoting animal welfare standards that are scientifically based and socially responsible. The organization believes that meaningful label claims, validated by third-party farm audits, are key to influencing the industry, raising consumer expectations, and creating long-lasting change (Global Animal Partnership, 2024).

These certifications can provide labels for the local market, bringing recognition of the production processes used by cattle ranchers. Currently, local recognition of these certifications may not lead to price differentiation unless required by buyers in Mexico and Guatemala (this is not happening since Mexican markets do not require any certification).

In terms of no deforestation, at present there are no cattle certifications for the verification of no deforestation in Belize. Internationally, the International Sustainability and Carbon Certification (ISCC) certification ensures that beef supply chains are deforestation-free, climate-friendly, and committed to reducing greenhouse gas emissions. It is an independent, multi-stakeholder initiative that supports sustainable, fully traceable, deforestation-free, and climate-friendly supply chains. ISCC certification ensures that agricultural and forestry feedstocks are produced in an environmentally, socially, and economically sustainable manner (International Sustainability and Carbon Certification, 2024).

Implementing a standard that certifies no deforestation in Belize, similar to Costa Rica's certification led by CORFOGA and the Ministry of Agriculture (MAG), in collaboration with INTECO and supported by the FAO-UNDP SCALA programme, is essential for the sustainable transformation of the livestock sector. Costa Rica has established a deforestation-free standard through pilot projects led by ICAFE, CORFOGA and the Ministry of Agriculture, with support from SCALA (UNDP-FAO). The standard aims to become Costa Rica's first technical standard for deforestation-free beef production. This certification will ensure the sustainable use of pastures, traceability, and the implementation of an automated registration and verification system for livestock farms (Instituto Nacional de Tecnologia, 2024), while preparing the country to comply with the upcoming EU Deforestation Regulation.

Any certification strategy should be grounded in an analysis of potential international markets and weighing local capacities. The Ministry of Foreign Affairs, Belize Animal Health Authority, and BELTRAIDE possess the expertise to support business analysis, market characterization, and the understanding of certifications and phytosanitary measures required for various international markets of interest to Belize.

7.2.6 Willingness to pay for sustainably-raised cattle

During interviews in the research, traders and the exporter to Mexico expressed that Mexican and Guatemalan buyers of Belizean cattle might not be inclined to pay more for sustainably produced cattle as their primary focus is on sourcing animals to meet the demands of their operations. These buyers prioritize the availability and supply of cattle to ensure continuous productivity, over the specific methods used in production. As long as the cattle meet the necessary health and quality standards, the production practices might not significantly influence their purchasing decisions.

Additionally, the economic constraints and market pressures faced by these buyers make cost efficiency a key consideration. They often operate within tight budgets and are driven by the need to maintain profitability.

As such, they are more interested in securing cattle at competitive prices rather than paying a premium for sustainable production methods, especially if the end consumers in their markets are not demanding sustainably produced beef.

7.2.7 Potential demand for sustainably-produced cattle

During interviews with traders and exporters, it was mentioned the interest of the Mexican importer to have the Belizean cattle sales grow from 4 566 heads to 20 000 cattle heads, three times the current volume. With the removal of import tariffs and VAT, demand for Belizean cattle has surged as Mexican buyers seek quality livestock to meet their needs. This growth is also driven by the increasing demand for beef in North America, where consumers are seeking premium-quality meat. The rise in demand is encouraging Belizean cattle producers to enhance their production capabilities to meet the growing market needs. The goal is to establish a robust and sustainable supply relationship. By importing more cattle each year, Mexico aims to ensure a steady supply of quality beef for its consumers while providing Belizean producers with a reliable market for their livestock. Currently, there are no requirements or potential market differentiation for sustainably produced cattle; the focus remains on ensuring that cattle are healthy and free of pests and diseases.

Mexico and Belize have been collaborating to enhance sanitary protocols for the safe importation of cattle. This joint effort aims to ensure that cattle imported from Belize meet stringent health standards, thereby safeguarding the livestock industries in both countries. The Ministries of Agriculture from both nations have developed a sanitary control mechanism to guarantee that imported cattle are free from pests and diseases of quarantine significance (Belize Agricultural Health Authority, 2024).

The updated protocol seeks to include more certified producers from Belize, who must demonstrate through clinical tests that their cattle are free from bovine tuberculosis, brucellosis, and ticks. However, the protocol does not include any requirements regarding the methods of raising or producing cattle in general.

Traders and exporters also indicated that there is currently insufficient capacity to meet this potential market demand. They highlighted a lack of capital to invest in getting enough cattle farmers committed or organized to meet market requirements providing or keeping cattle long enough to reach the requirements of the Mexican market. This investment is crucial to scaling up production and ensuring the sustainability of the supply chain. During the research, producers interviewed for the study emphasized the critical role of transporters in facilitating market access and minimizing transportation costs. The market they access offers higher prices and larger opportunities, but the associated costs are also higher, like transportation. Less than ten percent of producers can access transportation services on their own. Conversely, the local processor market provides stability, lower costs, and a supportive environment for cattle farmers in Belize. Balancing these factors is essential for the long-term success and sustainability of the industry. Although they have vertically integrated activities with cattle ranching operations, data and interviews indicate that their resources and supplies are becoming limited due to competition between the two main commercialization channels.

7.3. National beef market analysis

Despite the small size of the processed beef market, the national Belizean beef market plays a significant role in supporting the country's economy. It creates numerous job opportunities, from farm labor to processing and distribution logistics. This helps reduce unemployment and boosts the overall economic well-being of communities involved in the industry. The unique characteristics of Belize's beef industry are deeply intertwined with the nation's cultural heritage and diversity. The traditional practices and sustainable farming methods reflect the rich cultural tapestry of Belize, showcasing the dedication and resilience of its people. Additionally, the market contributes to the preservation of local customs and culinary traditions, making it an integral part of Belize's cultural identity.

7.3.1. Market size

In 2023, the national beef market produced and consumed 4 169 250 pounds of carcass weight, equivalent to 1 891 66 metric tons of beef, generating USD 7 817 344 (Ministry of Agriculture, Food Security, and Enterprise, 2024). This marked an increase from the 2022 consumption level, which was reported at approximately 1 700 metric tons of beef (Ministry of Agriculture, Food Security, and Enterprise, 2023).

Belizean beef production is projected to reach 1,910 metric tons by 2026, an increase of 0.6 percent from 1,750 metric tons in 2021. Since 1966, Belizean beef supply has grown 3.9 percent annually. (Report Linker, 2024)Revenue in the meat market amounts to USD 21.54m in 2024, of which fresh meat amounts to USD 16.14m. The meat market is expected to grow annually by 4.10 percent (CAGR 2024-2029) (Statista, 2024). The following table shows the different cut quantities processed and available for consumption in 2023 estimated using the industry yields provided in the interviews by the Belizean processors (PennState Extension Service, 2022).

Table 19. 2023 beef carcass breakdown (from total number of slaughter animals)

Primal Cut	Approximate yield (% of carcass)	Approximate yield (kilograms per carcass)	Total yield for 9 266 carcasses (MT)
Total Edible Yield	**60-70%**	**122.47-142.88**	**1 134.56 – 1 325.38**
Chuck	20-25%	40.82-51.26	378.41 - 474.98
Round	20-25%	40.82-51.26	378.41 - 474.98
Rib	10-12%	20.41-24.49	189.55 - 227.22
Sirloin	10-12%	20.41-24.49	189.55 - 227.22
Fat Trim	10-15%	20.41-30.84	189.55 - 283.66
Bone and Waste	15-20%	30.39-40.82	282.08 - 378.41
Short Loin	8-10%	16.33-20.41	151.59 - 189.55
Plate	7-8%	14.06-16.33	129.91 - 151.59
Flank	4-5%	8.16-10.43	75.46 - 94.40
Brisket	4-5%	8.16-10.43	75.46 - 94.40
Shank	4-5%	8.16-10.43	75.46 - 94.40

Source: Authors' own elaboration

The two cuts with the highest production from a 450-pound carcass are Chuck and Round, each yielding approximately 378 to 475 metric tons from a total of 9 266 carcasses. Among high-quality cuts, Rib has the highest production, yielding around 190 to 227 metric tons. These figures highlight the significant

contribution of both versatile and premium cuts to overall beef production, ensuring a diverse range of products for various culinary needs.

FAO estimated that the average world beef consumption in 2021 was 9.35 kilograms per person per year or 179 grams of beef per week (FAO, 2023). Belize consumed 4.8 kilograms of beef per person per year or 93 grams of beef per week. Therefore, Belize consumes less than half beef of the world on average.

Belize has a self-sufficient and localized beef market, where production meets domestic demand and ensures a steady supply of beef for local consumption. This self-sufficiency is crucial for maintaining food security within the country.

7.3.2. Market trends and consumer preferences

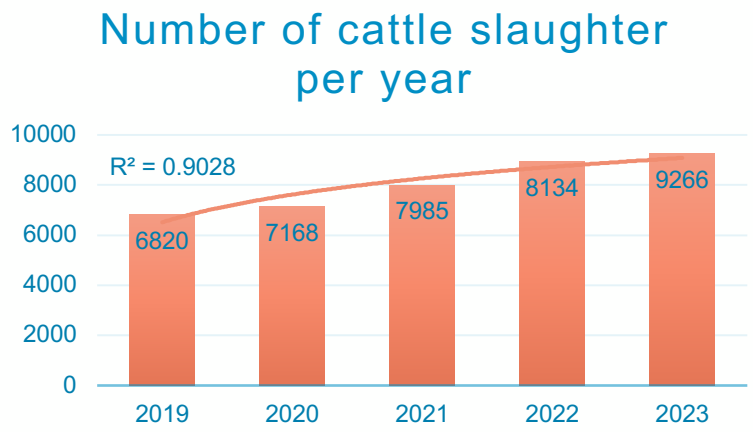
In Belize, the consumption patterns of beef display unique characteristics shaped by cultural preferences, economic factors, and availability. The lack of major worldwide fast-food chains and franchises also plays a role in influencing these dietary trends (News Channel5 Belize, 2024).

The beef market in Belize is experiencing steady growth, driven by increasing domestic and international (tourist) demand. The projected beef consumption in Belize is expected to reach 2 100 metric tons by 2026 (STATISTA, 2023).

Some slaughterhouse operations have integrated breeding, rearing, and fattening activities, but this integration does not provide sufficient animals for their needs. Processors have reported an annual increase of approximately ten percent in slaughtering operations since 2019. As a result, they must source animals from commercial cattle channels, competing with transporters.

This trend is evident in the historical data on slaughtered cattle in Belize, as reported by BLPA.

Figure 42. Number of cattle slaughters per year



Source: Authors' own elaboration

The observed growth in the beef market can be attributed to an economic power purchase growth of local consumers. Reports from the Statistical Institute of Belize, highlight significant changes in the middle-income bracket from 2018 to 2023 of Belize population.

By 2023, the threshold for this income bracket had increased, primarily due to inflationary pressures and adjustments in living costs over the past five years. Furthermore, improvements in wages and overall economic conditions have played a role in redefining these income brackets (Statisitcal Institute of Belize, 2024).

In response to this market demand, processors have expanded their product range to include a variety of items that cater to diverse income levels. This includes premium cuts, oxtail, and cow foot, ensuring broad appeal across different consumer segments. Each meat product requires specialized handling and preparation to uphold high quality and ensure compliance with industry standards. This is monitored by the BAHA auditing quality assurance measures. BAHA conducts comprehensive inspections, including water quality control and sample testing, to ensure the safety of beef products for consumers.

Some retailers and restaurants may prefer imported beef due to its consistent quality and availability. Imported beef often comes from countries with well-established beef industries, which can provide a reliable supply of high-quality meat.

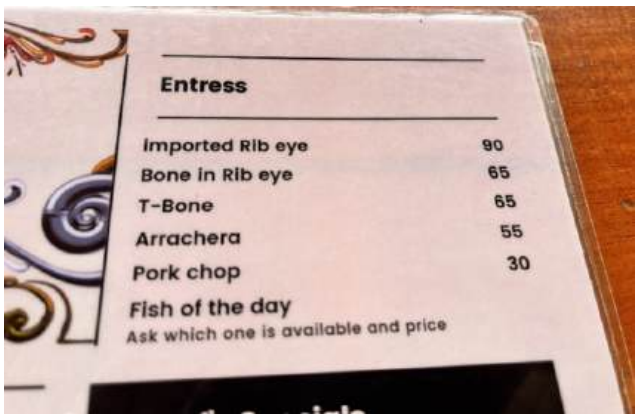
Tourism and local consumption have caused some issues with beef availability. Beef sales, particularly for burgers, spike during peak tourism months (April to June), coinciding with some reduced cattle supply due to the dry season (December to May). During this period, most cattle are sold to markets outside Belize, affecting the availability of ground beef. Consequently, restaurants source beef from processors, supermarkets, and butchers, all of whom are regulated by different authorities.

During the research one chef, owner of a beef restaurant was interviewed. The chef indicated that typically a beef-specialized restaurant in Belize will sell around 40 steaks of 300 grams (12 kg) and around 18 kg of ground beef per week. This information was confirmed also by the information collected from the processors.

During the interviews, representatives of the Ministry of Trade stated that there are no reports of official imports of frozen beef into Belize. Based on the custom code, there are no official imports of beef into Belize. However, the Ministry of Agriculture has the legal authority to provide special licenses to restaurants or hotels to import frozen beef into Belize, and BAHA provides and oversees the licenses of this importation hence, it is known that licenses to import frozen beef are given. The Government of Belize employs an Import Licensing Regime to protect the beef domestic market through non-tariff barriers. The Ministry of Agriculture manages this regime via the Supplies Control Unit. Applicants can register and submit applications online. It was not possible to obtain official data about the number of licenses or the amount permitted.

Imported beef can sometimes be more expensive due to shipping and import duties. The import tariff for beef into Belize generally falls under the Common External Tariff (CET) of the Caribbean Community (CARICOM) (US International Trade Administration, 2024). The import duty on beef is typically around 20 percent, but it can vary depending on specific regulations and classification.

Figure 43. Restaurant menu offering import beef in Belmopan, Belize



Source: Nolan Quiros (2024)

This image illustrates the price disparity between imported and local Rib eye cuts in the market, with the imported rib eye priced USD 12.50 higher than the local cut.

However, economies of scale in larger exporting countries can make imported beef competitively priced. According to the World Integrated Trade Report from the World Trade Organization, the United States exported 15 852 kg of frozen steak cuts to Belize (World Integrated Trade Solution,2024). Stakeholders interviewed for this research agree that these imports mainly serve the tourist industry.

7.3.3. Market channels

Currently, the beef market of Belize is supplied by 12 companies, comprising both butchers and established livestock processing units. These are in charge of providing the market with the following sequence of production:

- **Raw meat**: Cattle are slaughtered, and the carcasses are broken down into cuts. These cuts are then cooled, vacuum-sealed in their respective packages, and transported to wholesalers and retailers, including stores, restaurants, and hotels.
- **Processed meat:** This process includes several additional steps before the meat is ready for sale. The meat is first ground, then seasoned with salt and other ingredients, and finally packaged.

The processed beef products such as sausages, bacon, and roast beef, are subsequently sold to wholesalers and retailers, including stores, restaurants, and restaurants in hotels. The raw beef into cuts is sold to wholesalers and retailers, including stores, restaurants, and restaurants in hotels.

Research and interviews with major processors revealed minimal competition in the local market, as processors cater to different market segments. During the scoping mission, it was observed that some processors supply their products to supermarkets and shops with refrigeration services.

The beef in Belize is purchased by various consumers:

- Local residents: Belizeans buy these cuts for home cooking, and preparing traditional dishes like stewed beef, which is a staple in many households.
- Restaurants and food vendors: Local eateries, food stalls, and restaurants purchase these cuts to prepare meals for their customers. Traditional Belizean dishes are popular among both locals and tourists.
- Tourists: Visitors to Belize often seek out local cuisine and may purchase these cuts when they have access to cooking facilities or when dining out at local restaurants.
- Supermarkets and butcher shops: These establishments stock a variety of beef cuts to cater to the needs of their customers, including both locals and expatriates living in Belize.

This comprehensive selection ensures that Belize caters to diverse market segments, supporting both high-quality culinary experiences and everyday cooking needs.

7.3.3.1. Hotels, restaurants, and catering (HORECA)

The HORECA sector is crucial to the beef industry in Belize as it represents a significant portion of the demand for high-quality beef products. With the surge in tourism and the growing number of international visitors, the HORECA sector drives the consumption of premium beef, ensuring a steady market for local cattle producers.

Interviews with processors indicated that they sell between 20 percent to 30 percent of their production to the food service industry including restaurants, hotels and catering services. Based on the production of beef reported in 2023, this will represent 378 to 567 metric tons of beef annually. When asked about possibilities to grow in this segment of the market, processors are expectant of the behavior of tourism and visitors. Meaning that as their demand increases, they feel they can match. However, they focus more on the ten percent increase they see every year.

The sector's reliance on fresh, top-quality ingredients to satisfy the tastes of both local and international guests underscores its pivotal role in sustaining and boosting the beef industry. Moreover, as the hospitality industry continues to expand, so does the demand for beef, fostering growth and stability for cattle producers and processors in Belize.

Most businesses within this sector are members of the Belize Tourism Industry Association (BTIA), which represents a wide range of tourism-related enterprises, including restaurants. BTIA advocates for its members, influences tourism policy, and promotes sustainable industry development. Additionally, the Belize Hotel Association, which includes 600 hotels, plays a crucial role in the sector by supporting food service operations. According to the Statistical Institute of Belize, in 2021, the food and beverage service industry comprised 1 172 registered establishments (Statisitcal Institute of Belize, 2024). Sector representatives indicated that the sector has particularly thrived during the post-pandemic recovery period, with increased tourism and international travel contributing to this positive trend. From 2022 to 2023, the Statistical Institute of Belize is reporting a 7.8 percent annual growth (STATISTA, 2023).

7.3.3.2 Cruise industry

Since 2000, Belize has experienced rapid growth in cruise tourism, becoming the fastest-growing cruise market in the Caribbean from 2000 to 2005. In 2023, Belize recorded a total of 904 189 cruise passenger arrivals, reflecting a 47 percent increase from 2022. This figure trails behind the 2019 figures by 23 percent. As of September 2024, cruise tourism remains below pre-pandemic levels, with a total of 210 ship calls and 21 383 passenger arrivals compared to 278 ship calls and 165 885 passenger arrivals in January 2019.

Belize City stands as the primary port of call for cruise ships, accommodating over 40 percent of all cruise passengers. Its strategic location and developed infrastructure make it an ideal entry point for international visitors. In addition to Belize City, other significant ports include the Port of Belize, Big Creek, and the Port of San Pedro. These ports are not only crucial for the logistics of cruise tourism but also serve as gateways to Belize's diverse cultural and natural attractions, enhancing the overall visitor experience.

Cruise ship passengers often visit local restaurants, cafes, and food vendors, boosting demand for local food and beverages. In 2023, Belize welcomed 904 189 cruise ship passengers.

This number reflects a strong recovery in the tourism sector following the COVID-19 pandemic (Belize Tourism Board, 2024).

While cruise ships typically bring their food supplies, some lines purchase fresh produce, seafood, and other ingredients from local suppliers when they dock at a port. This was confirmed by the interviews with the processors. It was indicated that two of those lines include Belize in their itineraries.

The Cruise Line industry reports that on average a week of beef consumption represents in trip of around 15 MT to 20 MT of beef per week of travel, depending on the size and duration of the cruise (Norwegian Cruise Lines Holdings, 2023). During 2023, there was a total of 264 cruise ships cruise ships arriving in Belize from different cruise ship lines. These 264 ships represent from 3 960 to 5 280 metric tons of processed beef per year. At this moment, the processor is not selling beef to the cruise industry.

The processor indicated that some cruise ship companies are committed to sustainability and have set goals to source food locally and reduce its environmental impact. For example, participating in sustainability goals that include sourcing food locally to support local economies (Royal Caribbean Group, 2022).

Other ones are already supporting and investing in local communities (Norwegian Cruise Lines Holdings, 2023). At Harvest Caye in Belize, Norwegian Cruise Line has agreements to support local businesses by encouraging passengers to dine at local restaurants on the island.

7.3.3.3 Supermarkets

The retail sector represented mainly by supermarkets in Belize is a crucial component of the beef local market, significantly contributing to its development. The supermarket segment has shown a strong recovery after the pandemic, with both wholesale and retail trade experiencing robust growth (Statistical Institute of Belize, 2024). Supermarkets in Belize remain largely traditional, with online sales currently accounting for less than ten percent of total retail sales. However, this figure is expected to rise to nearly 15 percent by 2027 (US International Trade Administration, 2024). Most of the financing for the supermarkets is coming from Taiwan. Belize is one of the few countries in Central America that still recognizes Taiwan, and as a result, Chinese-owned businesses, including supermarkets, are a

prominent part of Belize's retail sector. Some of the well-known Chinese supermarkets in Belize include Happy, Dong Lee, and Fi Wi Mart. (Directorate General for Foreign Trade, 2923). These supermarkets cater to the local population, providing a range of imported and locally sourced products.

Distribution and sales channels for the supermarkets in Belize typically involve local importers who also act as wholesalers and distributors, followed by retailers, and finally, reaching consumers. Goods are primarily imported through the main ports of Belize which handles most of the import and export shipments. Wholesalers act as importers, bringing products into the country and storing them in strategically located warehouses. They use their logistics networks or partner with third-party providers to distribute these products to various retailers, including supermarkets and grocery stores. Retailers then sell the products to consumers, completing the distribution chain. This system ensures efficient import, storage, and distribution to meet consumer demand across Belize (International Trade Administration USA, 2024).

The research could not find segmented data or statistics on the amount of beef distributed by the retail sector. However, the processors interview mentioned that 30 percent to 40 percent of their sales are directed to supermarkets and meat shops in Belize. In 2023, the Belize national beef market produced and consume 1 891.66 metric tons. The supermarkets and meat shops sold between 566 to 756 metric tons of beef.

7.3.3.4 Convenience and specialized meat Stores and outlets

In Belize, convenience stores and specialized meat stores play a crucial role in the retail landscape. During the scoping mission, it was observed that convenience stores, such as Bettz's Store in Belize City and Waruguma Convenience Store in Dangriga Town, are widely spread across the country, providing quick access to everyday essentials like snacks, beverages, and basic groceries. These stores cater primarily to local residents and tourists, offering a convenient shopping experience in residential areas, city centers, and tourist hotspots.

Also, an observation of the visit to Belize, the technical team noted that specialized meat stores, like Joe's Meats Ltd and Meat Supply Butchery in Belize City, focus on offering a wide range of fresh, high-quality meats. They serve customers who prioritize fresh and specialized meat products, including local households, restaurants, and hotels. These stores are popular among those seeking specific cuts of beef, pork, chicken, lamb, and other meats for their meals or businesses, ensuring a steady supply of premium meats for their diverse culinary needs.

During the interviews, it was mentioned that most of the specialized meat stores in Belize, such as Joe's Meats Ltd and Meat Supply Butchery, typically source their meat from local farms and processors. These stores ensure that they provide fresh, high-quality meats by working closely with local suppliers who follow strict standards for animal welfare and meat processing (Joes Meat, 2024).

Another specialized meat store is Meat Supply Butchery. This store sources its beef from local farms in Belize. They work closely with local farmers who raise cattle under strict standards to ensure high-quality meat (Butchery, 2024).

Not all the specialized shops are selling online in a dedicated channel. At this moment, only Joe's Meats Ltd provides convenient online shopping for their customers. Joe's Meats Ltd offers a variety of fresh meats, including beef, pork, chicken, lamb, and turkey parts, through their website, along with home delivery services.

7.3.4 Purchase frequency

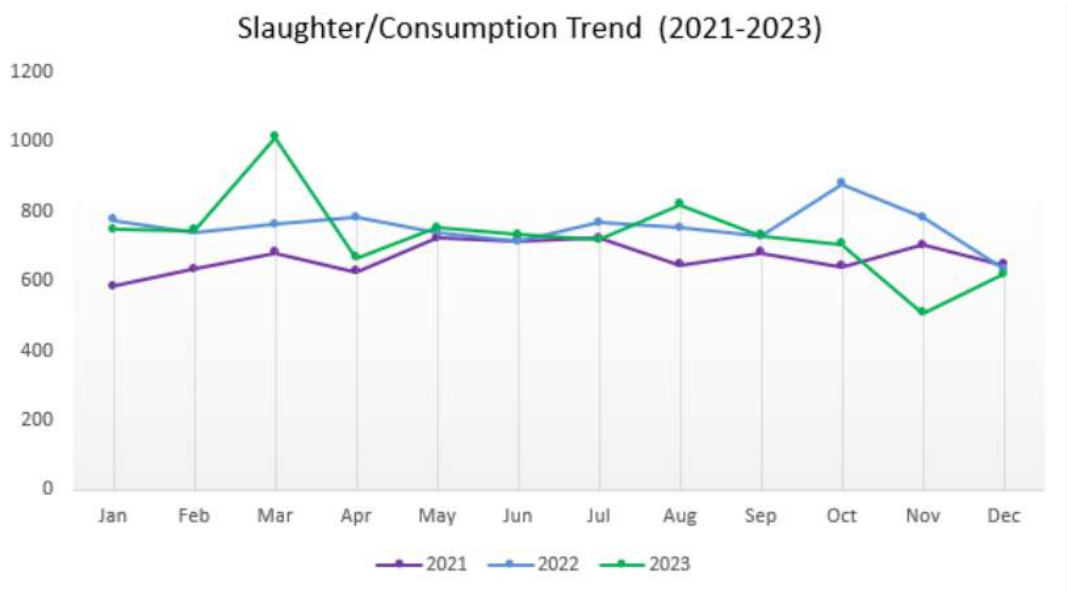
Belize beef holds a significant place in traditional cuisine, particularly during holidays and festive occasions. During Christmas, families prepare special dishes such as stewed beef, roast beef, and beef stews, often accompanied by rice and beans, a staple in Belizean meals. Easter also sees a high consumption of beef, with similar dishes served alongside sides like rice and peas and fried plantains. The cultural importance of beef is further highlighted during the Belize Beef Fest and Rodeo, an annual event in March that celebrates the country's livestock industry. This festival features a variety of beef dishes prepared by local chefs and draws crowds who come to enjoy the festive food (Belize Tourism Board, 2024).

The research did not find records of beef consumption or surveys on local purchases of beef by companies or individuals. Therefore, a proxy model was constructed using data collected by the Ministry of Agriculture from monthly slaughter reports. The assumption is that beef processing aligns with market demand and projected consumption as identified by producers and butchers. It indicates of how much beef is being processed and made available for consumption each month.

Some idea of purchasing patterns and times was derived from the interviews with restaurants. In this case, during the interview with the owner and chef of a beef restaurant was interviewed it was indicated that typically a beef-specialized restaurant in Belize will sell around 40 steaks of 300 grams (12 kg) and around 18 kg of ground beef per week. In addition, it was indicated that before the pandemic, there was clear seasonality in restaurant consumption patterns. However, during 2023 and 2024, there is no clear seasonality. The consumption described before is being kept during the low and high seasons of tourism.

The graph below illustrates that the pattern of beef processing has fluctuated between 600 and 800 slaughtered animals per month, equivalent to between 122.47 to 163.29 MT of beef.

Figure 44. Number of slaughter cattle heads per month 2021, 2022, 2023.



Source: (Belize Livestock Producer Association, 2024)

Between November and May, beef consumption in Belize experiences significant variations due to celebrations, the tourist season, and cruise ship arrivals. This period sees an influx of tourists, increasing the demand for beef in local restaurants, hotels, and food vendors (Belize Tourism Board, 2023). Major events such as Christmas, Easter, and the Belize Beef Fest and Rodeo coincide with this high season, further boosting beef consumption as both locals and visitors enjoy traditional beef dishes. The sunny, dry weather during these months also encourages outdoor grilling and barbecues, contributing to higher beef consumption.

From June to October, the rainy and hurricane season leads to a decrease in tourist numbers, causing beef consumption in tourist areas to decline. However, local demand remains steady, driven by residents and local celebrations. While restaurants may see reduced business from international visitors, local patronage and home-cooked meals help sustain the beef market to some extent during this period.

7.3.5 Willingness to pay premium prices for sustainably beef

Processors and butchers must compete with the sales of live cattle to intermediaries that sale outside of the border of Belize, leading to increased costs when supply is scare. This competition drives up the prices of beef domestically, regardless of the production systems, sustainability practices, or the breed's quality. Consequently, the price system does not differentiate based on these factors, resulting in uniform pricing across various beef products.

The pricing system utilized by processors has become distorted due to volatility in the cattle segment they source, particularly for animals aged three years and under. Fluctuations in the price of live cattle, which range from USD 2.75 to USD 3.00 per kilogram, affect the final price of processed beef products, introducing variability and uncertainty in pricing and quality.

The current price system in Belize creates limited availability of beef as processors and butchers must compete with other lucrative channels such as one of intermediaries and transporters for the same animals. This competition often results in other markets securing the cattle needed by local processors, leading to increased costs and reduced availability of beef domestically. Consequently, processors struggle to access sufficient quantities of cattle, impacting the overall quality of the beef. They are often forced to source from unfamiliar cattle ranchers, which can lead to inconsistencies in the quality and reliability of the supply. This situation makes it challenging for processors to meet the demands of local consumers, both in terms of quality and quantity, ultimately affecting the availability of high-standard beef products in the domestic market

Some restaurant owners affirm that the scarcity is impacting the quality of the beef. The limited resources hinder the possibility of maintaining uniform quality, as processors and butchers must source from the spot market, competing on price, weight, and availability of animals.

Figure 45. Angus cuts in a refrigerator with different quality

Source: Nolan Quiros, 2024.

The picture shows a noticeable difference in color and marbling between the cuts of beef in the same packed frozen package. This likely indicates that the meat comes from two different animals during processing.

Restaurants frequently encounter challenges in sourcing ground meat and premium cuts for steaks, which impacts their ability to provide a consistent complete menu. This scenario underscores the need for a differentiated pricing system that considers production methods, sustainability, and breed quality to better support local processors and ensure a stable, high-quality beef supply.

A segment of the restaurant industry prioritizes sustainability, aiming to educate consumers about sustainable beef. However, this effort has not yet been fully achieved. A combination of quality breeding for this segment, along with consumer education and transparency, may allow for greater substitution of imports with locally produced beef.

Similarly, restaurant owners have observed that there is little awareness or concern among Belizean consumers regarding the production systems of their beef. The retail sector in Belize does not differentiate prices based on whether beef is produced sustainably or through conventional methods. Additionally, visits to local markets and retail stores indicate that breed quality does not significantly affect the pricing of beef products. Belizean local consumers and restaurant clients are not willing to pay more for sustainably produced beef at the moment.

This uniform pricing structure means that consumers are not incentivized to choose higher-quality or more sustainably produced beef, which can impact the overall standards of the beef available in the market.

The picture below shows a steak cut Angus and a steak cut without breed denomination. The Angus cut is considered a higher quality cut than the local Boneless steak. However, the price differential does not distinguish the necessary effort of production when indicated on the label.

Figure 46. Local Black Angus Round steak USD 4.75 and local Boneless Steak USD 4.25

Source: Nolan Quiros, 2024.

In this case, it's evident that simply labelling beef with breed information is insufficient to create a meaningful price differential. For example, if an Angus steak, which is generally considered of higher quality, is priced similarly to a local boneless steak without breed denomination, the effort and costs associated with producing the Angus steak are not adequately reflected in the price. More likely this could be the situation with a denomination of production systems.

This lack of differentiation can diminish the incentive for producers to adopt superior or sustainable production practices. Therefore, any policy aiming to establish a price differential should include measures to educate consumers about the value of breed quality and the benefits of enhanced production methods. Additionally, creating distinct and clear labelling standards that highlight these qualities could help consumers make more informed choices, ultimately supporting higher quality and sustainable beef production practices.

Furthermore, resellers such as supermarkets contribute to this issue through their pricing strategies. By setting uniform prices that do not account for the differences in breed quality or production methods, supermarkets undermine the efforts of producers who invest in better practices. This pricing strategy can result in consumers lacking awareness of the added value associated with sustainably produced or high-quality beef, further perpetuating the cycle of limited price differentiation.

On the other hand, supermarkets may also be pressured to adopt such pricing strategies due to the volatility of cattle prices, which can fluctuate significantly based on market conditions. This volatility makes it challenging for supermarkets to maintain consistent pricing that reflects the true costs and value of different beef products. As such, supermarkets have a significant role to play in promoting transparency and educating consumers, which could lead to more informed purchasing decisions and a fairer market for producers.

Specialized beef stores in Belize generally have higher prices compared to supermarkets. For example, during the visit to specialized stores like Joe's Meats Ltd and Sammy's Smoked Meat and Deli, it was observed that prices for premium cuts such as T-bone and ribeye reached up to approximately USD 25.70 and USD 38.10 per kilogram respectively. In contrast, supermarkets like Brodies and Save U Supermarket offer beef rounds at around USD 4.55 to USD 6.06 per kilogram. Normally, supermarkets will not sell T-bone or ribeye.

7.3.6 Quality, certifications and traceability

In Belize, some beef shops are owned by processors who also own cattle, allowing them to closely monitor the beef's quality, traceability, and origin. For instance, Running W Brand Meats is a family-owned operation that manages both a cattle ranch and a meat processing plant. This vertical integration ensures that they can maintain high standards of food safety, quality, and consistency from farm to table. Similarly, Reinland Meat Co. Ltd operates a slaughterhouse and meat shop, providing traceable and high-quality beef products.

These processors use advanced tracking systems, such as the Belize Livestock Registry (BLR), which assigns unique identifiers to each animal, ensuring accurate record-keeping and transparency throughout the supply chain. This system helps in disease control, regulatory compliance, and maintaining consumer trust in the quality and origin of the beef they purchase.

BLPA and the Ministry of Agriculture work together to maintain and improve beef quality. This includes implementing best practices in cattle farming, ensuring proper nutrition, and maintaining health standards to produce high-quality beef (Ministry of Agriculture, Food security and Enterprises, 2023).

The national herd consists of approximately 190 413 cattle, with efforts focused on improving productivity and competitiveness through market access, research, innovation, and technology transfer. The Ministry of Agriculture promotes the use of superior genetic breeding stock that has better adaptability to the climate conditions of Belize and contributes to the smart agriculture activities of the industry.

Table 20. Ten Major breeds in Belize

2023 TOP BREEDS	Number of heads	Percentages of total herd
BRA - Brahman	96 893	50.89%
NEL - Nelore	54 954	28.85%
HOL - Holstein	11 466	6.02%
BRS - Brown Swiss	7 754	4.07%
BRN - Brangus	7 561	3.97%
BMR - Beefmaster	1 809	0.95%
JER - Jersey	1 714	0.90%
BAN - Black Angus	1 581	0.83%
WBF - Water Buffalo	1 257	0.66%
RAN - Red Angus	1,048	0.55%
OTH-Other breeds		2.31%

Source: Authors' own elaboration

Some of these breeds provide better quality beef for some segments of the beef markets:

- Black Angus (BAN): Known for their high-quality marbled beef, Black Angus cattle are highly prized for their tenderness, flavor, and early maturity.
- Red Angus (RAN): Similar to Black Angus, Red Angus cattle also produce excellent quality beef with good marbling and tenderness.
- Beefmaster (BMR): Beefmaster cattle are known for their hardiness and ability to thrive in various environments, producing high-quality beef.

These breeds are used in beef production for their excellent carcass characteristics and feed efficiency. These three breeds represented 2.33 percent of the total national herd or 4 438 animals in 2023. Access to these breeds has allowed processors to expand their product range to include a variety of items that cater to diverse income levels with diverse quality.

This includes premium cuts, oxtail, and cow foot, ensuring broad appeal across different consumer segments. Restaurants, from local eateries to high-end dining establishments catering to tourists, significantly drive the demand for quality beef. They often seek premium cuts, influencing producers to meet these standards. During data collection, restaurant industry representatives highlighted challenges in sourcing high-quality beef.

High-quality beef is characterized by a firm, velvety texture, fine grain, leanness, and bright red color. The fat is smooth, creamy white, and well-distributed, contributing to its tenderness, juiciness, and flavor. The degree of marbling, or intramuscular fat, is a key factor in determining the quality grade of beef, typically from young, well-fed cattle. In the United States, the USDA grades beef as Prime or Choice (Beef Research, 2021).

High-quality cuts of beef, such as ribeye steak, tenderloin (filet mignon), strip steak (New York strip), T-bone steak, and porterhouse steak, are prized for their marbling, which enhances flavor and texture when cooked.

Research indicates that the quality of Belizean beef ranges from moderate to high, depending on factors such as cattle breed, feeding practices, and processing methods. Belizean beef is primarily grass-fed, resulting in leaner meat with a distinct texture compared to corn-fed beef in the United States (US International Trade Administration, 2024). While some consumers appreciate the flavor and tenderness of grass-fed beef, others may find it less marbled and slightly tougher.

Each meat product requires specialized handling and preparation to uphold high quality and ensure compliance with industry standards. This is monitored by BAHA auditing quality assurance measures. BAHA conducts comprehensive inspections, including water quality control and sample testing, to ensure the safety of beef products for consumers.

Belize has implemented certifications for diseases such as Bovine Tuberculosis, Bovine Brucellosis, and Bovine Spongiform Encephalopathy (BSE). The system ensures that cattle are free from these diseases, meeting international standards for beef exports. Sanitary certification of export products is also part of BAHA's mandate, ensuring that meat processing establishments adhere to stringent food safety standards. It plays a crucial role in regulating processors and butchers. BAHA's Food Safety Department conducts inspections at various food processing facilities to ensure compliance with good manufacturing practices and HACCP principles.

Processors adhere to BAHA certifications and audits, while butchers are regulated by the Ministry of Health, which has more lenient requirements. The Public Health (Butchers) Regulations (1989), and the Processors Regulations share similarities but differ in their level of strictness and focus.

Table 21. Comparison between Public Health regulations and the processors regulations

Aspect	Butcher regulation	Processor regulation
Licensing	Must have a valid license granted by the Local Board of Health	Must obtain a license from BAHA.
Permit	Butchers and their staff must obtai n a Food Handlers Permit from the local Health Department	N/A
Inspection	Regular inspections by health dep artments to ensure compliance wit h health and safety standards.	Regular inspections by BAHA to e nsure compliance with health and safety regulations
Record keeping	Required to keep detailed records of operations, including slaughter methods, packaging, marking, and transportation of meat.	Required to maintain proper docu mentation, including permits and certificates for importing meat and meat products.
Sanitary standards	Must adhere to specific regulations forslaughter methods to ensure h umane treatment and food safety.	Must maintain high sanitary standa rds in facilities to prevent contamin ation and ensure food safety
Training	N/A	Must ensure staff undergo training in food safety and handling practices

Source: Authors' own elaboration

The butcher regulations focus more on the immediate handling and record-keeping of meat products, and while they are thorough, they are somewhat less stringent compared to the processor regulations. Processors have to maintain stricter sanitary standards, detailed documentation for imports, and rigorous training requirements to ensure food safety and handling practices. While both sets of regulations aim to ensure food safety and quality, the processors' regulations demand a higher level of compliance and oversight. This reflects the greater complexity and scale of operations in meat processing compared to butchering.

Beef certifications are essential for the Belize processing industry that has integrated cattle farming operations, ensuring the quality, safety, and sustainability of beef products. For the tourism sector, particularly HORECA businesses, offering certified beef products can significantly elevate the dining experience for international tourists who prioritize high-quality, ethically produced food. This not only boosts Belize's reputation as a destination committed to sustainable and premium food standards but also supports local producers in accessing global markets and achieving higher economic gains. There are other certifications available to provide information to consumers and other buyers, about the quality of the beef:

- **American Grassfed Association (AGA)** certification (as described in section 7.2.5)
- **Certified Grassfed by AGW (A Greener World)** (as described in section 7.2.5)
- **Certified Angus Beef (CAB)** brand is renowned for its high-quality standards and commitment to sustainability. CAB has taken significant steps to align consumer expectations for premium beef with sustainable practices in the cattle industry (Certified Angus, 2024).
- **International Brangus Breeders Association (IBBA)** offers certification for Brangus cattle, focusing on genetic purity and breed standards. While the IBBA certification primarily ensures the breed's quality and genetic integrity, it indirectly supports sustainability by promoting the hardiness and adaptability of Brangus cattle (International Brangus Breeder Association, 2024).
- **Low Carbon Beef Certification** requires that beef production releases 10 percent less greenhouse gas than the industry's standard baseline. It aims to promote environmentally responsible beef production (Low Carbon Technologies, 2024).
- **The Norwegian Cruise Line Holdings Ltd's Supplier Code of Conduct** serves as a guideline emphasizing ethical business practices, environmental stewardship, and social accountability. It is not a certification, but a set of principles that suppliers must follow. They are required to comply with all applicable laws and regulations, ensuring their operations are legal and transparent. Suppliers must adopt sustainable practices, use natural resources responsibly, and reduce waste and emissions. Human rights are a critical component, requiring suppliers to provide fair treatment, safe and healthy working conditions, and necessary safety measures for all workers (NCLH Procurement, 2024).

The National Bovine Traceability System in Belize involves identifying all cattle and establishments with an animal movement control component. This system captures relevant data into a real-time central information bank, supporting disease surveillance programs and ensuring that beef products can be traced back to their source. By providing comprehensive records of each animal's health, diet, and movement history, the traceability system helps ensure that beef is free of diseases and complies with world standards. The system is managed by BLPA in coordination with BAHA authorities.

Cattle traceability plays a vital role in ensuring the quality and safety of national beef products. By tracking cattle from birth to slaughter, the system provides comprehensive records of each animal's health, diet, and movement history. This detailed information allows producers to identify and address any issues that could affect beef quality, such as disease outbreaks or suboptimal feeding practices.

With cattle traceability, beef traceability becomes more robust, as each cut of beef can be linked back to the specific animal it came from. This transparency helps in verifying that the beef meets certain quality standards, including those related to marbling, tenderness, and flavor. For consumers, this means greater confidence in the beef they purchase, knowing that it has been produced under stringent conditions.

7.3.7 Potential markets

With the opportunities presented by both the cruise ship industry and the potential substitution of imports, Belizean beef processors could access a combined market size of up to 5 296 metric tons per year.

The increasing number of cruise ships arriving in Belize shows an opportunity for local beef processors to supply these vessels. Cruise ships typically have substantial food budgets, and beef is a popular menu item.

If cruise lines were to source beef locally, it could lead to substantial purchases of beef in Belize. The cruise lines industry reports that on average a week of beef consumption represents a trip of around 15 MT to 20 MT of beef per week of travel, depending on the size and duration of the cruise (Norwegian Cruise Lines Holdings, 2023).

In 2023, a total of 264 cruise ships arrived in Belize, carrying 904 189 visitors. If these ships were to purchase a week's worth of beef during their stop in Belize, the potential market size could range from 3 960 MT to 5 280 MT metric of processed beef per year. This substantial opportunity can be explored by engaging with relevant stakeholders in the cruise ship industry. Establishing connections with these stakeholders would be an effective starting point to consolidate opportunities for local processors. While specific certifications for beef may not be mandated, there is a commitment to ensuring evidence of animal welfare practices (NCLH Procurement, 2024).

On the other hand, Belize's importation of 15 852 kg of frozen beef last year presents a significant opportunity for local processors to substitute these imports with domestically produced beef. By investing in the enhancement of local processing facilities and adhering to high-quality standards, Belizean processors can meet the growing demand for beef within the country. Additionally, local processors can leverage certifications such as AGA and Certified Grassfed by AGW to offer premium, sustainably produced beef that appeals to both local consumers and the burgeoning tourism sector. Embracing this opportunity can lead to greater market share and economic resilience for Belizean beef producers.

8. FINANCIAL ANALYSIS

8.1 Financial performance of the economy and agriculture sector

In 2022, Belize was ranked as a middle-income economy for its tourism, agriculture, and services activities, with a per capita income of USD 6 385 (USD 2.83 billion) and GDP growth of 4.5 percent in 2022 (World Bank, 2023).

That year, the service sector contributed 26 percent to the country's GDP. This sector includes financial, real estate, insurance, rental, and leasing services. This contribution reflects the diversification in the country's economy (Statistical Institute of Belize, 2023). The construction (particularly related to tourism) and manufacturing industries have contributed significantly to 16 percent of the GDP. After COVID-19, they have experienced significant growth due to the increase in consumer demand and the increase in tourism (Statistical Institute of Belize, 2023).

In 2022, Belize's agricultural sector contributed USD 732 million (eight percent) to the GDP. This figure includes the contribution of various commodities such as crops, livestock, and fisheries. After COVID-19, the country's economic recovery improved partly because the agricultural sector had a favorable climate, which allowed this activity to grow by 11.8 percent (STATISTA, 2023) (CEPAL, 2022) (World Bank Group, 2024).

However, despite external debt restructuring in 2021 and significant fiscal consolidation, Belize's public debt remains high (72.8 percent of the GDP in 2022). Policy priorities include continued budgetary restraint, growth-enhancing structural reforms, addressing the impacts of climate change, and protecting the most vulnerable populations (BID, 2022).

Belize's prospects for sustainable growth and inclusion depend on protecting the environment and building economic resilience. Belize has an abundant natural capital along the coast, including the largest coral reef in the Americas and an extensive mangrove ecosystem. These ecosystems play a key role in protecting Belize's lower coast against adverse events caused by climate variability, helping to prevent loss of life, property damage, and coastal erosion. Belize also benefits from extensive areas covered by pristine tropical forests, which are vital for limiting soil erosion, runoff, flooding, and fostering climate resilience (BID, 2022).

Belize has a robust banking sector with three primary commercial banks: Belize Bank, Belize National Bank, and Atlantic Bank. Despite their critical role in the financial system, cattle farmers in Belize face significant challenges when seeking loans. Currently, cattle farmers do not benefit from specialized loan interest rates tailored to the agricultural sector. Instead, interest rates for agricultural loans typically range from eight to ten percent, which applies uniformly across the board. High loan interest rates pose a considerable challenge for farmers, particularly since cattle farming is inherently a long-term investment that requires substantial capital and time to yield returns. Additionally, many cattle farmers in Belize face further obstacles due to inadequate land documentation. The lack of formal land papers frequently impedes their ability to obtain loans, as banks generally require proof of land ownership or long-term lease agreements as collateral. This bureaucratic hurdle makes it challenging for many farmers to access the financing needed to expand or sustain their operations.

8.2 Barriers to accessing climate finance

Belize is placed 135th in the “Doing Business” ranking (out of 190 countries included), which assesses nations based on the ease of doing business they provide. By 2019, Belize had fallen ten places in this ranking, indicating that it had become more challenging to conduct business in the country (Doing Business 2020: Economy Profile Belize, 2020) (Datosmacro.com, 2020).

On the other hand, Belize's economy is considered “moderately free” according to the 2024 Index. Belize's economic freedom score is 61.2, making it the 73rd freest economy in the 2024 Economic Freedom Index. Its score has increased by 1.4 points compared to the previous year, ranking 15th among 32 countries in the Americas region. The country's economic freedom score is higher than global and regional averages (Heritage Foundation, 2023).

There are institutional weaknesses that limit dynamic economic growth. Despite a streamlined process for meeting regulatory requirements, business activities often encounter inefficiencies and a lack of transparency. Business activity is limited and recovery from the recent economic slowdown has taken time. The overall investment framework remains inefficient and there is no fully developed formal labour market. The most recent inflation rate available is 6.3 percent (Heritage Foundation, 2023).

Belize is a middle-income economy and a member of CARICOM, which allows it to participate in the markets of its member countries and benefit from the agreements established through this trade union. It has an export-oriented economy that benefits from its proximity to the large markets of the United States and Mexico (World Bank Group, 2024). This has contributed to its economic recovery, especially for its tourism, agriculture, and services activities, which shows a favorable business environment in the country (World Bank Group, 2023) (STATISTA, 2023) (World Bank Group, 2024).

During the scoping mission, the stakeholders consulted specifically referred to the following barriers:

- The high cost of imported inputs, such as packaging and equipment, is driving up production costs for processors.
- Financial institutions offer little support to processors, providing no reduced loan interest rates to aid business development or growth.
- The Mennonites require formal contracts and sufficient capital to secure the animals. Exporters are facing cash flow issues, delaying payments to cattle farmers, and resulting in the loss of clients.
- Current market competition has significantly reduced profits for Mexican exporters, leading to insufficient cash flow that hinders regular cattle purchases.
- There is a lack of concrete figures outlining the expenses associated with implementing traditional versus non-traditional practices in the cattle industry. Without this data, conducting cost-benefit analyses or assessing the financial feasibility of transitioning to more sustainable methods becomes challenging. This absence of cost information hinders both the development of economic models for farmers and the design of financial support mechanisms, such as tailored loans and grants, to support sustainable practices.

8.3 Investment incentives for the private sector

Access to specialized financial resources plays a crucial role in achieving the objectives set within climate change priorities, especially now that Belize has updated and increased its ambition level. The total estimated cost for implementing the updated NDC is USD 1.906 billion until 2030, while the cost of implementing the currently unfunded NDC is USD 1.663 billion (87.25 percent) (Commonwealth Secretariat, 2021).

The Climate Finance Strategy was developed from the Climate Finance Landscape Study and completed by CCFAH under the CAEP. The development process seeks to capitalize on identified strengths and address areas for improvement as identified in the climate finance landscape study. It is also linked to other key outcomes alongside the update process of Belize's NDC, including the Resource Requirements Report, the NDC Implementation Plan, the Climate Financing Options Report, the study on utilizing private sector investments and Multilateral Development Banks (MDBs) to leverage climate financing (Commonwealth Secretariat, 2021).

This strategy is proposed for five years (2021-2026). Its overall goal is to effectively access appropriate climate financing, contributing to improving climate resilience and mitigation actions in Belize. It focuses on three specific objectives (Commonwealth Secretariat, 2021):

1. Providing an integrated and strategic approach to accessing the necessary resources to improve Belize's climate resilience and climate change mitigation by 2021-2026;
2. Improving national capacities to mobilize and utilize the necessary resources for Belize’s priority climate actions;
3. Maximizing synergies with other sectoral development plans and the sustainable development co-benefits of climate investments.

As examples of funding achievements in recent years for implementing the Strategy, in 2022, the IDB approved a USD 15 million loan and a non-reimbursable investment grant of USD 800 000 to support the Sustainable and Inclusive Belize Project. The goal is to increase revenues in the agriculture and tourism sectors, which are pillars of the country's economy. The focus is on enhancing the competitiveness, climate resilience, and environmental sustainability of micro, small, and medium-sized enterprises in these sectors (BID, 2022).

With this IDB loan, support is also provided to low-income small producers residing in areas vulnerable to climate change, assisting them in improving their production systems to be profitable, sustainable, and climate-resilient. Non-reimbursable funds are allocated for technical assistance to producers to promote good agro-environmental practices, along with financial aid (BID, 2022).

Additionally, the government of Belize is managing a funding proposal for the Green Climate Fund titled “Facilitating Activities for Formulating and Implementing a National Multi-Sectoral Adaptation Plan for Belize,” which includes actions in the country's agricultural sector (Belize P. A., 2023).

Recently, a Memorandum of Understanding (MoU) for collaboration was signed between BLPA and the Development Finance Corporation (DFC) to establish collaborative assistance that promotes climate-smart practices among small, medium, and large producers, aimed at improving resilience and sustainability (DFC, 2024).

Through this partnership, there is an expectation to promote the adoption of climate-smart livestock practices among producers, enabling them to develop capacities for climate resilience and support the economic growth of Belize's livestock sector.

This initiative seeks to strengthen the industry by ensuring that producers have access to financial resources through credit and technical support to increase productivity, improve livestock genetics, implement sustainable practices, and expand operations. BLPA hopes that climate-resilient livestock loans, as a support avenue, will directly address the financial gap faced by many farmers in the country. However, BLPA and DFC are also jointly focused on capacity development and technical assistance to educate farmers on climate-smart practices and modern herd management techniques.

This partnership demonstrates the DFC's availability as a development bank to support livestock producers in implementing such practices through sustainable financial solutions (Television Great Belize, 2024).

During the scoping mission, the stakeholders specifically referred to the following incentives:

- The Ministry of Foreign Affairs (MFA) in Belize plays a crucial role in shaping and overseeing international trade regulations for the cattle industry. MFA possesses valuable insights into markets in CARICOM, Europe, the USA, Taiwan, El Salvador, the UK, CBF, and other countries.
- Beltraide has expressed a strong willingness to collaborate closely with MAFSE and BLPA to support micro, small, and medium-sized cattle farmers. Their objective is to enhance cattle farming businesses by developing training programs specifically tailored to the farmers' needs. They have also emphasized that its primary role is focused on capacity building, particularly in the development of value-added business opportunities.
- TNC has a project that aligns with Belize's national adaptation plan and the government-developed carbon bonus initiative aiming to incentivize sustainable agricultural practices.
- Angus breeders focus on raising a hybrid mix of Angus and Nelore cattle. They began with purebred Angus but found it did not meet expectations. All animals are registered with the Angus Association of the USA, ensuring full traceability of their origin. This experience can be replicated with other investors.
- Mexican buyers are interested in investing in infrastructure to increase exports to Mexico because more feedlots and transportation are needed.

8.4 Investment estimates for the transition to climate-smart livestock farming

8.4.1 Assumptions for estimating costs and investments in climate-resilient practices

The estimates were based on the information provided by BLPA as detailed in Annex 2, which reflects the most current data available regarding the costs of implementing CSAs in Belize. The methodology followed was as follows:

1) A scope was established for the estimates, corresponding to a model farm of 50 acres (20 hectares).

2) Six CSA practices were selected for the estimates based on available information and the intervention priorities at the farm level.

3) For five of the selected CSA practices, cost adjustments were made based on the defined scope, technical literature, and expert judgment.

4) For fodder banks, for which direct cost information was not available in Belize, the cost information provided by MAG (Ministerio de Agricultura y Ganadería, 2010) was used as a referenceThe costs in USD were updated to 2024 values for the defined scope.

5) Summary tables were prepared for each of the six proposed practices.

The estimation follows a general model of a small-scale cattle farm in Belize, with assumptions outlined in Table 22.

Table 22. Assumptions for the small-scale farm model in Belize

Assumptions for the small-scale cattle farm model in Belize:
Farm conditions: • 50 acres farm (20 ha) • 80 percent of the farm is pastureland (40 acres, 16 ha) • Does not include purchase of land to expand pastures • Operation of 35 cows and calves • No animal purchases included • No deforestation for expanding pasturelands • Focus on improving production conditions and ecosystem services **Expected production:** • 1 U.A. per acre (2,25 U.A./ha) = 35 adult cows and 1 bull • 80 percent conception rate: 35 cows x 0.8 = 28 calves/year • 90 percent survival rate before weaning = 25 weaned calves • 25 weaned calves, approximately 12 heifers and 13 bulls • 15 percent cow replacement = 5 replacement heifers

Source: Authors' own elaboration

8.4.2 Cost and investment estimates for key practices

a) Pasture improvement and rotational grazing

Based on the farm model described earlier, implementing a combined practice of pasture improvement and rotational grazing with barbed wire fencing requires the following costs and investments:

Table 23. Costs and investments of an improved pasture system and rotational grazing

Item	USD/unit	Total (USD)
Land preparation	150/acre	6 000
Weed control	4 gallons at 50/gallon	200
Labor for weed control	8 days at 25/day	200
Improved pasture seeds	4 lbs/acre at 15/lb	2 400
Seed dispersion in pasture	6 days at 150/day	900
Barbed wire	80 rolls at 70/roll	5 600
Total costs and investments/40 Acres		**15 300**
Costs and investments/ Acre		**383**

1/ Price delivered at the farm.
Source: Consultant team with industry data

Mombasa grass (*Panicum maximum* cv Mombasa) is favored for its high crude protein content, alongside other species such as Setaria (*Setaria spacelata*) for lowlands and Andropogon (*Andropogon gerardii*) for low-fertility soils (Holder, s.f.).

b) Live fences in the rotational grazing system

Establishing live posts of trees and shrubs in the rotational grazing system's fences requires the following costs and investments, assuming that small-scale farmers purchase all the live posts. However, in practice, farmers often source posts from their own farms or nearby locations, significantly reducing costs. It is recommended to gradually establish live fences to avoid a large initial investment.

Table 24. Costs and investments of live fences in a rotational grazing system.

Item	USD/unit	Total USD
Live posts of trees and shrubs	12 000 at 2.5/post [1]	30 000
Total costs and investments/40 Acres		**30 000**
Costs and investments/ Acre		**750**

1 The price assumes all posts are purchased off-farm, although this material can often be sourced from the farm, reducing costs. Planting is expected to be done by the available farm staff.
Source: Authors' own elaboration

Regarding live fence posts (Holder, s.f.), the most commonly used species is Madre Cacao (*Gliricidia sepium*), which is easy to establish through cuttings, thorn-free, and offers high yields of hardwood and rich leaf litter. The planting design can vary, with the most common practice being alternating live posts with dead wooden posts. Posts with a diameter of two inches or more are best established when taken from flowering plants during the dry season, a few weeks before the rains. Other commonly used live fence materials include Gumbo Limbo (*Bursera simaruba*) and Leucaena (*Leucaena glauca*).

c) Regeneration and planting of trees on cattle farms

To improve the management conditions of pastures and other livestock farm areas, selecting and protecting trees that serve conservation purposes or have future uses within the farm is essential. Additionally, it is necessary to promote the planting of timber or multipurpose trees that contribute to ecosystem services and enhance climate resilience in the farm's operations. Recommends tree species from the legume family (Fabaceae), such as Leucaena, as well as the Cohune nut tree (*Orbigyna cohune*), the laurel palm (*Sabal morrisiana*), the silver thatch palm (*Thrinax radiata*), the Ramon tree (*Brosimum alicastrum*), the silk cotton tree (*Ceiba pentandra*), the laurel cedar (*Suriana maritima*), and Gumbo Limbo (*Bursera simaruba*), all of which hold economic value for the farm. The following costs and investments are assumed to establish these types of trees (Holder, s.f.).

Table 25. Costs and investments of planting trees on cattle farms

Item	USD/unit	Total USD
Timber and multi-purpose trees	1 000 at 2.5/post[6] [1]	2 500
Total costs and investments/40 Acres		**2 500**
Costs and investments/ Acre		**63**

Source: Authors' own elaboration

d) Mixed fodder banks

Fodder banks represent practices that establish a standard of nutrition for animals, helping them maintain their weight and vitality (Moreno, Young, & Joseph, Consultancy to carry out an In-depth analysis of an improvement plan implemented, 2021). They should be designed to provide sufficient forage for animals during the dry season when grass production is limited. Mixed forage banks consisting of sugarcane (*Saccharum officinarum*) and Madre Cacao (*Gliricidia sepium*) are a viable option to enhance animal nutrition, complementing grass forage. Additionally, food production can be used to produce silage, ensuring high-quality feed is available for animals during the dry season. The following table summarizes the implementation costs of a forage bank.

The costs and investments required to establish a forage bank depend on its location within the farm, the type and availability of seeds, labor needs, and the necessary inputs and resources. It is recommended to establish forage banks progressively to avoid high initial investments. The following table summarizes the costs and investments required for establishing a mixed forage bank.

Table 26. Costs and investments of mixed fodder banks[7].

Item	Cost USD/2,5 acres		
	Leguminouse shrub	Sugarcane	Cutting grass
Seed, transport, trenching	150	450	200
Inputs (herbicides, fertilizers)	500	650	450
Labor (planting, herbicide application, fertilization)	300	450	150
Subtotal	**950**	**1 550**	**800**
Total Costs and Investment / 2.5 Hectares			**3 300**
Total Cost / Acre			**3 300 / 6.18 = 534**

Source: Authors' own elaboration

e) Electric fencing

Electric fences represent investments that enable better control of animals within the grazing system, resulting in greater efficiency in the operation and management of available pastures.

The establishment costs of an electric fence on an 80-acre farm in Belize, utilizing a solar photovoltaic system, are presented in the following table (Penner, s.f.).

[6] The price assumes all trees are purchased off-farm, though this material can be sourced internally, reducing costs. Planting is expected to be done by farm staff

[7] Adapted from: MAG (2010). Forage Banks. Technical Sheet 18. In: Technical Guide for the Dissemination of Sustainable Agricultural Production Technologies. San José, Costa Rica.

Table 27. Costs and investments of electric fencing.

Electric Fencing			
Item	**Unit quantity**	**Cost/unit USD**	**Total USD**
Solar fence charger	1	838	838
Wire for electric fence, rolls	65	95	6 175
Electric fence post	1 600	4	6 000
Solar Energizer (10 joules)	1	1 500	1 500
		Total Cost per 80 Acres	**14 513**
		Total Cost / Acre	**181**

Source: Authors' own elaboration

f) Water harvesting and storage system

Livestock farms must have efficient water supply systems in pastures to ensure that animals have access to fresh, clean water every day. Low-cost and efficient supply systems can be installed. Additionally, rainwater harvesting and storage systems are essential for capturing water from rainfall and other sources, allowing it to be stored and utilized for various tasks, especially during times of scarcity. Penner S.F. outlines the following costs for establishing a water supply system on livestock farms in Belize (Penner, s.f.).

Table 28. Costs and investments of water harvesting and storage system.

Water system			
Ite,	**Unit**	**Cost/unit USD**	**Total USD**
Water well	90	35	3 150
Pressure tank	1	1 448	1 448
Solar pump	1	438	438
Pipes of 1 inch	240	10	2 515
Tank of water (4 tanks)	4	168	168
		Total Cost per 80 Acres	**7 718**
		Total Cost / Acre	**96**

Source: Authors' own elaboration

8.4.3 Projection for financial needs for smallholder farmers

Based on the classification system developed by BLPA (Belize Livestock Producer Association, 2024), small-scale livestock producers are defined as those managing between three and 50 animals on their farms. In December 2023, 87 percent of registered producers in the beef value chain belonged to this segment, collectively representing 23 percent of the total registered cattle inventory in Belize. This amounts to approximately 5 923 small livestock producers.

Using this segment as a basis, the following table proposes a projection of financing needs for small farmers in Belize to implement at least the practices described in this section. The percentage used for each practice is defined according to their potential intervention priorities as a group. A producer may be interested in investing in a set of practices. For this reason, the following projection estimates a higher number of practices in relation to the number of livestock producers in Belize.

Table 29. Projection for financial needs for small farmers.

Practice	% Interested producers	Number of interested producers in practice[8]	Amount per practice (USD)	Total financing required (USD)	Investment per acre[9] 2/
Pasture improvement and rotational grazing	40	2 370	15 300	36 261 000	383
Live fencing in the rotational grazing system	20	1 185	30 000	35 550 000	750
Tree regeneration and planting on the farm	30	1 777	2 500	4 442 250	63
Mixed fodder banks	30	1 777	3 300	5 864 100	534
Electric fencing	40	2 369	14 513	34 381 297	181
Water harvesting and storage system	40	2 369	7 718	18 283 942	96
TOTALS		**11 847**		**131 782 839**	
Total practices financed to producers (a producer can invest in several practices)				**11 847**	
Average investment per producer, USD				**11 377**	

Source: Authors' own elaboration

These practices represent distinct and independent options available to small Belizean livestock producers, aimed at implementing climate-smart improvements on their farms while enhancing their production capacity. Small producers can choose practices based on their interests and convenience, enabling them to improve the productive and operational conditions of their farms while preparing for climate resilience.

8.4.4 Importance of climate investments in livestock farms

This set of climate-resilient management practices within the beef value chain of Belize is recognized and applied by the national livestock sector. They contribute to climate mitigation and adaptation by promoting the use of green infrastructure and landscape-scale services to foster sector resilience. This includes efficient water harvesting and usage systems (to address drought and desertification), tree planting in pastures, and the protection of watercourses (which aids in biodiversity protection and reduces thermal stress on animals due to excessive heat), as well as improved pastures (which enhance carbon sequestration and better withstand drought, pests, and diseases).

The benefits for smallholder farmers who can access funding for implementing these practices include freeing up unproductive areas for rehabilitation and/or restoration, reducing environmental degradation, increasing tree cover and biodiversity, enhancing carbon capture, managing and utilizing water resources, reducing greenhouse gas emissions, promoting adaptation of this productive activity to climate change, and increasing the productive efficiency of livestock farms, as will be illustrated later in this section.

[8] Total of 5,923 small livestock producers. The same producer may be interested in several practices.

[9] Model farm of 50 acres.

Financial support directed towards implementing these practices aligns with the current national policies and priority strategies: The National Agriculture and Food Policy of Belize 2015-2030 (Belize, 2015); National Climate Change Adaptation Strategy for the Agricultural Sector (CCCCC, 2015); the Climate Finance Strategy for Belize (Secretariat, 2021); and PLANBELIZE 2022-2026 (Belize, 2023).

8.4.5 Herd growth projection

This section presents a herd growth projection, aiming to estimate the potential development of Belize's cattle herd. The objective is to guide decision-making processes that strengthen the national productive base and identify potential investment opportunities.

Table 30 summarizes the assumptions used for the herd growth projection.

Table 30. Assumptions for the small-scale farm model in Belize

Herd growth projection assumptions
• The cattle herd data is based on the 2023 Annual Report from the Belize Livestock Producers Association (BLPA, 2023b), which records a total population of 190 483 animals, consisting of 146 466 females (77 percent) and 43 577 males (23 percent). These figures are used to distribute each category of the herd in the projection. • Animals older than 96 months are primarily culled during years one to three. • Starting in year four, 15 percent of the herd (those older than 96 months) is replaced annually. • The pregnancy rate is estimated at 80 percent • The survival rate is 90 percent • Calving rates are 48 percent for females and 52 percent for males. • Each cow is expected to produce a total of eight calves • Heifers (zero to 15 months) and cows (15 to 96 months) are not sold, as the goal is to expand the herd. • Young bulls (12 to 36 months), old bulls (over three years), and other culled animals are sold. • Under these conditions, the herd is projected to almost double by year seven.

Source: Authors' own elaboration

Table 31 presents the herd projection based on the assumptions described in the previous table.

Table 31. Projection of Belize's cattle herd based on the established assumptions.

HERD STRUCTURE	Age	Weight Kg	Years									
			1	2	3	4	5	6	7	8	9	10
Calf	0-12 months	35 to 272	6 789	32 641	30 378	34 065	39 454	45 308	52 147	59 984	69 008	79 387
Young bulls	12 to 36 months	272 to 1043	9 818	6 789	32 641	30 378	34 065	39 454	45 308	52 147	59 984	69 008
Old bulls years older	3 years older	1043	27 204	9 818	6 789	32 641	30 378	34 065	39 454	45 308	52 147	59 984
Heifer	0 to 15 months	35 to 272	22 727	30 130	28 042	31 444	36 419	41 823	48 136	55 370	63 700	73 281
Cows	15 to 96 months	272 to 408	87 182	81 139	90 984	105 378	121 016	139 282	160 213	184 317	212 039	243 933
Ready market cows and other discarded animals	96 months up	340 to 363	36 764	28 770	20 285	13 648	15 807	18 152	20 892	24 032	27 648	31 806
		SALE	**73 786**	**45 377**	**59 715**	**76 667**	**80 250**	**91 671**	**105 654**	**121 487**	**139 778**	**160 798**
		Totals	**190 484**	189 287	209 119	247 554	277 138	318 084	**366 150**	421 157	484 525	557 398
		% Herd growth		0.63	10.48	18.38	11.95	14.77	15.11	15.02	15.05	15.04

Source: Authors' own elaboration

This projection demonstrates the potential to significantly increase Belize's cattle herd in the medium term, possibly doubling the herd size around the seventh year. This projection assumes that heifers (zero to 15 months) and cows (15 to 96 months) are not sold during this period. Retaining heifers and cows provides an ideal scenario for reproduction and herd growth. Still, it is not a viable option, as it would negatively impact the current markets in the short term (three years).

If a policy is implemented to retain females as a reproductive base, incentives could be created for ranchers to keep at least part of their heifers and cows on their farms.

There are no restrictions on selling other categories of animals within the herd structure. Therefore, by adopting a policy of only selling young bulls (12 to 36 months) and mature bulls (over three years), it is possible to meet the current demand of existing markets starting from the third year. The sale of steers could satisfy the demands of markets in Mexico, Guatemala, and local processors, and may even open up new market opportunities. Approximately 55 000 animals would be needed to meet this demand, which aligns with the herd growth discussed in the Market Analysis chapter.

Additionally, the option of herd growth through the purchase of animals and genetic improvement via embryo transfer and artificial insemination should be considered. However, these options are financially constrained by the costs associated with the technology and animal acquisition.

8.4.6 Costs and profitability by stage of the production system

Table No.32 provides a detailed description of the prices, costs, and expected profitability per animal based on each commercial category of the herd. The data was gathered from interviews with producers during the scoping mission and from the University of Belize. It is recommended that BLPA review and adjust the data in this projection, particularly with regard to the costs.

Table 32. Prices, costs, and profitability by commercial herd category

Cattle	Age	Weight, kg	Max. weight, kg	Price, USD	Selling price, USD	Cost per Kg/USD	Cost, USD	Profit margin, USD
Young bulls	7-12 months	204 to 272	272	1.45	394.40	0.75	204.00	190.40
Young bulls	12 to 15 months	272 to 454	454	1.35	612.90	0.75	340.50	272.40
Ready market cows	5 years up	340 to 363	363	0.90	326.70	0.75	272.25	54.45
Old bulls years older	3 years older	1 043	1 043	1.10	1 147.30	0.75	782.25	365.05
Heifer	7 to 15 months	250 to 272	7272	1.13	306.00	0.75	204.00	102.00

Source: Authors' own elaboration

The provided information in Table 32 indicates that, at the commercial level, it is more profitable for ranchers to fatten and sell their animals during the young bull stage (12 to 15 months) and the mature bull stage (over three years). These stages offer higher profitability per animal, USD 272,40 for young bulls (12-15 months) and US 365,05 for older bulls (three years and older) as long as there is market demand for these animals. The increase in profit comes from the additional weight gain, which generates more revenue, even though fattening incurs higher costs. However, costs may be reduced because the fattening process is often done through grazing activities.

Moreover, considering the possibility of implementing climate resilience practices, which simultaneously increase the production of forage biomass on farms, ranchers will be able to fatten their animals in a shorter time and increase the stocking rate per area. This will reduce production costs and increase profitability. Table 33 shows the cost of implementing the most important CSA practices per animal. The cost is estimated through the calculated useful life of the implemented practice and expressed in the model per animal.

Table 33. Projection of costs of each CSA practice per animal.

Practice	% Interested Producers	Number of Interested Producers	Amount per Practice (USD)	Total Financing Required (USD)	Total acres	Investment per Acre, USD	Investment per hectare, USD	Animals/ hectare	USD/ Animals	Useful life, years	Cost USD/ animal/ year
Pasture improvement and rotational grazing	40	2 370	15 300	36 261 000	118 500	383	958	2,25	426	7	60,79
Live fencing in the rotational grazing system	20	1 185	30 000	35 550 000	59 250	750	1 875	2,25	833	10	83,33
Tree regeneration and planting on the farm	30	1 777	2 500	4 442 500	88 850	63	158	2,25	70	10	7,00
Mixed fodder banks	30	1 777	3 300	5 864 100	88 850	534	1 335	2,25	593	10	59,33
Electric fencing	40	2 369	14 513	34 381 297	118 450	181	453	2,25	201	10	20,11
Water harvesting and storage system	40	2 369	7 718	18 283 942	118 450	96	240	2,25	107	10	10,67
Totals		**11 847**		**134 782 839**							
Total practices financed to producers (a producer can invest in several practices)				**11 847**							
Average Investment per producer, USD				**11 377**							

Source: Authors' own elaboration

In order to calculate the remaining profitability of the cattle business after implementing the CSA practices, the estimated profitability of young bulls is used as the reference. Table 32 indicated that the profitability in the market of young bulls 12-15 months old was USD 272,40. Table 34 summarizes the cost impact per animal of implementing each CSA showing the remaining profit when applied to the young bulls as an example.

Table 34. Profit margin per animal of implementing each CSA practice.

Practice	Young bulls Profit Margin, USD	Cost USD/animal/ year	Profit Margin USD/animal/ year
Pasture improvement and rotational grazing	272,40	60,79	211,61
Live fencing in the rotational grazing system	272,40	83,33	189,07
Tree regeneration and planting on the farm	272,40	7,00	265,40
Mixed fodder banks	272,40	59,33	213,07
Electric fencing	272,40	20,11	252,29
Water harvesting and storage system	272,40	10,67	261,73

Source: Authors' own elaboration

As example in the Highlighted in yellow there is an analysis that subtracts the cost (USD 60.79 of pasture improvement and rotational grazing practices from the profitability of selling young bulls (USD 272.40), resulting in a significant remaining profit of USD 211.61. Similar profitability outcomes are observed with the other suggested climate-resilient practices.

The result shows that climate-resilient practices in livestock farming allow reducing the climate impacts associated with the activity, as well as generating profitability for the livestock farmer. This is relevant because it demonstrates that investment in sustainability generates financial resources for livestock farming families while facilitating business competitiveness and profitability.

8.4.7 Costs of production: Traditional system versus sustainable system

In this section the operational cost of both systems is calculated per animal. Later these costs are included to differentiate. Table 35 outlines the basic operational costs of a traditional livestock system for 50 animals and for 100 animals in Belize. This information of the traditional system is based on data from the University of Belize (Annex 2) and is used as a reference for comparison with the sustainable livestock production systems promoted by BLPA in the country. The model of 100 heads is included because the CSA could double the number of animals per acre without jeopardizing the sustainability of the farm. However, it should be noted that 2 animals per acre (or 100 animals in 50 acres) is not sustainable unless CSA practices are implemented.

Table 35. Basic operational costs of a traditional livestock system for 50 animals and for 100 animals in Belize.

Operational costs of traditional livestock farming. (Cost 50 animals)	Cost 50 animals					Cost 100 animals			
Description	**Period**	**Unit cost (USD)**	**Unit**	**Total USD**	**Remarks**	**Unit cost (USD)**	**Unit**	**Total USD**	**Remarks**
Rabies	Annual	1	64	64	USD1/dose	1	100	100	USD1/dose
Blackleg	Annual	2	64	96	USD 1,5/dose	2	150	225	USD 1,5/dose
Needles and syringes	Annual	0	150	19		0	300	38	
Mineral salts	Month	33	12	390	50 lb. Sacs	33	24	780	50 lb. Sacs
BLR	Bi annual	10	25	250	USD 5/tag/animal + movement permits	10	50	500	USD 5/tag/animal + movement permits
Medications/tick control	Month	25	12	300	Standard costs of Bayticol or equivalent	25	12	300	Standard costs of Bayticol or equivalent
Vet fees	Annual	1	300	150	Varies by availability of vet	1	300	150	Varies by availability of vet
Subtotal variable costs				1 269				2 093	
Land extension Cost 50 Acres									
Land tax		9	50	450	USD/acre	9	50	450	USD/acre
Corral, fence repairs and maintenance	Month	100	12	1 200		100	12	1 200	

Labour	Month	6	1 460	8 030	Family labour at USD 5.5/hr @ 4hrs/day	6	1 460	8 030	Family labour at USD 5.5/hr @ 4hrs/day
Weed control	Month	38	36	1 350	USD 37,50/hr. Bush-hog @ 3hrs per month	38	36	1 350	USD 37,50/hr. Bush-hog @ 3hrs per month
Equipment	Month	50	12	600	Knapsack sprayer, machete, files, etc.	50	12	600	Knapsack sprayer, machete, files, etc.
Subtotal fixed costs				11 630				11 630	
Total Cost				**12 899**				**13 723**	
Operational cost/acre/animal				**258**				**274**	

Source: Authors' own elaboration with industry data from the University of Belize (Annex 2).

Table 36 compares the costs of the traditional system (Table 35), to the costs of a sustainable system that includes the six selected CSA practices.

In the sustainable system, it is assumed that the animal load per acre will double after its establishment. This increase in animal load implies integrated management and optimization of the livestock production system that adopts it. As a reference, with the implementation of the NAMA Livestock Program in Costa Rica (Segura, 2024), the animal load was successfully doubled to 2.6 AU/ha on farms that adopted CSA.

As seen in the table, the costs per animal per year are reduced. Additionally, the cost per pound for a 600-pound animal is 26 percent lower compared to the traditional system. These estimates demonstrate that systems enhanced with CSA practices can be more profitable than traditional systems.

Table 36. Comparison traditional system vrs sustainable system.

CSA Practice	TRADITIONAL SYSTEM					SUSTAINABLE SYSTEM				
	Cost/Acre USD	Useful life/Yr	USD Cost/Yr	Cost/animal/Yr Traditional Sys @ 1.0 animal/Ac USD	Unit	Cost/Acre USD	Useful life/Yr	USD Cost/Yr	Cost/animal/Yr Sustainable Sys @2.0 animal/Ac USD	Unit
Pasture improvement and Rotational Grazing	382,50	7	54,64	54,64	acre	382,50	7	54,64	54,64	acre
Live fencing	750,00	10	75,00		acre	750,00	10	75,00	75,00	acre
Tree regeneration and planting	62,50	10	6,25		acre	62,50	10	6,25	6,25	acre
Mix Fodder Bank	534,00	10	53,40		acre	534,00	10	53,40	53,40	acre
Electric Fencing	181,00	10	18,10		acre	181,00	10	18,10	18,10	acre
Water harvesting and storage	96,00	10	9,60	9,60	acre	96,00	10	9,60	9,60	acre
Operational Cost										
Subtotal fixed cost	232,62	1	232,62	232,62	acre	253,07	1	253,07	253,07	acre
Subtotal variable cost	25,38	1	25,38	25,38	animal	20,93	1	20,93	20,93	animal
Total Cost	258,00			**296,86**		274,00			**470,06**	
Total Cost/animal/acre/year				**296,86**					**235,03**	
Total Cost/lb of 600 lb animal				**0,49**					**0,39**	

Source: Authors' own elaboration

9. The Costa Rican experience: Climate-resilient good practices in the beef cattle value chain

The Government of Belize selected Costa Rica as a reference case for the development of this study to incorporate the country's experience in managing sustainable livestock farming as an example for Belize. In Costa Rica, the Low Carbon Livestock Strategy (Chacón, Reyes, & Segura, 2015) and the Livestock NAMA (Quesada & Chacón, 2015) were published in 2015. These initiatives have been implemented on pilot beef and dairy farms, generating valuable data and facilitating knowledge exchanges on climate-resilient production practices. These practices have simultaneously improved the socioeconomic conditions and competitiveness of farming families.

The most significant results achieved in Costa Rica are as follows (Segura, 2024):

- By 2024, 104 000 hectares of livestock farms have been improved.
- From 2019 to 2024, 255 000 tons of carbon dioxide equivalent have been mitigated.
- There are 600 farms conducting monitoring, reporting, and verification (MRV) to ensure the implementation of climate-resilient measures, providing technical data verified by third parties.
- Stocking rates increased to 2.6 AU/ha, nearly doubling the levels before the program started.
- Over 2 800 farms are registered under the Livestock NAMA, with their location, farmer details, and implemented improvements documented.
- 89 percent of the farms have shown increased productivity, and 90 percent have demonstrated reduced losses.
- Financial management has improved on 61 percent of the farms, and 93 percent of producers anticipate the development of a differentiated market mechanism to reward these efforts.
- Conservation ecosystems represent 34 percent of the farms, and there has been a two percent increase in tree coverage on livestock farms across the country. This contributes to better water resource availability, improved soil coverage, and soil recovery.

As a technical reference for the study of Belize's beef value chain, this section summarizes a set of climate-resilience practices and technologies, based on the classification of Costa Rica's Sustainable Finance Taxonomy (MINAE & SUGEF, 2024), that comply with the provisions of the Livestock NAMA (Quesada & Chacón, 2015) and the Low Carbon Livestock Strategy of Costa Rica (Chacón, Reyes, & Segura, 2015). They are compared to those implemented by the Belize Livestock Producers Association (BLPA), as part of efforts to transition livestock farming toward sustainable and climate-resilient production.

In this Taxonomy of reference, three environmental objectives are addressed:

1) Climate change mitigation (increasing carbon storage and sinks in forested and agricultural lands);
2) Climate change adaptation (managing climate risks in agricultural production);
3) Transitioning to a circular economy (reducing waste, optimizing resource use, and regenerating ecosystems).

The proposed classification in the Taxonomy is as follows:

Table 37 presents a comparative list of practices (measures or technologies) based on the previous classification, related to those being implemented in Belize. The goal is to identify additional practices (to be verified) that BLPA could implement with its members. As can be seen, the range of practices being developed is broad and focused on the priorities of sustainable financing referenced for the study. It is advisable to carry out a field inventory to verify the degree of compliance with each of them.

Table 37. Comparative list of climate-resilient practices (measures or technologies) in livestock production in Belize[10] [1/]

Practice / Technology Classification	Climate-resilient livestock practices and technologies recommended by the Taxonomy of Sustainable Finance of Costa Rica	Resilient livestock practices and technologies implemented in Belize
BASIC PRACTICES		
Division and rotation of paddocks	**1)** Live fences **2)** Electric fences **3)** Use of improved pastures	**1)** Beginning the implementation **2)** Beginning the implementation **3)** Implemented
Efficient management and protection of water sources	**4)** Efficient water supply systems in pastures **5)** Water collection and storage systems **6)** Meters for monitoring water consumption	**4)** Beginning the implementation **5)** Beginning the implementation **6)** Not implemented
Physical protection of soil and increase of aerial and underground biomass	**7)** Silvopastoral practices in pastures **8)** Protein and energy forage banks **9)** Strips of grasses, herbaceous pants, shrubs and trees interspersed in paddocks **10)** Use of decomposing organic materials as soil cover	**7)** Beginning the implementation **8)** Beginning the implementation **9)** Beginning the implementation **10)** Not implemented
INTERMEDIATE PRACTICES		
Diversification of productive activities	**11)** Grazing in perennial crop and forestry plantation	**11)** Not implemented
Organic fertilizers, manure and effluents in pastures and forage banks	**12)** Management systems and incorporation of manure, slurry and organic fertilizers in pastures and forage banks	**12)** Beginning the implementation

[10] It is advisable to conduct a field inventory to verify the degree of compliance of each of the climate-resilient practices implemented in Belize.

Practice / Technology Classification	Climate-resilient livestock practices and technologies recommended by the Taxonomy of Sustainable Finance of Costa Rica	Resilient livestock practices and technologies implemented in Belize
Degraded soil recovery	**13)** Establishment of cover crops and incorporation of organic fertilizers **14)** Rehabilitation of degraded pastures **15)** Exclusion of grazing on degraded land or fragile ecosystems (gullies) **16)** Soil conservation works and living barriers **17)** Voisin Rational Herding **18)** Measurement of soil organic carbon (SOC)	**13)** Not implemented **14)** Beginning the implementation **15)** Not implemented **16)** Beginning the implementation **17)** Beginning the implementation **18)** Beginning the implementation
Animal welfare	**19)** Alley pastures **20)** Dietary supplements to reduce emissions **21)** Improvements in corrals and access roads	**19)** Not implemented **20)** Not implemented **21)** Beginning the implementation
ADVANCED PRACTICES		
Intensive Silvopastoral Systems (IPSS) and Conservation	**22)** Establishment of IPSS **23)** Establishment of regeneration and conservation areas **24)** Traceability systems, certifications and declarations on farms	**22)** Implemented **23)** Beginning the implementation **24)** Traceability systems – Implemented Certifications and declarations on farms - Not implemented
COMPLEMENTARY TECHNOLOGIES		
Complementary climate-resilient technologies	**25)** Climate-resilient animal genetic improvement **26)** Electricity-efficient motors and pumps **27)** Cooling System **28)** Biodigesters **29)** Photovoltaic solar generation systems **30)** Establishment of forest plantations with native species	**25)** Implemented **26)** Beginning the implementation **27)** Not implemented **28)** Beginning the implementation **29)** Beginning the implementation **30)** Beginning the implementation

Source: Consultant team with industry and own data

10. BELIZE BEEF VALUE CHAIN SWOT ANALYSIS

This chapter summarizes all the relevant findings of the research using the SWOT (acronym indicating a four-box divided by Strengths, Weaknesses, Opportunities, and Threats) framework. This analysis is also subdivided by key topics in the corresponding boxes for visible segmentation. Following the SWOT table, there is a summary and discussion of key topics to facilitate the relative contribution of each one of them.

Table 38. Belize beef value chain SWOT analysis

STRENGTHS	WEAKNESSES
Production: • Many small producers actively participating in economic activity • Cattle breeds are of high quality, and suitable for the market • Health and wellness activities being practiced • Land availability • Reliable water resources for livestock management • Livestock farmers use sustainable practices (e.g., rotational grazing, pasture improvement, provision of water and shade in pastures, and forest patches within farms) • Disease-free livestock • Strong sanitary controls in place with Mexico • Traceability system in place • BLPA provides training for smart agriculture practices • Ministry of Agriculture provides support and resources for smart agriculture initiatives. **Market:** • Growing demand for local and healthier beef products • Strong reputation high-quality products • Diversity of products catering to various consumer demands • The Mennonite community's value chain benefits its members, fostering local economic growth	**Market:** • The potential market for local beef products is underserved/underexploited. • Market fluctuations and economic volatility. • Strong competition from buyers from Guatemala and Mexico. • Local market price mechanism is distorted by foreign buyers. • Local supply is insufficient to meet both domestic and foreign demand. • Foreign purchases push up beef prices for local consumers. • Unfair competition of transporters buying for Guatemala towards intermediary that sell to Mexico. • Unfair competition arises from transporters buying cattle for Guatemala, disadvantaging intermediaries selling to Mexico. • There is no culture of price differentiation based on production methods or breed quality. • Imports of frozen beef create competition with locally processed beef products, impacting sales. **Knowledge and technical assistance**: • Lack of knowledge about cost of production, profit margins and market opportunities. • Livestock farmers are often unaware of agricultural projects that could provide technical assistance. • Limited government support. • Climate-smart practices being applied are often basic and lack a comprehensive approach.

- The local market faces fewer regulations from BAHA, making it a more accessible option for small-scale producers
- The highest profit margins in the value chain are achieved at local market level

Climate change:

- A significant number of farmers are actively implementing climate-resilient practices to mitigate the effects of changing weather patterns such as improved pasture system a rotational grazing, living fences, electric fences, regeneration and planting of trees, fodder banks, water harvesting and storage system, and others
- Implementation of practices that facilitate sustainable water harvesting and use in production
- Adoption of practices that promote soil recovery
- Capacity to continuously monitor climate patterns and share adaptation strategies with international organizations to apply resilience measures

Meat processing:

- Wide spectrum of products catering to various income levels
- Processors are engaged in smart agricultural practices on their farms
- Processors source cattle from the national herd, supporting local producers
- Little competition amongst processors

- Many farmers lack the necessary knowledge and technical assistance to adopt better production and sustainability practices.
- Knowledge gaps hinder the use of techniques like cattle genetic improvement.
- Some tools and their costs lead farmers to opt for less advanced options or rely on common knowledge.
- Lack of veterinary assistance and sanitary programs in the meat industry.

Production:

- High costs of importing quality genetic material
- There is a high concentration of farmers focused primarily on breeding, which adds less value to the production chain.
- Extensive systems are used, and in some cases, the agricultural frontier is being expanded, which does not necessarily lead to sustainable operations.
- Lack of adoption of practices focused on soil protection and restoration, which limits long-term sustainability.
- There is a lack of concrete figures outlining the expenses associated with implementing traditional versus non-traditional practices in the cattle industry. This absence of cost information hinders both the development of economic models for farmers and the design of financial support mechanisms.
- Producers do not comply with vaccination programs.
- Certain diseases go unprevented due to inadequate sanitary practices.
- Some producers lack awareness of the benefits of implementing climate-resilient practices.
- A greater number of producers need to adopt good climate resilience practices.

Meat processing:

- Biodegradable packaging presents limitations for preserving beef products.
- High electricity costs impact the overall production costs of processors.
- Processors compete for the same cattle as exporters from Guatemala and Mexico, leading to shortages and higher prices.

Governance: • BLPA represents a leading organization representing the sector and advocating for its interests **Logistics and Transportation** • Transporters and exporters offer crucial services to cattle producers and act as intermediaries to help facilitate transportation to international markets	• Butchers operate under different sanitary regulations. • Inconsistent quality of beef products due to limited access to a stable supply of quality cattle. • There are no government programs supporting sustainability or the growth of processors. **Governance** • There is a lack of institutional communication among government stakeholders, leading to inefficient policies and practices. **Climate change:** • Belize does not have a climate-resilient livestock strategy to mitigate the effects of climate change. • There is no data to support the results of the implementation of good practices. • Expansion of agricultural frontiers to increase pasture coverage. **Financing and incentives:** • Limited access to capital. • Financing of agriculture is limited to small producers. • International bank transactions are very expensive in Belize Banks. **Technology and equipment:** • Lack of modern technology and equipment. • Limited availability of cattle management software. **Logistics and Transportation:** • Lack of transportation. • Lack of clear transportation policies to support the logistics of farmers and processors. **Staff and labour:** • Labor shortages. • Understaffed BAHA. • Limited technical livestock production staff at BLPA.

	• Institutional strengthening of BLPA needed to allow for addressing weaknesses within the industry. • Limited veterinary Access. • Farms rely mainly on seasonal workers. • Difficult access to labor.
OPPORTUNITIES	**THREATS**
Market: • Growing global demand for beef presents a significant opportunity for Belizean exports • Belize positive economic growth • Expansion of Cattle Trading • Increasing volume demand from Mexico • Potential business opportunity with cruise ships • Strategic location for market access • Increasing consumption of sustainable beef • Mennonite community strong organization allows for consistent volume supply (bulk supply) • Sales experience to intermediaries (particularly from Mennonites) • International trade agreements with Taiwan, CARICOM, and the UK • European Union Deforestation Regulation (EUDR), offers access to future markets by incorporating resilient, sustainable practices into farm operations • Faster recognition of sustainability through the adoption of Smart Agricultural Activities by large cattle farms **Production:** • High demand for genetics in the livestock • Increase stock replenishment factor • Productivity increases without needing to clear more land or create new pastures through the use of silvopastoral activities • Climate-resilient practices enhance efficiency and production capacity • Herd increases to maintain stock levels • Higher producer profits once they reach the fattening stage	**Policies and regulation:** • Taxes on imported production inputs. • Taxation on processed beef products (GST – General Sales Tax 12.5 percent). • The import of single-use plastic is not regulated, contributing to environmental issues. • CARICOM's strict trade regulations affect exports to those countries. • Informal traders who evade taxes. **Market**: • Meat shortage for the local market. • Locals do not recognize price difference due to production methods. • Importing creates competition. • Mexico market access is not through a trade agreement • The Mennonite exporter is facing cash flow issues, require formal contracts and sufficient capital to secure the animals. • Low volumes available to Mexico. • Current market competition leading to insufficient cash flow that hinders regular cattle purchases. • Belize's lack of capacity to meet the demand of the Mexican market. • Additional requirements for export to Mexico, compliance with stricter sanitary standards. • Continued imports of meat affect the demand for locally produced beef. • Market fluctuations and economic volatility. • International buyers and supermarket chains create stronger competition. • Any outbreak of diseases, such as screwworm, could result in an immediate closure of the

Policies and regulation: • Elimination of import tariffs for cattle products going to Mexico **Governance** • New roles for BLPA can lead to enhanced support for the management of the national herd • Leverage the expertise of government institutions to support the development of the livestock industry • Beltrade knowledge and willingness to help • Have BLPA participate in International Cattle Organizations **Meat processing**: • Recovery of the meat processing business • Medium income class is improving their purchasing power • Several HACCP-certified operations. **Knowledge and technical assistance**: • Existence of organizations that can provide research, technical assistance, training programs and best practices to support growth in the cattle industry, gaining the trust of livestock producers. • Interest and knowledge in genetic improvement of herds. **Technology and equipment:** • Introducing advanced breeding techniques like in-vitro fertilization (IVF) • Improving artificial insemination • Adoption of robotics • Alternative energy sources are available to producers **Climate change:** • Belize has public policy instruments in place to support the development of climate-resilient livestock practices.	Mexican market and disrupt access to Guatemala as well, causing significant losses. • Climate-resilient practices open markets but do not necessarily lead to higher product prices (In Belize and Internationally). **Production** • Insufficient cattle for the local market, a significant portion of Belize's cattle are sold to Guatemala for fattening or to Mexico for processing, leaving a shortage in the local market. • Farmers skipping vaccination's programs. • Spread of bovine diseases that can be prevented. **Meat processing**: • No specific government programs are supporting the growth or sustainability of meat processing businesses. • The high cost of imported inputs, such as packaging and equipment. **Financing and incentives:** • Limited access to capital. Lack of incentives, subsidies, or accessible loans for operational growth. • Financing for climate-smart agricultural activities is restricted to small producers. • There is a shortage of financial programs or incentives to support the growth of livestock farmers and processors. • The Mennonites require formal contracts and sufficient capital to secure the animals. • Financial institutions offer little support to processors. **Climate change:** • Increasing temperatures, changes in rainfall and temperature patterns, prolonged dry spells, and flooding events. • Climate variability affects the productive and reproductive performance of livestock. • Droughts affect water availability and increase the cost of supplying livestock.

• Opportunities for public-private partnerships to design climate-resilient livestock strategies. • Many cattle farmers own forests, riparian zones and natural habitat that need to be preserved, limiting future expansions. **Financing and incentives:** • Memorandum of Understanding signed between BLPA and the Development Finance Corporation (DFC).	• Degradation of pasture quality. • Limitations on availability and access to fresh water. • Rising veterinary costs due to pest outbreaks linked to extreme weather conditions. **Knowledge and technical assistance**: • Disadvantage compared to international producers with better access to technology transfer.

Source: Authors' own elaboration

a) Production

- Many small-scale producers participate in the cattle value chain, though their contributions remain relatively small. In countries with similar circumstances, cattle organizations have opted to manage the national herd as a unified entity, often referred to as "One Big Farm." This approach, as seen in Uruguay's cattle farming model, reflects a collective strategy and vision that integrates the management and coordination of the country's entire livestock value chain to enhance efficiency and promote sustainable practices (The Land Group, 2023)Under this model, Uruguay is seen as one large farm with common technological integration, traceability, sustainable practices, and extension services, leading to improved productivity, increased competitiveness and resource management, and enhanced position to supply high-quality, compliant beef in international markets. (Bianchi, 2013) Cattle breeders in Uruguay primarily focus on cultivating high-quality herds with superior genetics. Breeds like Brahman, Angus, and Nellore are highly valued for their excellent meat quality, resilience, and adaptability to local climates.
- Particularly in Belize, many cattle farmers—especially within the Mennonite community—own large extensions of pastureland. This extensive land base provides an opportunity to implement sustainable agricultural practices and manage renewable resources effectively. Instead of expanding the agricultural frontier, many farmers are prioritizing the optimization of land use through sustainable methods.
- For instance, the Mennonite community and other cattle producers are engaging in reforestation efforts, such as planting fast-growing species like bamboo, which provide shade for livestock within just three years. However, it is essential to also prioritize the planting of multi-use and native timber trees that are suited to the local ecosystem. This not only enhances animal welfare but also contributes to ecological restoration and ensures long-term land productivity.

- Additionally, cattle farmers generally have reliable access to water sources, which is vital for effective livestock management and sustainable farming practices. This access plays a critical role in supporting the long-term viability of their operations.
- Farmers in Belize also benefit from the land's rich biodiversity, which supports sustainable farming practices. They often share their farming activities with patches of forest and rivers, which they actively protect. Many of these farmers practice rotational grazing and use efficient water and pasture management techniques, further contributing to the sustainability of their operations.
- Cattle farmers often overlook the fact that the majority of profits in the cattle industry are generated through beef slaughter and export. To maximize their earnings, farmers must focus on growing their herds and ensuring that cattle reach their optimal finished weight before slaughter. This requires not only improving herd management practices but also understanding the importance of quality and responding to market demands. By prioritizing these factors, farmers can better position themselves for success in the beef market and capitalize on the full range of by-products that contribute to profitability. Additionally, farmers must ensure that they maintain the appropriate number of animals for restocking and not only sustain the herd size but also work toward increasing it.
- However, the strict protocols set by the Belize Agricultural Health Authority (BAHA) make it both costly and complex to import high-quality genetics from South America, particularly from countries like Argentina and Brazil.
- The lack of veterinarians and poor management of vaccine programs by some farmers are leading to outbreaks of bovine diseases in Belize, like Blackleg and rabies issues that could be mitigated with proper veterinary care and extension services. Sick cattle are not only unproductive but can severely affect the overall profitability of a farm.
- Although large farms may have more land available for expanding the agricultural frontier and developing extensive grazing, this does not necessarily equate to sustainable system management. Sustainable practices must focus on intensification and increasing forage production, enabling farmers to raise more livestock on the same or even smaller areas of land.
- There is a clear need to adopt more comprehensive smart agricultural practices that can protect soil nutrients and, in degraded areas, help restore soil health. Unfortunately, many farmers are still relying on basic rotational pasture activities, not taking into consideration the pasture growth cycle, maximum grazing period, and time necessary for pasture to remain foraging-free after cattle movement to other paddocks, which may not be sufficient to address the long-term challenges of soil degradation.
- The systematization of data on costs associated with the implementation of traditional and non-traditional practices in the livestock industry should be improved. Improving the quality of cost information will facilitate the development of economic models for farmers, as well as the design of financial support mechanisms, such as tailored loans and grants, to support sustainable practices.

b) Meat processing

- During the COVID-19 pandemic, many meat processors were forced to operate in "survival mode," facing significant declines in sales. However, in recent months, they have seen a strong recovery in sales.

- Over the past three years, processors have experienced a steady annual growth rate of ten to 20 percent, highlighting the increasing demand for their products. This growth has been largely driven by their ability to target different market segments, with minimal competition among themselves. A loyal customer base has also played a key role in boosting sales and maintaining stable market positions.
- The growing demand and limited supply of cattle for slaughter are leading to increased quality inconsistencies in the products offered to customers. This not only affects the beef industry but also has a ripple effect on other sectors and individuals concerned with breed quality. As processors often find themselves competing with transporters and sales intermediaries for available cattle, they sometimes have to source from what remains, further impacting product consistency.
- The high cost of imported inputs, such as packaging and equipment, is driving up production costs for processors.
- Processors have also raised concerns about the use of biodegradable packaging for beef products, citing that it is unsuitable due to its tendency to melt, leading to spoilage and significant losses. To ensure product longevity, beef must be vacuum-sealed in appropriate packaging.
- Additionally, processors have expressed frustration over the lack of specific government programs designed to support and enhance their businesses. Another concern is the practice of local competitors selling final products that include imported products, such as ribeye. Processors are unsure how these practices are regulated and accepted by the Government of Belize, which adds to their uncertainty in navigating the market.
- Financial institutions offer little support to processors, providing no reduced loan interest rates to aid business development or growth.
- Several processors are HACCP certified which is one of the main requirements to frozen beef or carcass to other countries.

c) Market

- Belize’s unique geographical position, bordering Guatemala and Mexico, presents significant opportunities to supply the neighboring markets with sustainable beef cattle products.
- Unlike imported beef, local beef is renowned for its absence of added moisture, chemicals, tenderizers, and water. As a result, consuming Belizean beef is considered a healthier and more natural option.

- The beef market in Belize offers a diverse range of products that cater to different income levels. From premium cuts to traditional offerings like oxtail and cow foot, the variety ensures broad appeal across consumer segments.
- Belize's strong focus on high-quality breeding and animal husbandry has helped build a solid reputation for Belizean beef. This reputation not only commands premium pricing but also drives increased demand from consumers who prioritize quality over quantity.
- The local markets often have fewer regulatory and logistical barriers compared to accessing international markets or building vertically integrated operations. This makes it easier for smaller operations to sell their products without extensive compliance and export documentation. Selling within local markets typically requires fewer certifications by government organizations, lower infrastructure investments, and less compliance with stringent sanitary standards. For small-scale farmers, this makes transporters and slaughterhouses a more viable option. For example, exporting cattle directly to Mexico requires significant infrastructure, such as approved corrals and facilities to quarantine cattle for at least 21 days, adding to the cost and complexity. These regulations present a significant hurdle, especially for farmers without access to the necessary financial resources to meet these standards, reinforcing their reliance on local channels.
- Many farmers have long-standing relationships with local slaughterhouses and butchers, providing a stable and reliable market for their cattle. Farmers often prefer to operate within local market structures, where they are familiar with demand trends, regular buyers, and the logistical challenges involved in selling cattle. This familiarity reduces risk and uncertainty, making local markets more attractive, especially for farmers who may not have the experience or resources to handle the complexities of markets outside of Belize.
- Focusing on these two markets reduces transportation and logistics costs associated with moving cattle across borders or to other farms. Most cattle farmers lack their own transportation, which propels them to sell their cattle to transporters. This finding aligns with data collected during the scoping mission, which revealed that farmers primarily rely on transporters and processors who have the necessary transportation infrastructure.
- There is a steady demand for beef within Belize, driven by local consumption patterns. Meeting this demand can provide a consistent and predictable revenue stream for breeders and farmers. During interviews, all processors expressed that their business has sustained growth of ten percent over the last two years.
- Price volatility in the cattle market is largely driven by Guatemalan traders, leading to significant fluctuations that present both advantages and challenges for farmers. On the one hand, this volatility can negatively impact the profitability of Mexican exporters, who benefit from a more stable pricing environment. On the other hand, rising cattle prices can offer farmers short-term gains, allowing them to capitalize on higher market rates. While this may result in immediate financial benefits, it also introduces uncertainty, complicating long-term planning and investment strategies within the cattle industry.
- Current market competition has significantly reduced profits for Mexican exporters, leading to insufficient cash flow that hinders regular cattle purchases.

- Additionally, price volatility has a direct impact on the prices of processed beef products, which in turn influences consumer purchasing behavior. When cattle prices fluctuate, processors may adjust their pricing to maintain profit margins, leading to varying costs for products like steaks, ground beef, and other cuts.
- Mexico's annual demand for cattle has risen to 25 000 heads, raising concerns among exporters about Belize's ability to consistently meet this substantial demand. If Belize fails to supply the required volume, there is a risk of losing export opportunities to Mexico. Therefore, ensuring a reliable supply chain and the capacity to meet this demand consistently is crucial for expanding cattle production in Belize.
- Data indicates that national competition in the cattle market, particularly for weaners, continues to drive prices upward. On a global scale, demand for beef is steadily increasing, presenting a potential opportunity for Belizean cattle farmers to expand their operations and explore exporting beef products.
- Exporting value-added beef products plays a crucial role in contributing to Belize's national economy by creating jobs and retaining revenue within the country. This export activity not only supports local labor but also bolsters economic stability. Currently, processors are already working to sale beef products to The Bahamas and other Caribbean nations. However, the fattening and transport infrastructure, processing plants, among others, must be improved.
- The cattle trading industry in Belize presents two key opportunities: raising cattle to 800 pounds for sale to Mexico or supplying local processors, as described in the study of costs and profitability in this chapter. By focusing on reaching the finished weight, Belizean cattle farmers can meet the demands of the Mexican market, which favors larger cattle for export, while also serving local processors who require substantial volumes for their operations.
- Mexico has a strong demand for large volumes of cattle, and to meet this demand, Belizean cattle producers must scale their operations accordingly. Ensuring a steady and reliable export flow to Mexico is essential for maintaining this market.
- However, failing to meet the required volume for export to Mexico could diminish the country's interest in Belizean cattle. Moreover, the elimination of tariffs and IVA for Mexican importers is not part of a formal trade agreement, meaning this unilateral commitment could be altered or revoked at any time.
- Processors have expressed interest in establishing business relationships with cruise ships visiting Belize, aiming to expand their market reach and increase sales opportunities.
- Cattle farmers in the Mennonite community have reached levels of organization that contribute to their participation in formal exports. This knowledge includes systems to supply volume and maintain and monitor quality and requirements. The Mennonites are strategically organized to ensure a consistent supply of cattle to the intermediaries who sell to importers in Mexico. This experience must be replicated and taught to other communities and cattle farms.
- International regulations such as the European Union Directive on Deforestation (EUDR) open new market access opportunities to those producers that have not cleared forests since December 2020.

- International markets could close at any time when diseases appear in the herd. A scenario of this kind requires good management of the supply of cattle and diversified markets.
- Having big cattle farm operations already using smart agricultural activities can speed the process of recognition of Belize as having a sustainable cattle and beef industry.
- There is no price differentiation in the local markets. Customers do not get informed of production methods or breed quality and will not pay more for that differentiation since today, it already is ignored in their market. However, import substitution may be possible since the tourism segment recognizes price differentiation for quality meat.
- High-end resorts in Belize are importing beef for their restaurants instead of sourcing from local butchers, which affects local industry support. The resorts import U.S. beef to cater to the preferences of tourists, particularly those from the United States, as the imported meat is perceived to be more tender and flavorful. Imports can be replaced with domestic production, but it requires high-quality cattle that can produce meat comparable to Angus. The cuts must meet the quality standards that hotels typically import.

d) Policies and regulation

- The Mexican government agreed to waive the 15 percent import duty on all cattle imported from Belize, an action that will undoubtedly benefit Belizean cattle farmers by making exports more competitive.
- The skyrocketing input prices are significantly impacting cattle farmers by driving up production costs. For instance, processors have reported that packaging materials for their final products are expensive in Belize, forcing them to import these materials from Mexico or other foreign countries. This solution, however, is complicated by the exacerbated import duties imposed by the Government of Belize, further increasing costs.
- Processors have noted that processed beef products are subject to high government taxes, whereas raw beef products are exempt from GST. This tax disparity raises the cost of processed beef, placing a heavier financial burden on producers.
- While the Government of Belize advocates for the use of biodegradable packaging, there has been inadequate action to regulate the import of goods that still rely on single-use plastics, creating a disconnect in the country’s sustainability efforts.
- Mennonite exporters to Mexico have also noted a significant disparity in tax obligations between formal cattle exporters and informal traders or "coyotes", who frequently evade taxes. This unequal treatment creates an uneven playing field, putting formal exporters at a disadvantage. Addressing tax compliance across all market participants is essential to ensure fairness and support the formal sector.

e) Financing and incentives

- The cattle industry requires substantial long-term investment and a steady cash flow, which many farmers in Belize currently lack. The high costs of raising cattle including feed, veterinary care, and land management pose significant financial challenges for farmers, many of whom struggle to secure the necessary capital to sustain and grow their operations.

- There is a notable absence of financial support from both the government and financial institutions for cattle farmers in Belize. Without access to grants, subsidies, or low-interest loans, farmers face difficulties expanding their operations, investing in essential infrastructure, and improving the long-term sustainability of their businesses.

- Processors have reported that commercial banks do not offer special interest rates tailored to their needs. However, Blue Creek Credit Union provides the lowest interest rates available to them. Processors are seeking duty waivers on imported inputs, particularly packaging materials, to reduce their operational costs.

- Solutions to mitigate the financial costs could come from public-private partnerships, financial grants, or innovative financing models that help distribute the upfront expenses over time.

- Ranchers feel that there is little recognition from buyers and the market for their efforts in sustainability. Developing clearer market incentives, such as certification programs, premium pricing for sustainably produced goods, or direct incentives for eco-friendly practices, could help shift this perception and reward ranchers for their commitment to sustainable practices.

- Cattle breeders are facing high transaction fees from international banks, particularly American banks when importing and exporting cattle inputs such as genetics and machinery. These additional costs are putting pressure on profit margins, making it more challenging for breeders to maintain financial stability.

- Breeders implement robust health management practices alongside genetic selection, including regular veterinary care, vaccinations, and nutritional planning. Breeders have noted a significant demand for high-quality genetics, presenting a promising opportunity for Belize's cattle industry. However, to fully capitalize on this demand, the Belize Agricultural Health Authority (BAHA) needs to ease national restrictions on importing genetics from South America, allowing breeders access to superior genetic material that could improve herd quality and enhance market competitiveness from South America.

- There is an opportunity to develop incentives within the value chain through the potential benefits offered by the MFA (Ministry of Food and Agriculture), BELTRAIDE, The Nature Conservancy (TNC), Angus breeders, and Mexican buyers. These stakeholders could play a key role in creating initiatives that promote sustainable practices, improve cattle quality, and enhance market access for Belizean ranchers.

- The Mennonites require formal contracts and sufficient capital to secure the animals. The Mennonite exporter is facing cash flow issues, delaying payments to cattle farmers, and resulting in the loss of clients.

f) Technology and equipment

- Many small farmers in Belize face challenges in accessing management software due to the high costs of technology and limited training opportunities.
- Farmers in Belize struggle with limited access to advanced equipment, as the high import duties make it financially prohibitive to bring in modern machinery. As a result, they are forced to rely on less advanced, locally available equipment, putting them at a disadvantage compared to their counterparts in more developed countries.
- Advanced breeding techniques, such as Artificial Insemination (AI) and in-vitro fertilization (IVF), present significant opportunities to enhance the cattle industry. This technology promises faster genetic improvements, increased production efficiency, and reduced strain on pastureland.
- To address labor shortages, cattle farmers are exploring the adoption of robotic technologies. For instance, they are considering the use of robots for tasks such as installing fencing posts, this could help alleviate labor challenges, boost efficiency, and reduce the time and effort needed for manual labor.
- Some institutions have secured funding to support the use of alternative energy sources for farmers, which is crucial for powering water systems and fencing. This is crucial for water access and fencing. Access to these resources is essential for the sustainable management of farms.

g) Transport

- A significant challenge faced by cattle farmers is the limited availability of suitable transportation. Only a small percentage of farmers own vehicles capable of safely transporting cattle to the Guatemalan border or the ranches of wholesale buyers. This lack of transportation options limits their ability to negotiate better prices, as they often have to accept the purchase price offered at the ranch gate. Consequently, farmers may miss out on potentially higher prices that could be obtained through direct sales or alternative markets.
- Private sector transporters play a crucial role in supporting the cattle industry by providing services that are either unavailable or too costly for the government to afford.
- Intermediaries also play a significant role in cattle exports, providing essential services such as transportation, financing, and expertise in customs and regulatory requirements. Being instrumental in facilitating exports for farmers, helping them navigate the complexities of the international market.

h) Staff and labor

- Cattle farmers, particularly in the Blue Creek Mennonite community near the southern Mexican border, are struggling to find sufficient manpower. Workers are increasingly drawn to opportunities in the islands and the Tren Maya Project. Farmers remain hopeful that once the Maya Project concludes, labor availability will improve, helping to ease their staffing challenges.
- BAHA is also facing staffing shortages, which hinder timely access to veterinary services for cattle farmers. Logistical issues, such as a lack of vehicles or fuel, further cause delays in providing essential care, putting additional strain on farmers.
- BLPA does not have the required technical livestock officers needed to assist its members in livestock production management at the farm level. There is a need for Institutional development at BLPA to begin offering these essential extension services to its members.

i) Knowledge and technical assistance

- Many cattle farmers are unaware that selling cattle at optimal slaughter weights can lead to significantly higher profit margins. This knowledge gap has created opportunities for Guatemalan traders, who have capitalized on the situation by mainly purchasing cattle weighing 499 pounds or less. These traders then fatten the cattle before selling them to the Mexican market for beef, thereby capturing the added value.
- Investing in education and resources will be crucial for farmers to fully grasp these opportunities and implement effective strategies that can improve profitability. Cattle farmers particularly value the research conducted by students from the Belize High School of Agriculture, which focuses on tick and fly infestations affecting their herds. They encourage more educational institutions to engage in similar research, inviting schools to conduct studies on their farms to help advance the industry.
- While many ongoing agricultural projects in Belize could benefit cattle farmers particularly those in vulnerable areas, not all farmers, especially those from remote or rural regions, are aware of these initiatives. As a result, they miss out on opportunities for assistance and support that could enhance their operations.
- Government programs that provide financial assistance, subsidies, or policy frameworks promoting sustainability could be highly effective in overcoming these barriers. Many ranchers lack access to the technology and training required to adopt sustainable practices. This highlights an opportunity for capacity-building initiatives, such as educational programs and the provision of modern tools, which could improve the ability of ranchers to implement effective and sustainable methods.
- In addition, increasing efforts to educate consumers about the benefits of sustainable beef can help boost demand, creating a market-driven incentive for ranchers to adopt these practices.

j) Climate change

- Rising temperatures lead to heat stress in cattle, which negatively impacts their overall health, reproductive performance, and milk production. According to farmers, cattle may become lethargic, eat less, and produce lower-quality meat and milk during periods of intense heat.
- Prolonged dry periods have significantly impacted farmers, leading to higher operational costs as they are forced to source alternative water supplies. This includes drilling deeper wells and installing irrigation systems.
- Changes in rainfall patterns and temperature can degrade pasture quality, leading to reduced forage availability. As a result, this forces farmers to invest more in supplemental feeding, further increasing costs and reducing profit margins.
- Warmer temperatures and shifting weather patterns create more favorable conditions for pests and diseases that affect cattle. This can increase veterinary costs and adversely impact livestock health.
- Climate variability also results in extreme weather events, such as flooding, which have led to the loss of livestock, causing an economic and social impact on the Belizean families who rely on their cattle for their livelihoods.

k) Governance

- BLPA plays a crucial role in the cattle industry, amplifying the voices of ranchers and representing their interests before the government. It also facilitates the inclusion of civil society and the private sector in a co-governance model, where policies and projects are developed collaboratively.
- While the institutions and organizations within the government related to the cattle industry are effective, they often work in isolation. This lack of communication leads to overlapping efforts, duplicated actions, or sometimes no action at all on important policies in the sector.
- BLPA could play a key role in improving institutional communication within the government. It could also provide avenues to connect farmers with the knowledge and resources available through government-supported market policies. Additionally, international organizations can offer valuable knowledge transfer and branding opportunities to promote the sustainability of the cattle and beef industry.

10.1 Summary of challenges and opportunities in the climate-resilient beef value chain to include in roadmap

The challenges, as outlined by priority areas (Table 39) must be overcome in the beef value chain. Similarly, the opportunities (Table 40) are organized by the same topics, highlighting aspects upon which a proposal can be built to enable the development of the value chain based on these intervention priorities. These aspects will be the basis for intervention in the roadmap proposed in the following section.

Table 39. Challenges in the climate-resilient beef value chain.

CHALLENGES	
Market	Climate-resilient practices open markets but do not necessarily lead to higher product prices (deforestation-free, low-carbon, and traceable beef) 1) There is insufficient cattle supply to meet local market demands (transporters, intermediaries, and processors) 2) Limited cattle availability to serve the potential market in Mexico 3) No formal free trade agreement exists between Mexico and Belize (Mexico's unilateral decision to suspend tariffs) 4) Imports of meat products create competition 5) Local beef shortages persist 6) Low export volumes to Mexico 7) Belize lacks the capacity to meet Mexico's demand 8) Strict requirements for exporting to Mexico 9) Meat imports impact local product demand 10) The market experiences significant fluctuations and volatility 11) International buyers and market chains create strong competition 12) Any disease outbreak can shut down markets 13) Lack of veterinary assistance and sanitary programs in the meat industry
Production	15) Producers do not comply with vaccination programs 16) Certain diseases go unprevented due to inadequate sanitary practices 17) Some producers lack awareness of the benefits of implementing climate-resilient practices 18) A greater number of producers need to adopt good climate resilience practices
Meat processing	19) There are no government programs supporting sustainability or the growth of processors
Governance	20) Communication gaps between government institutions limit policies and practices
Knowledge, technology, and equipment	21) Many farmers lack the necessary knowledge and technical assistance to adopt better production and sustainability practices 22) Knowledge gaps hinder the use of techniques like cattle genetic improvement

CHALLENGES	
	23) Some tools and their costs lead farmers to opt for less advanced options or rely on common knowledge 24) Disadvantage compared to international producers with better access to technology transfer
Climate change	25) Increasing temperatures, changes in rainfall and temperature patterns, prolonged dry spells, and flooding events 26) Degradation of pasture quality 27) Limitations on availability and access to fresh water 28) Rising veterinary costs due to pest outbreaks linked to extreme weather conditions 29) Expansion of agricultural frontiers to increase pasture coverage
Financing and incentives	30) Limited access to capital 31) Financing for climate-smart agricultural activities is restricted for small producers 32) Lack of incentives, subsidies, or accessible loans for operational growth

Source: Authors' elaboration.

Table 40. Opportunities in the climate-resilient beef value chain.

OPPORTUNITIES	
Market	1) Economic growth in Belize 2) Strategic location for market access 3) Growing global demand for meat products 4) Expansion of livestock trade 5) Increased demand from Mexico 6) Demand for meat from cruise tourists 7) Rising meat consumption among the population 8) The Mennonite community's organizational model enables bulk supply 9) International trade agreements with Taiwan, CARICOM, and the UK 10) European deforestation regulations limit meat access from other suppliers. 11) Rapid recognition of sustainability through the adoption of best practices by large ranchers. 12) Export experience (Mennonites)
Production	13) Climate-resilient practices enhance efficiency and production capacity

OPPORTUNITIES	
	14) Herd increases to maintain stock levels 15) Higher producer profits once they reach the fattening stage
Meat processing	16) The processing business is recovering 17) The middle class in Belize has improved its purchasing power 18) Certified HACCP processors are available
Governance	19) New roles for BLPA can increase support for managing the national herd 20) Leverage the expertise of government institutions to support the development of the livestock industry 21) BLPA participates in international organizations
Knowledge, technology, and equipment	22) Institutions are available to provide educational assistance, extension activities, and training programs, gaining the trust of livestock producers 23) Interest and knowledge in genetic improvement of herds
Climate change	24) Opportunities for public-private partnerships to design climate-resilient livestock strategies 25) Significant numbers of farmers are knowledgeable about and use climate-resilient production practices 26) Implementation of practices that facilitate sustainable water harvesting and use in production 27) Adoption of practices that promote soil recovery 28) Capacity to continuously monitor climate patterns and share adaptation strategies with international organizations to apply resilience measures
Financing and incentives	29) A financing agreement exists between BLPA and the Development Finance Corporation (DFC).

Source: Authors' elaboration.

11. ROADMAP AND STRATEGIC RECOMMENDATIONS

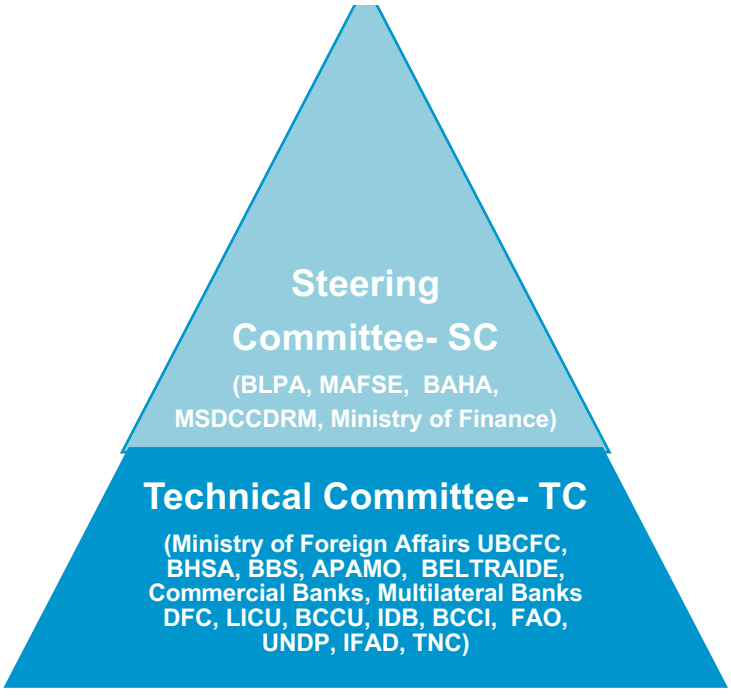
11.1 Governance structure proposal

The development of Belize's sustainable beef value chain requires a strong public-private governance framework that allows the formation, strengthening, and leadership of livestock producers. The organization that represents them (BLPA), public institutions, with the support of private trade entities, academia, technical assistance and technology transfer bodies, and financial entities should be part of this governance framework.

Figure No.48 presents an initial proposal for the governance structure of the sustainable beef value chain. At the first level, a **Steering Committee (SC)** made up of BLPA, MAFSE, representatives of formally established livestock organizations representing all beef production areas, and universities. A leading organization must be identified to guide the formation of this governance structure to drive the strategy and operation of the sustainable beef value chain. This leadership will facilitate the decision-making process required during implementation. This leadership organization should be a transformed and institutionally strengthened BLPA.

At the second level, a **Technical Committee (TC)** would be established, consisting of public and private organizations involved in technology transfer, trade associations, national trade, planning, statistics agencies, and representatives from the financial sector.

Figure 47. Proposed Governance Structure for the Development of Belize's Sustainable Beef Value Chain



Source: Authors' elaboration.

To ensure their official establishment, all organizations representing each productive activity within the sustainable beef value chain must be formalized and hold legal representation following Belizean law. This legal foundation will safeguard the governance structure, ensuring compliance through properly represented organizations. Table 41 outlines the roles and responsibilities of the Steering Committee (SC)

Table 41. Roles and responsibilities of the SC

Entity	Organizations	Roles and responsibilities
STEERING COMMITTEE (SC)	BLPA MAFSE BAHA MSDCCDRM Ministry of Finance	• Appoint a Secretariat for the SC (preferably an industry-leading organization). • Organize the SC operations. • Coordinate the implementation actions for the development of the sustainable beef value chain with producers, breeders, processors, marketers, and transporters. • Execute the actions implemented by the SC. • Monitor and evaluate the outcomes of these actions. • Communicate results for public and private endorsement.

Source: Authors' elaboration.

Table 42. Roles and responsibilities of the Technical Committee (TC).

Entity	Organizations	Roles and responsibilities
TECHNICAL COMMITTEE (CT)	UBCFC BHSA MSDCCDRM BBS APAMO BELTRAIDE Commercial Banks, Multilateral Banks DFC LICU, BCCU BCCI, TNC FAO, UNDP IFAD Ministry of Foreign Affairs and Foreign Trade	• Develop, approve, and execute annual work plans for the TC to support the SC's efforts. • Provide strategic and technical guidance to drive the development of the sustainable beef value chain and ensure efficient execution for the implementation plan. • Assess the progress of the implementation plan. • Guide the work based on strategies, plans, sectoral policies, related to climate change and agricultural development. • Promote access to national and cooperative funding for the implementation of the value chain development plan. • Recommend necessary adjustments in resources or timelines to the SC to meet the objectives of the plan's programs and projects. • Promote and validate products, studies, and documents generated for the value chain's development. • Ensure compliance with memorandums of understanding, procedures, manuals, and regulations applicable to the executions of donated resources for value chain development. • Validate applicable regulations for the value chain's development.

Source: Authors' elaboration.

Table 43. outlines the roles and responsibilities of each organization within the governance structure of Belize's sustainable beef value chain.

Table 43. Roles and responsibilities of organizations in the governance structure of Belize's sustainable beef value chain

Organization	Roles and responsibilities
BLPA	• Coordinate relationships with producers, breeders, processors, marketers, and transporters. • Promote the involvement of all stakeholders in the plan's implementation. • Lead and oversee the development plan for the value chain. • Manage resources and timelines in collaboration with the Technical Committee (CT) to fulfill programs and projects. • Request research and development actions to meet objectives. • Promote the exchange of experiences among value chain stakeholders. • Build organizational leadership capacities within the sector • Inform stakeholders and the public about the progress of objectives and plans.
MAFSE	• Coordinate activities with institutions involved in the plan's implementation. • Guide various entities to provide the necessary support. • Facilitate logistical and technical structures for plan development. • Facilitate experience-sharing with national and international stakeholders. • Provide technical advice and facilitate training and technical assistance. • Promote technical capacities among producers within the value chain.
BAHA	• Support preventive medicine programs and disease control efforts. • Assist with sanitary control processes for exports associated with the value chain. • Transfer knowledge and provide sanitary technical assistance to cattle producers. • Oversee animal processing to ensure product quality and safety. • Contribute to maintaining standards and market access.
MSDCCDRM	• Manage and coordinate communications with national and international entities on climate change issues. • Propose guidelines for tracking, monitoring, reviewing, and verifying climate change compliance. • Coordinate with official agencies on data management and climate-related information processing. • Align climate finance efforts with related initiatives. • Share knowledge with similar processes and climate-related initiatives. • Exchange experiences with national and international actors. • Facilitate and promote access to national and cooperative funding. • Develop institutional capacities for climate resilience within the value chain.
Ministry of Finance	• Provide critical financial guidance and policy support, which will be essential in driving forward a sustainable cattle industry and securing necessary funding for long-term development initiatives.
BBS	• Ensure compliance with quality standards and regulations for products and services in the value chain. • Ensure that processing plants for animals meet and adhere to quality standards.
UBCFC BHSA	• Conduct research and development on sustainable beef production and commercialization based on climate resilience criteria. • Transfer research results into implementation plans for the value chain. • Support training and technical assistance programs required for cattle producers. • Develop institutional capacities in the field. • Coordinate additional research with national and international academic and technical organizations.
APAMO	• Support the management of protected areas through a participatory and collaborative process.

Organization	Roles and responsibilities
	• Build capacities for the protection of natural resources. • Contribute to agro-environmental policies and strategies (natural resource conservation and rural beef production management near nature reserves). • Support decision-making for value chain development in rural areas.
BELTRAIDE	• Promote and facilitate the trade of products from the sustainable beef value chain. • Support the exploration of new export markets. • Contribute to market research and analysis. • Assist in obtaining required certifications in the value chain.
BCCI	• Support the continuous systematization of trade statistics related to value chain development. • Provide relevant technical and commercial guidance for market implementation and commercial development of the value chain. • Promote the involvement of cattle producers in implementing commercial and industrial strategies related to market development.
Commercial Banks (Belize Bank, Belize National Bank, Atlantic Bank, Heritage Bank) DFC LICU BCCU	• Design and offer green financial products with simplified requirements and applications for cattle producers, breeders, processors, marketers, and transporters involved in the value chain. • Serve as a liaison to secure new financial resources from various national and international partners. • Support the implementation of actions required for climate change mitigation and adaptation.
Multilateral Banks (IDB, World Bank)	• Provide both reimbursable and non-reimbursable resources for the development of the value chain. • Facilitate and/or support the identification and management of seed capital and risk funds for value chain development.
TNC	• Promote regenerative livestock production by intensifying productive operations and implementing silvopastoral systems. • Train cattle producers in regenerative and climate-resilient production practices.
UNDP FAO IFAD	• Provide reimbursable and non-reimbursable financial resources for the implementation of the value chain development plan. • Contribute technically with methodologies, tools, and other resources to facilitate the development of climate change mitigation, resilience, and adaptation options for climate-resilient beef production. • Facilitate the exchange of experiences nationally and internationally. • Link the value chain development plan with other international initiatives to access technologies and financial resources.

Source: Authors' elaboration.

11.2. Official formalization of governance

To formalize the governance proposal for a climate-resilient beef value chain in Belize, it is recommended that it be officially declared a matter of public interest through an Executive Decree. This approach facilitated the implementation of the Low-Carbon Livestock Strategy in Costa Rica. As a strategy, such a declaration ensures the mandatory participation of various stakeholders, supports coordination and implementation efforts, and aids in securing public, private, and cooperative funding to sustain the initiative.

Furthermore, all organizations represented within the governance structure of Belize's climate-resilient beef value chain must meet the requirement of formal legal recognition. Each organization should designate an official representative, in compliance with national legislation, to confirm its legal establishment and representation. This measure strengthens the governance structure, ensuring that only duly recognized and committed organizations participate, thus securing compliance and accountability within the initiative.

11.3. Policy proposals for value chain development

The foundation of this roadmap is proposed to be built on the following set of national policies, which will serve as the basis for strategic and technical interventions in the development of a climate-resilient beef value chain in Belize:

1) **Governance.** Establishment of a governance structure for the climate-resilient beef value chain in Belize, led by MAFSE and BLPA, to ensure sector compliance with national commitments related to environmental, climate, and commercial objectives. This structure will support training, technical assistance, processing, market development, and domestic and international commercialization (breeding, development, and fattening policies). Additionally, it will facilitate the development of a genetic improvement program and a comprehensive animal health program.
2) **Financing.** Financial support and access to credit, providing financial facilities for farmers to adopt climate-resilient practices that intensify production, retain breeding females to grow the national herd, reduce the sale of young animals, acquire genetic material to enhance the herd, implement required sanitary management practices, and enable potential carbon credit sales to international organizations and companies.
3) **Incentives.** Tax reductions to lower costs of genetic improvement, easing the import costs of semen, embryos, and in vitro procedures, fostering genetic improvement of the national herd. Implementing a Responsible Business Alliance (RBA) mechanism should be considered, in order to recognize such investments as deductible from income tax or offering partial reimbursements upon verification of their implementation. Define an allowable limit of expansion to meet a projected 10-20 years of demand and thereafter limit agricultural expansion by restricting the expansion of agricultural lands and intensifying production within existing areas through climate-resilient practices and financial incentives for protecting designated areas. This involves assessing the effectiveness of current environmental and sustainability laws to prevent land-use change, curb expansion, and promote natural regeneration and reforestation through sustainable livestock systems.
4) **MRV and traceability.** Technological support and strengthening of the animal traceability system, enhancing BLPA’s system to support herd growth strategies, market supply control, genetic improvement programs with quality animals adapted to climate variability and market demands, and comprehensive sanitary management practices. This system would manage the national herd as a unified entity. In addition, the creation of transparent market control mechanisms, and thr development of traceability tools to regulate market fluctuations, including transport permit quotas, differentiated tariffs based on animal weight, transport moratoriums, and public auction sales management.

5) **Trade agreements.** Review trade agreements with Guatemala and Mexico to assess the benefits of Belize's trade agreements and define quotas, closed seasons, or control mechanisms that enable producers to participate in the fattening stages and generate higher income.

11.4. Actionable roadmap and strategic recommendations

Based on the study findings and considering the identified challenges and opportunities, the following strategic recommendations are proposed:

1) **Production.** Promote herd growth and meat production by implementing and strengthening good climate resilience practices in livestock production, allowing the sustainable intensification of production in the same area and avoiding replacing forests with pastures.
2) **Governance**. Establish governance for the meat industry whereby participants create a climate-resilient production policy aligned with the goals linked to the fulfillment of the NDC and seize market opportunities.
3) **Unified vision.** Position the meat production sector as a unified entity by developing policies that support the industry as a "one big farm" concept.
4) **Policy and enabling environment.** Increase cattle production to ensure that the supply meets current and potential demands for live and processed meat.
5) **Financing.** Secure climate financing options by identifying and concretizing climate financing provided by international and multilateral cooperation agencies for various sustainable beef value chain actors.
6) **Markets and trade.** Develop a marketing strategy to promote climate-resilient, high-quality livestock production and its derived products.

For each strategic recommendation, a set of actions will be proposed to improve competitiveness, sustainability, and resilience, along with the relevant stakeholders to participate in each strategy. This approach will allow for the immediate exploitation of market opportunities by increasing production while maintaining operations resilient to climate variability. Given the nature of these strategies, there may be common actions across them.

Strategic Recommendation # 1.

SWOT TOPIC: PRODUCTION **1) Promote the growth of the herd and meat production through the implementation and strengthening of good climate resilience practices in livestock production, that allow the sustainable intensification of production in the same area and avoid replacing forests with pastures**
a) Design and implement a climate-resilient livestock strategy aimed at increasing the national herd size. This requires: • Participatory governance for decision-making and execution of the strategy (Strategy 2) • Commitment to maintain sufficient livestock and genetic material (Strategy 3) • Accessible financing to support activities with small producers (Strategy 5) Explicit limitations on the expansion of the agricultural frontier (Forest Act - Belize Law Chapter 213). Growth is therefore linked to access to financing (h) below without expanding the agricultural frontier

SWOT TOPIC: PRODUCTION

1) Promote the growth of the herd and meat production through the implementation and strengthening of good climate resilience practices in livestock production, that allow the sustainable intensification of production in the same area and avoid replacing forests with pastures

b) Expand the use of climate-resilient practices promoted by BLPA. This requires:

- Utilizing the registry of producers and animals to assess practices (Strategy 3)
- Classifying producers into those who already have some practices without support and those who have none, and defining workshops and training for the latter (Strategy 3)

c) Prioritize more complex and coordinated best practices (improvement of pastures, rational grazing, tree planting on farms, electric fencing, water harvesting and storage systems, among others). This requires:

A census of practices will also determine financing needs by practice; for example, how many projects involve rotation with electric fencing powered by solar energy (Strategy 3). After the census, the results would be processed in coordination between the SC and the TC, to prioritize the follow-up actions.

ncrease the dissemination of training, technical assistance, and experience sharing in climate-resilient practices. This requires:

- Financing for extension services (Strategy 5)

Demonstration workshops (Strategy 3). The design and organization will be the responsibility of the TC.

e) Intensify productive systems on farms and free up areas for conservation. This requires:

- Investment capital for rotation with soft loans or non-repayable grants (Strategy 5)

f) Increase animal leasing activities (which may include renting bulls for genetic improvement or renting cows to serve as host wombs) to boost production and enhance the breeding stock of production systems (these cannot be sold). This requires:

- A BLPA capable of managing a single farm policy in support of the Ministry of Agriculture, Food Security, and Enterprise (MAFSE) to carry out extension activities (Strategy 3)
- Financial support for producers utilizing the system through development funds (Strategy 5)
- Designing and implementing policies that address short-term financial needs (including climate resilience practices) to prevent premature sales of animals by producers (Strategies 3 and 5)

g) Review tax burdens to reduce the cost of importing semen, embryos, or in vitro procedures to support breeders. This requires:

- Analysis of the various taxes and fees associated with importing industry inputs and verify the fiscal benefits versus the limitations imposed on added value
- Offering a tax exemption period for producers who commit to maintaining an adequate percentage of animals for reproduction and improvement of the national livestock inventory

h) Limit the expansion of the agricultural frontier (Forest Act - Belize Law Chapter 213). This requires:

- Finding financial incentives to maintain forested areas and protect aquifers, rivers, and other water sources (e.g., Law 7575 creating FONAFIFO - National Forest Financing Fund and PSA - Payment for Environmental Services in Costa Rica)
- Intensifying forage production without expanding pasture areas through the use of climate-resilient practices (improving pastures, rational grazing, live fence posts, organic fertilizers for soil recarbonization, and so on).
- Monitoring and recording BLPA animals for herd growth and market supply control. This is essential for projecting market demand, participation quotas, price control, and so on.

Stakeholders involved:	**Mitigated challenges:**	**Opportunities addressed:**
Steering Committee and Technical Committee	2, 3, 14-18, 20, 25-29	3-8, 11-15, 19-28

Strategic Recommendation #2.

SWOT TOPIC: GOVERNANCE **2) Establish governance in the meat industry whereby participants create a climate-resilient production policy aligned with the goals linked to the fulfillment of the nationally determined contributions (NDC) committed by Belize and seize market opportunities**		
a) Create, through Executive Decree, a public-private commission that includes the political, technical, and research support for the governance structure of the beef value chain. This requires: • Commitment from stakeholders to promote climate-resilient activities that enhance productivity and foster a fair market for producers • Defining the leading organization to coordinate and support the strategic and operational development of the governance structure • Establishing the roles and responsibilities of each participant within the governance structure of the value chain		
Stakeholders involved: Steering Committee and Technical Committee	**Mitigated Challenges:** 1-8, 19, 20, 21-24	**Opportunities Addressed:** 3-8, 13-18, 19-22, 24

Strategic Recommendation # 3

SWOT TOPICS: UNIFIED VISION **3) Position the beef production sector as "one big farm" through the establishment of policies that benefit the industry**		
a) Define breeding, development, and fattening policies that comprehensively benefit all actors in the beef value chain. This requires: • Defining technical production parameters associated with market opportunities (weight for sale in national and international markets, restrictions on international sales) • Define the traceability mechanisms that demonstrate the standardization of policies, procedures, and monitoring. • Creating subsidies for breeding and fattening, which also benefit processors (Strategy 4) (Strategy 1) b) Create instruments to mitigate the impact of price volatility. This requires: • Discipline and monitoring of the application of BLPA policies among its members • Institutional support for market monitoring and cross-border trade • Financing to establish programs supporting required instruments (transport permit quotas, differentiated fees based on animal weight, transport moratoriums, quotas or closure periods, or control mechanisms). This approach can help establish mechanisms that replace undesirable market incentives (selling livestock before reaching market weight for immediate cash) (Strategies 5 and 4) c) Implement centralized auction control managed transparently by BLPA, ensuring these instruments do not affect producers' income. This requires: • Support from BLPA to map the national inventory distribution and understand supply throughout the year (Strategy 4) • Communication with the Ministry of Agriculture to promote awareness of the auction and formulate commercial strategies (Strategy 3)		
Stakeholders involved: BLPA MAFSE MSDCCDRM	**Mitigated Challenges:** 1, 2, 11-18, 19, 21-24	**Opportunities Addressed:** 3-8, 13-20, 22, 23

Strategic Recommendation # 4

SWOT TOPICS: PRODUCTION **4) Increase livestock production to meet the current and potential demand identified for live animals and processed meat**
a) Intensify production on cattle farms through climate resilience practices. This requires: • Establishing a policy to retain females for reproduction and herd growth

SWOT TOPICS: PRODUCTION **4) Increase livestock production to meet the current and potential demand identified for live animals and processed meat**		
• Focusing primarily on the sale of bulls, young bulls, and cull animals • Implementing rational grazing systems, pasture rotation, electric fencing, water supply in pastures, and tree planting on farms to increase forage biomass production and carrying capacity (number of animals per area) b) Create transparent instruments to control market fluctuations (transport permit quotas, differentiated fees based on animal weight, transport moratoriums, and so on). This requires: • A governance structure that can inclusively represent different sectors, including the private sector and civil society • A system to monitor prices, potentially achieved through controlled auctions where information is shared and disseminated among producers c) Re-evaluate the benefits of trade agreements between Belize with Guatemala and Mexico, and CARICOM, United Kingdom, and Taiwan. This requires: • Establishing quotas or closure periods or control mechanisms to allow producers to participate in the fattening phases and generate more income (Strategy 4).		
Stakeholders involved: BLPA MAFSE Technical Committee	**Mitigated Challenges:** 1, 2, 4, 7-9, 11, 13, 17, 18, 21, 23, 26, 29	**Opportunities Addressed:** 1, 2, 9-15, 19-21, 25-28

Strategic Recommendation # 5

SWOT TOPICS: FINANCING **5) Secure climate financing options provided by international and multilateral cooperation agencies for various stakeholders in the sustainable beef production value chain**		
a) Follow up on the search for climate funds for livestock activities. This requires: • Governance that institutionally supports the market and proposes operational mechanisms (Strategies 2 and 3) b) Collaborate with NGOs (e.g., The Nature Conservancy) and government offices (Office of Climate Change) to sell carbon credits from protected forest areas managed by producers (Strategies 2 and 3). This requires: • Attracting investment or non-repayable funds into the country's financial sector • Institutional coordination (similar to the collaboration between BLPA and DFC) for market distribution of carbon credits • A national financial policy enabling the sale of carbon credits to organizations and companies abroad in international offerings c) Design and implementation of a credit program tied to no-deforestation commitments (acknowledging that farmers may still engage in land-use change), offering zero-interest rates along with additional facilities and incentives		
Stakeholders involved: BLPA MAFSE Technical Comitee	**Mitigated Challenges:** 1, 11, 12, 20, 21, 22-32	**Opportunities Addressed:** 1, 5-11, 13, 15, 19-21, 24, 25, 29

Strategic Recommendation # 6

SWOT TOPICS: MARKETS AND TRADE **6) Develop a marketing strategy to promote climate-resilient, high-quality livestock production and its derived products**
a) Establish a program for producers who can apply for certification or voluntary third-party verification of sustainable production methods. This requires: • Coordination and support from BLPA to guide and select those producers ready for certification (Strategy 2).

SWOT TOPICS: MARKETS AND TRADE **6) Develop a marketing strategy to promote climate-resilient, high-quality livestock production and its derived products**		
• Financing for necessary requirements (Strategy 5) b) Create a national brand based on this certification to identify and communicate the production systems utilized by the industry. This requires: • Institutional support from BLPA for producers within industry guidelines (Strategies 2 and 3) • A registration program for producers who meet the requirements and provide evidence for the national brand (Strategies 2 and 3)		
Stakeholders involved: BLPA MAFSE Technical Committee	**Mitigated Challenges:** 11, 13, 17-20, 25-29	**Opportunities Addressed:** 9-15, 18, 20, 24-28

11.5. Implementation phases

Table 44 outlines a phased ten-year implementation schedule for the roadmap and strategic recommendations for developing Belize's climate-resilient beef value chain

Table 44. Implementation schedule for the ten-year roadmap and strategic recommendations

Roadmap and strategic recommendations	Responsible	Short term (1 to 4 years)	Medium term (5 to 7 years)	Long term (8 to 10 years)
SWOT TOPICS: PRODUCTION **1) Promote the growth of the herd and meat production through the implementation and strengthening of good climate resilience practices in livestock production that allow the sustainable intensification of production in the same area and avoid replacing forests with pastures.**				
a) Design and implement a climate-resilient livestock strategy aimed at increasing the national herd size	SC - TC	X		
b) Expand the use of climate-resilient practices promoted by (BLPA	BLPA - MAFSE	X	X	X
c) Prioritize more complex and coordinated best practices (improvement of pastures, rational grazing, tree planting on farms, electric fencing, water harvesting and storage systems, among others)	BLPA - MAFSE	X	X	X
d) Increase the dissemination of training, technical assistance, and experience sharing in climate-resilient practices	BLPA – MAFSE - MSDCCDRM	X	X	X
e) Intensify productive systems on farms and free up areas for conservation	BLPA - MAFSE	X	X	X
f) Increase animal leasing activities (which may include renting bulls for genetic improvement or renting cows to serve as host wombs) to boost production and enhance the breeding stock of production systems (these cannot be sold)	BLPA – Ministry of Finance	X	X	

Roadmap and strategic recommendations	Responsible	Short term (1 to 4 years)	Medium term (5 to 7 years)	Long term (8 to 10 years)
g) Review tax burdens to reduce the cost of importing semen, embryos, or in vitro procedures to support breeders	BLPA – Ministry of Finance	X		
h) Limit the expansion of the agricultural frontier (Forest Act - Belize Law Chapter 213)	BLPA - MSDCCDRM	X		
SWOT TOPIC: GOVERNANCE **2) Establish governance in the meat industry whereby participants create a climate-resilient production policy aligned with the goals linked to the fulfillment of the NDC targetsand seize market opportunities**				
a) Create a public-private commission that includes the political, technical, and research support for the governance structure of the beef value chain	SC - TC	X	X	X
SWOT TOPICS: PRODUCTION AND MARKET **3) Position the beef production sector as "one big farm" through the establishment of policies that benefit the industry**				
a) Define breeding, development, and fattening policies that comprehensively benefit all actors in the beef value chain	SC - TC	X	X	X
b) Create instruments to mitigate the impact of price volatility	Ministry of Finance - BBS	X		
c) Implement centralized auction control managed transparently by BLPA, ensuring these instruments do not affect producers' income	BLPA – Ministry of Finance	X	X	X
d) Implement a mandatory national herd health management program for producers to ensure disease and pest prevention practices, safeguarding the marketability of products within the beef value chain	BAHA – BLPA - MAFSE	X	X	X
SWOT TOPICS: PRODUCTION AND MARKET **4) Increase livestock production to meet the current and potential demand identified for live animals and processed meat**				
a) Intensify production on cattle farms through climate resilience practices	BLPA – MAFSE	X	X	X
b) Create transparent instruments to control market fluctuations (transport permit quotas, differentiated fees based on animal weight, transport moratoriums, and so on)	BLPA – UBCFC - GALEN	X	X	
c) Re-evaluate the benefits of trade agreements between Belize and Guatemala and Mexico	Ministry of Trade - BLPA	X		
SWOT TOPICS: CLIMATE CHANGE **5) Secure climate financing options provided by international and multilateral cooperation agencies for various stakeholders in the sustainable beef production value chain**				

Roadmap and strategic recommendations	Responsible	Short term (1 to 4 years)	Medium term (5 to 7 years)	Long term (8 to 10 years)
a) Follow up on the search for climate funds for livestock activities	BLPA – MAFSE – MSDCCDRM	X	X	X
b) Collaborate with NGOs (e.g., The Nature Conservancy) and government offices (Office of Climate Change) to sell carbon credits from protected forest areas managed by producers (Strategies 2 and 3)	MSDCCDRM – TNC – BLPA – Ministry of Finance	X	X	X
c) Design and implement a credit program linked to no-deforestation commitments (while recognizing that farmers may still engage in land-use change), offering zero-interest loans along with additional facilities and incentives	MSDCCDRM – TNC - BLPA	X	X	X
SWOT TOPICS: MARKET AND CLIMATE CHANGE **6) Develop a marketing strategy to promote climate-resilient livestock production and its derived products**				
a) Establish a program for producers who can apply for certification or voluntary third-party verification of sustainable production methods	BLPA – BBS - MAFSE	X	X	X
b) Create a national brand based on this certification to identify and communicate the production systems utilized by the industry	BLPA – BBS – MAFSE - UBCFC	X	X	X

11.6. Implementation budget

Table 45 provides a detailed budget in U.S. dollars for implementing the roadmap and strategic recommendations to develop Belize's climate-resilient beef value chain.

As outlined, the total budget amounts to USD 39 893 438 for the first ten years, covering the required strategic, technical, and operational work. This budget relies on a combination of reimbursable and non-reimbursable resources, secured through engagement with various financial stakeholders identified during the study at both national and international levels.

Table 45. Ten-year implementation budget for the roadmap and strategic recommendations

Roadmap and strategic recommendations	Calculation assumptions	USD Short term (1 to 4 years)	USD Medium term (5 to 7 years)	USD Long term (8 to 10 years)	TOTAL USD
SWOT TOPICS: PRODUCTION AND CLIMATE CHANGE **1) Promote the growth of the herd and meat production through the implementation and strengthening of good climate resilience practices in livestock production that allow the sustainable intensification of production in the same area and avoid replacing forests with pastures**					

Roadmap and strategic recommendations	Calculation assumptions	USD Short term (1 to 4 years)	USD Medium term (5 to 7 years)	USD Long term (8 to 10 years)	TOTAL USD
a) Design and implement a climate-resilient livestock strategy aimed at increasing the national herd size	Technical staff for MAFSE and BLPA dedicated to training, knowledge transfer, experience exchange, monitoring, and recording the growth of the national herd. A total of eight personnel: four from MAFSE and four from BLPA. Salary set at USD 2 000 per agronomist per month, with no deductions or social contributions, based on Belize's official salary data	768 000	576 000	576 000	1 920 000
b) Expand the use of climate-resilient practices promoted by BLPA	Consultancy to survey climate-resilient practices, with a budget of USD 40 000. The market value of consultants in Belize and inflation adjustments are not taken into account	40 000			40 000
c) Prioritize more complex and coordinated best practices (improvement of pastures, rational grazing, tree planting on farms, electric fencing, water harvesting and storage systems, among others)	Accessible climate financing for a set of selected practices. In the short term, funding will be provided to 284 small-scale farmers; in the medium term, 528 farmers; and in the long term, 850 farmers. The average financing amount per practice is estimated at USD 11 000, based on the financial analysis conducted	3 127 713	5 804 453	9 354 043	18 286 208
d) Increase the dissemination of training, technical assistance, and experience sharing in climate-resilient practices	Training workshops: 24 producer workshops at USD 4 000 per workshop	384 000	288 000	288 000	960 000
e) Intensify productive systems on farms and free up areas for conservation	Included under other ítems				-
f) Increase animal leasing activities (which may include renting bulls for genetic improvement or renting cows to serve as host wombs) to boost production and enhance the breeding stock of production systems (these cannot be sold)	Subsidy for small producers using non-reimbursable funds. Grants should be equivalent to the profit margin from the sale of a heifer, estimated at USD 100 per heifer for projection purposes. The retention of 5 000 heifers per year is considered. For medium and large producers, access to capital will be provided under favorable conditions that allow for accessible repayment through cattle sales	2 000 000	1 500 000	1 500 000	5 000 000
g) Review tax burdens to reduce the cost of importing semen, embryos, or in vitro	Included under other items				-

Roadmap and strategic recommendations	Calculation assumptions	USD Short term (1 to 4 years)	USD Medium term (5 to 7 years)	USD Long term (8 to 10 years)	TOTAL USD
procedures to support breeders					
h) Limit the expansion of the agricultural frontier (Forest Act - Belize Law Chapter 213)	Included under other items				-
	SUBTOTALS STRATEGY 1	**6 319 713**	**8 168 453**	**11 718 043**	**26 206 208**
SWOT TOPIC: GOVERNANCE **2) Establish governance in the meat industry whereby participants create a climate-resilient production policy aligned with the goals linked to the fulfillment of the NDC targets and seize market opportunities**					
a) Create a public-private commission that includes the political, technical, and research support for the governance structure of the beef value chain	Inter-institutional coordination for establishing the proposed governance structure of the beef value chain. Operational expenses for governance consolidation are estimated at USD 3 000 per month	144 000	108 000	108 000	360 000
	SUBTOTALS STRATEGY 2	**144 000**	**108 000**	**108 000**	**360 000**
SWOT TOPICS: PRODUCTION AND MARKET **3) Position the beef production sector as "one big farm" through the establishment of policies that benefit the industry**					
a) Define breeding, development, and fattening policies that comprehensively benefit all actors in the beef value chain	Consultancy for designing a breeding, development, and fattening policy. Budget: USD 40 000	40 000			40 000
b) Create instruments to mitigate the impact of price volatility	Institutional support for market monitoring and cross-border trade. One professional at USD 2 000 per month	96 000	72 000	72 000	240 000
c) Implement centralized auction control managed transparently by BLPA, ensuring these instruments do not affect producers' income	Financing to establish programs to support the required instruments (transport permit quotas, differentiated tariffs based on animal weight, transport moratoriums, closed seasons, or control mechanisms). Budget: USD 50 000 per year	200 000	150 000	150 000	500 000
	Implement a centralized auction control system managed transparently by BLPA, ensuring that these mechanisms do not negatively impact producers' income. Budget: USD 2 000 per month for a permanent staff member	96 000	72 000	72 000	240 000

Roadmap and strategic recommendations	Calculation assumptions	USD Short term (1 to 4 years)	USD Medium term (5 to 7 years)	USD Long term (8 to 10 years)	TOTAL USD
	Implement a centralized auction control system managed transparently by BLPA, ensuring that these mechanisms do not negatively impact producers' income. Budget: USD 50 000 for the auction system's technological equipment, with an annual maintenance cost of USD 5 000	100 000	15 000	15 000	130 000
d) Implement a national herd health management program, with mandatory compliance by producers, to ensure disease and pest prevention practices that affect the commercialization of products in the beef value chain	Design of the national herd health program	80 000			
	Producer training: 24 workshops for producers at USD 4 000 per workshop	384 000	288 000	288 000	960 000
	Implementation of an accessible health program for livestock farmers. Subsidy for small-scale farmers using non-reimbursable funds. Grants should be equivalent to USD 100 per farmer	800 000	450 000	300 000	1 550 000
	Monitoring of the national health program implementation: One professional at USD 2 000 per month.	96 000	72 000	72 000	240 000
	SUBTOTALS STRATEGY 3	**1 892 000**	**1 119 000**	**969 000**	**3 900 000**
SWOT TOPICS: PRODUCTION AND MARKET **4) Increase livestock production to meet the current and potential demand identified for live animals and processed meat.**					
a) Intensify production on cattle farms through climate resilience practices	Implement rational grazing systems, pasture rotation, electric fences, pasture watering and tree planting on farms to increase forage biomass production and gazing capacity (number of animals per area) (Budget separate in USD 131,205,112) (Strategy 1)				-
b) Create transparent instruments to control market fluctuations (transport permit quotas,	Consulting to create transparent instruments to control market fluctuations. USD 40 000	70 000	30 000	30 000	130 000

Roadmap and strategic recommendations	Calculation assumptions	USD Short term (1 to 4 years)	USD Medium term (5 to 7 years)	USD Long term (8 to 10 years)	TOTAL USD
differentiated fees based on animal weight, transport moratoriums, and so on) c) Re-evaluate the benefits of trade agreements between Belize and Guatemala / Belize and Mexico	A price monitoring system through controlled auctions where information is shared and disseminated among producers (Strategy 3)	96 000	72 000	72 000	240 000
	SUBTOTALS STRATEGY 4	**166 000**	**102 000**	**102 000**	**370 000**
SWOT TOPICS: CLIMATE CHANGE **5) Secure climate financing options provided by international and multilateral cooperation agencies for various stakeholders in the sustainable beef production value chain**					
a) Follow up on the search for climate funds for livestock activities	Inter-institutional coordination for establishing the proposed governance structure of the beef value chain to support the market. Consultancy to manage sources of climate finance: USD 30 000.	30 000	30 000	30 000	90 000
b) Collaborate with NGOs (e.g., The Nature Conservancy) and government offices (Office of Climate Change) to sell carbon credits from protected forest areas managed by producers (Strategies 2 and 3).	Design and implementation of a platform for the sale of carbon credits, funded in the first year, with subsequent funding generated through carbon sales.	200 000			200 000
	Coordination for the sale of carbon credits through government offices—management of non-reimbursable climate funds. Carbon credit price: USD 7.50. 100 000 carbon credits in the first phase (one to four years), 100 000 carbon credits in the second phase (five to seven years).	750 000	750 000		1 500 000
c) Design and implementation of a credit program linked to no deforestation (understanding that farmers may still engage in land-use change), with zero-interest rates and additional facilities and incentives.	Consultancy for program design: USD 40 000.	40 000			40 000

Roadmap and strategic recommendations	Calculation assumptions	USD Short term (1 to 4 years)	USD Medium term (5 to 7 years)	USD Long term (8 to 10 years)	TOTAL USD
	Non-reimbursable climate financing to encourage zero deforestation practices. In the short term, 50 farmers will be funded; in the medium term, 100 farmers will be funded; and in the long term, 150 farmers will be funded. The average incentive per farmer is estimated at USD 2 400.	523 710	682 410	841 110	2 047 230
	SUBTOTALS STRATEGY 5	**1 543 710**	**1 462 410**	**871 110**	**3 877 230**
SWOT TOPICS: MARKET AND CLIMATE CHANGE **6) Develop a marketing strategy to promote climate-resilient livestock production and its derived products**					
a) Establish a program for producers who can apply for certification or voluntary third-party verification of sustainable production methods	Establishment of a Country Brand program for the certification of producers (voluntary verification) by third parties on sustainable production practices. Program creation: USD 80 000.	80 000			80 000
b) Create a national brand based on this certification to identify and communicate the production systems utilized by the industry	A registration program (MRV: monitoring, reporting, and verification) for producers who meet the requirements and provide evidence for the national brand (Strategies 2 and 3). Budget: USD 100 000.	100 000			100 000
	Selection and certification of producers: USD 5,000 per certification, with a total of 100 producers per year. (Non-reimbursable financing)	2 000 000	1 500 000	1 500 000	5 000 000
	SUBTOTALS STRATEGY 6	**2 180 000**	**1 500 000**	**1 500 000**	**5 180 000**
	TOTAL	**12 245 423**	**12 459 863**	**15 268 153**	**39 893 438**

11.7. Conclusions and recommendations

Production and technical assistance

- Belize has a large number of small cattle producers. This diversity leads to non-standardized practices across the country, making it difficult to foster efficiency and productivity. Countries with similar challenges have implemented Uruguay´s Cattle Farming Model, managing the national herd as “one big farm.”
- Most farmers utilize at least one sustainable production practice, typically basic rotational pasture activities. However, these isolated practices do not guarantee full protection of soil nutrients, water sources, or forest protection. For example, while some farmers engage in reforestation, the introduced species do not always contribute to long-term ecological restoration or efficiency.
- Farmers sell their cattle before the animals reach an optimal weight before slaughtering. By selling young animals, they lose the opportunity to maximize weight potential and contribute to herd growth. This happens because there is a market that offers readily available incentives (Guatemalan buyers) with low risk and easy short-term earnings to farmers but also because there is a financial need, especially for small farmers.
- Selling young animals hinders the growth of the national cattle inventory. This limits the development of new markets and opportunities to improve the herd's genetic material.
- There is a cyclical issue between production and market demands. Young animals are sold to meet the needs of existing markets, but the national herd cannot grow fast enough to keep up with market demand.
- Veterinarian support and adequate management of vaccination and preventive health programs are rare in Belize. Additionally, importing high-quality genetic material from South America is both complex and costly.

Recommendations:

- At the national level, BLPA should encourage the adoption of standard practices to implement the “one big farm” model to improve efficiency, integrate technology, CSA practices and provide extension technical services. This model could also support Belize in seeking an international certification to verify the quality and advancement of the country's cattle sector.
- Develop agricultural extension models that provide producers with access to genetic resources and "leasing" arrangements for breeding animals, with the commitment to keeping young animals to grow the national herd.
- Implement policies and training programs that promote and support beef exports to Mexico, which requires heavier animals. This would require producers to keep their animals for longer, choose those that will be used for herd growth, and ultimately achieve a higher return on investment for each animal sold.
- Develop a comprehensive technical package and training programs, supported by systematic extension activities in CSA practices. For example, guiding farmers on which species to plant, protecting the agricultural frontier, adapting to climate change, focusing on using endemic varieties and promoting practices that strengthen intensive rotational pasture activities. This approach will allow for more animals to be raised on the same land, effectively increasing herd

sizes. Moreover, farmers should implement a comprehensive package of sustainable practices tailored to their specific circumstances, considering factors like land extension, topography, soil condition, and so on. A clear step-by-step guide should be provided, outlining what to implement first and how to progress with integrated practices over time. This strategy will enable more integrated smart agricultural practices that will contribute to climate adaptation, enhance environmental protection, and increase productivity. These guidelines should be developed collaboratively by BLPA jointly and the Ministry of Agriculture, with incentives to encourage farmers to adopt these practices.

- Provide educational programs for farmers and incentivize the enhancement of herd management practices according to technical guidelines. This program should include practices to help farmers to keep the correct number of animals available for restocking and teach them how to raise them to an adequate weight before selling (including potential financial benefits). These programs must also be linked with appropriate sustainable practices to foster intensive management to gain weight more efficiently.
- Organize and provide veterinary control and extension services to farmers. BLPA should also work with government authorities to simplify the import process for high-quality genetic material to improve the national herd.
- BLPA and local veterinary science universities should establish partnerships with institutions in Mexico, the U.S., and Canada to explore funding for scholarships and develop joint programs. These partnerships could include student and faculty exchanges and the integration of "social service" requirements, where students provide supervised services to the industry as part of their academic programs and graduation requirements. For foreign students, the incentive would be not only the opportunity to spend time in Belize but also to gain direct industry experience while subsidizing their education.
- The recommended effort to retain female cattle in the national herd, aimed at expanding the country's production capacity, should be complemented by the introduction of climate-resilient breeds. These breeds must align with potential markets to enhance producers' incomes effectively. Another recommendation in this effort can be to establish a financing support mechanism to 1) on-lend to the farmer the value of his intended sale of young heifers and or 2) allow for BLPA to purchase heifers and reselling them to farmers who are capable of growing them and putting them into production.
- It is necessary to implement an MRV and traceability system that enables the Government and BLPA to monitor the implementation of CSA practices on farms, ensuring their impact on sustainable compliance and reducing potential risks.

Meat processing

- Processors operated under very difficult conditions during the COVID-19 pandemic. However, they have experienced steady annual growth over the past three years. While they have a loyal customer base, the rising demand for beef and the decreasing availability of slaughter cattle is creating strain, particularly due to competition with transporters and intermediaries exporting cattle. This situation may impact not only the availability of final cuts but also the quality of products.

- There is a lack of government programs specifically designed to assist processors in improving productivity, meeting high-quality standards, and adopting modern packaging practices. Regulations governing meat handling are inconsistent. Processors are subject to strict food safety protocols, while butchers follow less stringent public health regulations.
- There is also a lack of coordination in balancing Belize's food security needs with access to imported beef aimed at satisfying the tourism industry. While local processors can produce the cuts and quality tourists seek, no policy has been developed to address this issue. Additionally, imported products, such as ribeye cuts, with unknown management and production practices, which compete directly with processors, increasing the stress in the system.

Recommendations:

- Develop, jointly with academic institutions and government agencies, a package of good production processing practices that may be certifiable by international standards. The government should also provide recognition and support in form of incentives for implementing such practices.
- The government must establish clear guidelines and labeling standards for imported products, to ensure compliance with the same regulations applied to local processors.
- Develop governance with BLPA that enables stakeholders to transparently utilize existing mechanisms for importing beef cuts. This governance could create systems to regulate the supply and demand of imports within the framework of national production.

Markets

Live Cattle Market

- Price volatility in the cattle market, is mainly due to Guatemalan traders, while the Mexican market looks for a more stable pricing demands of the Mexican market. This price volatility also impacts the local market with price fluctuation in different beef products.
- Mexico has shown interest in increasing the demand for cattle, reflecting an international trend of high demand and limited supply. This increase in demand for the Mexican market represents a very good opportunity to expand cattle production in Belize.
- Local producers, such as Mennonites have successfully participated in formal cattle sales to the Mexican importers of cattle. Their high level of organization enables them to consistently engage in the export market.
- Access to suitable transportation of cattle is a challenge for farmers since most of them do not have vehicles for safely transport cattle to ranches, processors, or the Guatemalan border. This limitation impedes negotiating better prices at the gate since they do not have control of the transportation logistics.
- There are currently no sufficient genetic resources or animals in the national herd to meet the necessary growth in the market without compromising the country's domestic protein needs.
- The Mexican export market relies on a decree that grants Mexican importers exemptions from import taxes and VAT. Any sectoral policy or investment would depend on Mexico's unilateral

decision-making. For instance, a declaration of screwworm presence in Belize would halt exports for at least 18 months. While Guatemala could remain an option, Mexico could also close the Guatemalan market for the same phytosanitary reasons.

Beef Cattle Market

- The local beef products are considered to be healthier and more natural compared to imported ones. The production offers products to a wide variety of segments in the local market, from popular low-cost cuts, to premium ones. There is also an important trade with Guatemala and Mexico, that limits internal growth potential, while production constraints restrict the ability to capitalize fully on these markets.
- There is an increasing international regulations environment (i.e. the European Union Directive on Deforestation, HACCP certified products, free trade agreement with Taiwan) that opens new markets and provide opportunities to position the country itself as a sustainable cattle beef producer, differentiating it from more traditional cattle-producing nations.
- Local processors have also identified potential available beef markets available like high end resorts, cruise ships and other countries in the Caribbean, including the Bahamas with a very active cruise ship industry.
- Local beef markets, (consumers especially), except for tourists who seek imported beef, do not differentiate beef pricing based on production methods (e.g., sustainable vs. non-sustainable beef) or cattle breed quality.
- Local beef consumers are unwilling to pay a premium for beef produced through sustainable methods, as they are already paying higher beef prices compared to poultry or pork in the market.

Recommendations:

Live Cattle Market

- Raise cattle to adequate weight by implementing consistent practices to take advantage of more formal and price-stable markets like Mexico. However, it is also important to increase the herd size, to keep internal market at reasonable prices and accessible to local consumption. By satisfying these volumes, the cattle industry could also benefit from a formal trade agreement with other countries.
- Replicate the experience of the producers that have engaged in formal sales (almost exporting processes), making their practices scalable to other producers or groups of small producers to create joint efforts.
- Promote Belize as a country with integrated sustainable practices as a reliable and good quality source of cattle. This would open not only potential markets but also position of Belize in terms of quality, not competing with large volumes producers. The country should develop a comprehensive marketing strategy make a business case and show the sustainable practices in

the country, like other organizations have done it (i.e. CORFOGA in Costa Rica). Consider the advantages of a national brand backed by international sustainability certification.

- It is important that BLPA participates in international organizations to facilitate knowledge exchange and technology transfer, as well as to use these platforms to showcase Belize's cattle industry initiatives.
- Producers will benefit from an increased, consistent local beef supply under the "one big farm" concept, strengthening the supply chain.

Beef Cattle Market

- Since Belize is not self-sufficient in supplying beef for local consumption, it is advisable to focus the initial phase of the strategy on increasing the livestock inventory through NAMA schemes, to meet domestic demand. In a subsequent phase, the strategy can then target the development of export markets.
- Support processors through government agencies to foster commercial relationships with the potential identified markets. A governance structure should be established, involving institutions with expertise in international trade, to collaborate in identifying new markets. This governance should also include agencies responsible for clarifying regulatory requirements and identifying pathways to meet them. The governance concept can be rooted in the "one big farm" model, which addresses opportunities from the perspective of local market needs.
- Created value-added products such as beef jerky, marinated steaks, or ready-to-cook meal kits advertising the sustainable origin and introducing the concept of better health and price premium. These products are consumed by a differentiated public in Belize with more income.
- Leverage online platforms or partner with specialized beef retailers to directly reach consumers seeking high-quality, sustainably produced beef.
- Collaborate with restaurants that prioritize sustainable and locally sourced ingredients. This can create a steady demand and justify premium pricing. Additionally, secure contracts with businesses committed to sustainability, supplying them with sustainable beef for their cafeterias or events.
- Target health-conscious consumers who are willing to pay more for sustainably produced, high-quality beef. Implement a model where consumers pay upfront for a share of the beef produced over a season, ensuring steady income and fostering customer loyalty.

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Governance, policies and regulations

- The institutions and organizations related to the sector in Belize work very well but in silos. This lack of synergies produces not only overlapping and duplication of efforts but in some areas no action at all.
- Formal beef exporters to Mexico face tax and phytosanitary obligations, while informal traders ("coyotes") often do not, putting formal exporters at a cost disadvantage.

Recommendations:

- To formalize the governance proposal for the "Climate-Resilient Beef Value Chain of Belize," it is recommended that it be officially declared a matter of public interest through an Executive Decree. Besides, all organizations represented within the governance structure of Belize's climate-resilient beef value chain must meet the requirement of formal legal recognition.
- BLPA should play a role in being the pivotal agent to articulate institutional communication and efforts bringing all farmers together to create well-thought policies and practices for the industry. BLPA should also strengthen ties with international organizations to facilitate knowledge transfer and distinguish Belize's cattle industry through differentiated branding.
- The tax structure of the sector should be reviewed by assuring that proper practices are encouraged, and adequate collection takes place. Taxes from the sector should be re-invested in technology transfer, knowledge enhancement, and technical support to improve productivity, quality, and sustainability in the cattle industry.

Financing and incentives

- The cattle industry requires continuous cash flow and long-term investments for improved breeding, appropriate feed of cattle, veterinary care, land and pasture management, amongst others. However, farmers face difficulties in accessing financial support from government and financial institutions which makes it difficult to expand their operations and improve their business sustainability.
- Farmers receive little recognition particularly from buyers, for their efforts to implement sustainable production practices.

Recommendations:

- The herd's growth must be linked to financing measures allowing producers to adopt sustainable intensification practices, rather than deforestation. A “zero-rate” financial tool could be developed, offering non-repayable funds to producers in exchange for committing to maintaining forest cover on their lands.
- Create specific mechanisms for grants, subsidies or low interest loans to producers, making more accessible the capital to improve operations. These solutions may take the form of public-private partnerships even with international financial institutions.
- Develop clear market incentives such as certification programs, or financial incentives for sustainable practices to make farmers’ and processors’ efforts toward higher quality and sustainability more visible.
- Increase low-interest credit lines for cattle rearing and fattening, using the cattle as collateral. This could also include a leasing arrangement, allowing producers to access capital without large upfront investments.

Knowledge, technology and equipment

- Many farmers lack the necessary knowledge and technical assistance to adopt better production and sustainable practices. For example, small farmers may not be fully aware that selling cattle under the optimal slaughter weight decreases profit margins. As stated previously, Guatemalan traders capitalize on this opportunity, fattening the cattle and then selling to the Mexican market.
- This knowledge gap also impacts the use of available techniques, for example for genetic improvement of the cattle. Some tools and their costs make farmers use less advanced options or rely on common knowledge, creating a disadvantage with other international producers with better access to technological transfer.

Recommendations:

- Create educational assistance, extension activities and training programs jointly in collaboration with government agencies and educational institutions in Belize, which have the trust of farmers. These programs should also focus on making modern equipment and technology accessible.
- Expand to all producers, advanced breeding techniques like in-vitro fertilization or artificial insemination, in a systematic way. Extension programs should accompany these initiatives to accelerate genetic improvements within the herd.

Climate change

- The climate change aspect can be seen in rising temperatures, changes in rainfall patterns and temperature, longer dry periods, changing weather patterns and flooding events. All these manifestations of climate change directly impact the cattle sector for example degrading the pasture quality, making difficult to access fresh water, increasing veterinary costs due to pests outbursts, and even loosing animals due to extreme weather conditions.

Recommendations:

- Design a climate-resilient cattle farming strategy for Belize through a public-private partnership that aligns organizational goals and resources toward its national implementation.
- Implement weather-resilient practices as part of the technological transfer and educational package that must be developed by joint efforts by government agencies, educational institutions, and BLPA. These practices may lead to better pasture management, access to water resources and forest preservation, making specific sectors less vulnerable to climate volatility.
- Limit agricultural frontier expansion to prevent the loss of primary and secondary forests and ecosystem damage and the county's biodiversity. Instead, promote the intensification of production in existing pasture areas using climate-resilient practices, which will also increase productivity.
- Monitor weather patterns continuously and exchange adaptation strategies with international organizations to apply climate resilience measures suited to Belize's specific conditions.

11.8. Recommendations for future studies and monitoring

Based on the findings and recommendations of this study, several potential areas for future research and monitoring have been identified. These areas were not the primary focus of the current project but could further enhance and support the proposed strategies and solutions in this report:

1. **GHG Emissions Inventory**: Conduct comprehensive research to estimate the current greenhouse gas (GHG) emissions inventory from the beef cattle industry in Belize, as well as the GHG emissions resulting from herd growth based on this study's recommendations. This study should encompass all relevant emission sources, including enteric emissions, manure, and others. The findings could provide the Government of Belize and the Belize Livestock Producers Association (BLPA) with critical information needed to adjust goals and actions in line with the Nationally Determined Contributions (NDC) for this sector while aligning with market development initiatives proposed herein.
2. **Public Registry Verification**: Perform a study to verify the public registry of cattle ranchers' farms. This research could aim to ensure the implementation of Climate-Smart Agriculture (CSA) practices on these farms and to mitigate potential negative impacts from activities lacking legal formalities.
3. **Market Demand Analysis**: Conduct an analysis focused on the hotel, restaurant, and catering sectors to assess demand for high-quality beef products. Given the rise in tourism and international visitors, understanding the market's preference for premium beef presents a viable opportunity for local producers to cater to this niche market.
4. **Low Carbon Beef Certification**: Investigate the feasibility of integrating a “Low Carbon Beef Certification” within the value chain of Belize's beef industry. This research would require that beef production emits fewer GHGs than the industry standard, supporting the country's commitment to environmentally responsible beef production. Moreover, aligning this certification with the implementation of the roadmap and strategic recommendations from this study can significantly enhance the market's sustainability credentials.
5. **Rebranding Campaign**: Develop a study to outline a “rebranding” communication campaign. The results of this research could enable the Government of Belize and BLPA to effectively promote sustainable production methods that ensure a high-quality meat supply. Such a campaign can expand the local market for Belizean producers, reduce imports, lower GHG emissions, and bolster the domestic beef industry's market share.

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ANNEX No.1. List of actors in the beef cattle value chain

No.	Organization	Type of Stakeholder	Description	Contribution to Research	Position in the value chain
1	Cattle Producers	Private	Cattle farmers (6,808 according to BLPA) play fundamental role in the production and supply of beef. Their primary responsibilities include raising and managing cattle, which involves tasks such as feeding, breeding, and maintaining animal health.	Provide information on the whole process of raising cattle, cattle feed, cattle diseases, market prices, sustainable practices, and the overall role of breeders in the beef cattle value chain.	Producers
2	Cattle Breeders	Private	15 cattle breeders are focused on improving the genetic quality of livestock through selective breeding.	Provide information on breeding techniques/processes, quality genetics, sustainable practices and the overall role of breeders in the beef cattle value chain.	Producers
3	Beef Processors	Private	12 beef processors are mainly focused on producing by-products of beef cattle.	Provide information on processing products, processing requirements, sustainable practices, the overall role of breeders in the beef cattle value chain.	Transformers/Processors
4	Cattle traders, exporters and transporters	Private	82 cattle transporters are also known as traders. They play a crucial role in determining market prices and ensuring that cattle are efficiently transferred between producers and end-users	Provide information on cattle market prices, trading requirements, exportation demand and supply, and the overall role of breeders in the beef cattle value chain.	Traders, exporters and transporters
5	Belize Livestock Producer Association (BLPA)	Private	Advocating for livestock industry stakeholders, enhancing farmers' access to high-value markets, and disseminating new	Information on BLPA members, cattle livestock and sustainable beef cattle in Belize.	Industry/Business Association

No.	Organization	Type of Stakeholder	Description	Contribution to Research	Position in the value chain
			technologies and information through technical training, education initiatives, and projects.		
6	Belize Hotel Association (BHA)	Private	Responsible to support the sustainable growth of member hotels and the tourism industry in Belize through global marketing initiatives, private and public sector partnerships and training opportunities aimed at increased standards and professional service.	Information on the challenges and opportunities in the sustainable beef cattle market.	Industry/Business Association
7	Belize Tourism Industry Association (BTIA)	Public	Responsible to bring together tourism related interests to meet the challenges of a dynamic and growing tourism industry in Belize.	Information on the challenges and opportunities in the sustainable beef cattle market.	Industry/Business Association
8	Belize Chamber of Commerce and Industry (BCCI)	Private	Quasi agency responsible in assisting all business members including agriculture in an equitable manner.	Information on business development challenge surrounding the sustainable beef cattle value chain.	Industry/Business Association
9	Belize Trade and Investment Development (BELTRAIDE)	Public	Beltraide is Belize's national trade and investment development agency, dedicated to promoting economic growth by supporting trade,	Information about export opportunities and how they can help BLPA members grow their businesses and the livestock sector as a whole.	Government entity or regulator

No.	Organization	Type of Stakeholder	Description	Contribution to Research	Position in the value chain
			investment, and business development initiatives.		
10	Association of Protected Areas Management Organizations (APAMO)	ONG Private	Supports the management and conservation of protected areas through collaboration, capacity-building, and advocacy	Information about protected areas and sustainable practices	Support and development
11	The Nature Conservancy (TNC)	Private	The Nature Conservancy (TNC) is a global environmental organization dedicated to preserving the lands and waters on which all life depends through science-driven conservation efforts and partnerships.	Information on sustainable practices for cattle farmers.	Support and development
12	Caribbean Community Climate Change Centre (CCCCC)	Subregional intergovernmental public organization	Responsible for climate change management and adaptation in the Caribbean, its mandate is to contribute to the protection of the climate system for present and future generations.	Climate change information.	Support and development
13	Consumers	Private	Domestic buyers, Guatemalan buyers, Mexican buyers.	Información de consume, gustos y preferencias	Commercial information
14	Ministry of Agriculture, Food Security, and Enterprise (MAFSE)	Public	Government institution responsible for coordination of agriculture activity.	Comprehensive information and data on beef cattle value chain.	Government entity or regulator
15	Belize Agricultural Health Authority (BAHA)	Public	Provides efficient, competent and cost-effective professional animal health, plant health,	Information on cattle health services	Government entity or regulator

No.	Organization	Type of Stakeholder	Description	Contribution to Research	Position in the value chain
			quarantine and food safety services that protect human health, animal health and welfare, plant health and the environment, ensure safe and wholesome food, strengthen national food security and facilitate trade and commerce.		
16	Ministry of Environment (MOE)	Public	Provides guidelines and support for the protection of the country's environment.	Comprehensive information and data about the impact of best practices	Government entity or regulator
17	Ministry of sustainable Development, Climate change and Disaster Risk Management (MSDCCDRM)	Public	The Ministry of Sustainable Development, Climate Change and Disaster Risk Management is in charge of implementing the 2030 Agenda in Belize.	Information on environmental priorities in the country, available policies, and possible challenge for effective response.	Government entity or regulator
18	Ministry of Economic and Development (MED)	Public	Institution responsible for promoting economic and social development in the country	Comprehensive information and data on beef cattle value chain	Government entity or regulator
19	Ministry of Finance	Public	Responsible for advising on, coordinating, and implementing the Government's economic and fiscal policies and programs, including the generation and allocation of financial resources to provide	Comprehensive information and data on beef cattle value chain	Government entity or regulator

No.	Organization	Type of Stakeholder	Description	Contribution to Research	Position in the value chain
			appropriate public services and contribute to the overall development of Belize.		
20	Ministry of Tourism and Diaspora Relations	Public	Gov. Institution responsible for	Information on the challenges and opportunities in the sustainable beef cattle market.	Government entity or regulator
21	Belize National Bureau of Standards (BBS)	Public	Government agency that develops, promotes and implements standards for goods, services and processes.	Insights on standards and challenges faced by beef cattle value chain.	Government entity or regulator
22	Central Bank of Belize	Public	Promote stability in the monetary system and exchange rate.	Information about monetary system	Government entity or regulator
23	Atlantic Bank	Private	Provides loans to MSMEs, training on business development	Information on challenges faced by MSMEs and recommendations on how best MSMEs can be developed.	Financial Institution
24	Belize Bank	Private	Provides loans to MSMEs, training on business development	Information on challenges faced by MSMEs and recommendations on how best MSMEs can be developed.	Financial Institution
25	Belize National Bank	Public	The National Bank of Belize is a government-owned financial institution that provides banking services, including loans and savings accounts, to support economic development and financial inclusion in Belize.	Information on challenges faced by MSMEs and recommendations on how best MSMEs can be developed.	Financial Institution
26	Inter-American Development Bank (IDB)	Multilateral Bank	Committed to support robust, inclusive, and sustainable growth in Belize strengthening fiscal sustainability,	Information on improving livestock productivity and climate resilience in Belize.	Intl development/multilateral/UN

No.	Organization	Type of Stakeholder	Description	Contribution to Research	Position in the value chain
			revamping the role of the private sector as an engine for growth, and improving the human capital, with a gender perspective and strengthening resilience to climate change.		
27	World Bank Group	Multilateral Bank	Supports country investments related to the development of priority projects.	Information and financial support for the implementation of projects.	Information and financial support.
28	Development Finance Corporation (DFC)	Public	Provides loans to MSMEs, training on business development	Information on challenges faced by MSMEs and recommendations on how best MSMEs (Cattle farmers) can be developed.	Financial Institution
29	La Inmaculada Credit Union (LICU)	Private	Provides loans to MSMEs, training on business development	Information on challenges faced by MSMEs and recommendations on how best MSMEs can be developed.	Financial Institution
30	Blue Creek Credit Union (BCCU)	Private	Provides loans to MSMEs, training on business development	Information on challenges faced by MSMEs and recommendations on how best MSMEs can be developed.	Financial Institution
31	University of Belize Central Farm Campus (UBCFC)	Public	University dedicated to agricultural education and research	Academic information and research	Support and research
32	Belize High School of Agriculture (BHSA)	Public	University dedicated to agricultural education and research	Academic information and research	Support and research
33	Galen University	Private	University with an Environmental Science (ESCI) bachelor degree program, and a Veterinay Technician Program.	Academic information and research	Support and research
34	Food and Agriculture Organization of	International Cooperation	International organization supporting the	Information on the support that has been offered for cattle livestock, particularly in sustainable beef cattle.	Intl development/multilateral/UN

No.	Organization	Type of Stakeholder	Description	Contribution to Research	Position in the value chain
	the United Nations (FAO)		agriculture sector in Belize.		
35	United Nations Development Programme (UNDP)	International Cooperation	International organization supporting the implementation of sustainable development projects, including agriculture.	Information on the support that has been offered for cattle livestock, particularly in sustainable beef cattle.	Support of projects
36	International Fund for Agricultural Development (IFAD)	International Cooperation	International organization supporting the agriculture sector in Belize, particularly farmers from rural areas.	Information on the support that has been offered for cattle livestock, particularly in sustainable beef cattle.	Intl development/multilateral/UN
37	Green Climate Fund (GCF)	International Cooperation	Financial mechanism to assist developing countries in climate change adaptation practices.	Financing for climate-resilient productive practices.	Financial support
38	Retailers	Private	Composed of hotels, restaurants, resorts, catering services, commercial beef establishments and conventional shops, food stores, and specialized cruise services. Some notable restaurants relevant to the project include Hamanasi Resort Belize, The Lodge at Chaa Creek, Sleeping Giant Lodge, and Old River Bar and Grill	Commercial information on consumption, tastes, and consumer preferences.	Commercial
39	Hamanasi Resort Belize	Private	Are luxurious in Belize offering a unique, immersive jungle experience. Recognized as	Information on consumer preferences for sustainably sourced beef	Retailer

No.	Organization	Type of Stakeholder	Description	Contribution to Research	Position in the value chain
			one of the best eco lodges, it's a commitment to sustainability and adventure travel.		
40	The Lodge at Chaa creek	Private	Are luxurious in Belize offering a unique, immersive jungle experience. Recognized as one of the best eco lodges, it's a commitment to sustainability and adventure travel.	Information on consumer preferences for sustainably sourced beef	Retailer
41	Sleeping Giant Lodge	Private	Are luxurious in Belize offering a unique, immersive jungle experience. Recognized as one of the best eco lodges, it's a commitment to sustainability and adventure travel.	Information on consumer preferences for sustainably sourced beef	Retailer
42	Old River Bar and Grill	Private	The Old River Bar and Grill is a popular dining establishment in Belize known for its relaxed atmosphere and diverse menu featuring local and international cuisine.	Information on consumer preferences for sustainably sourced beef	Retailer
43	Input Suppliers	Private	Suppliers of veterinary products, feed products, feeding equipment, watering systems, agricultural inputs, information technology providers, packaging materials suppliers, and genetic improvement	Information on types of materials and consumption.	Suppliers

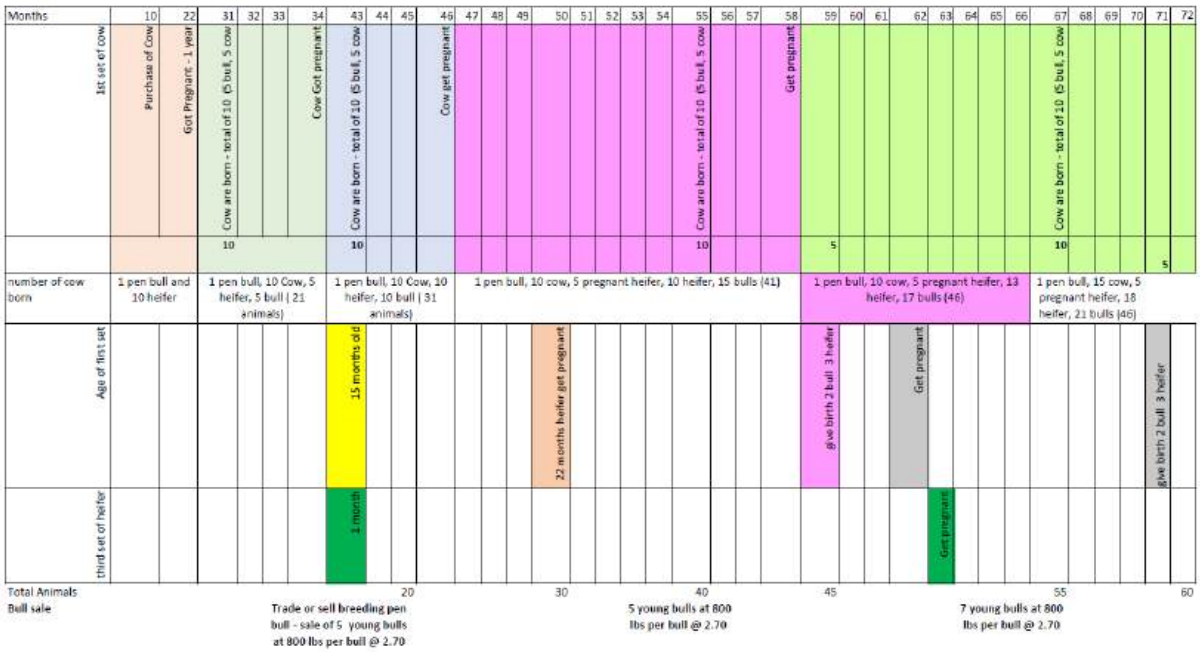
No.	Organization	Type of Stakeholder	Description	Contribution to Research	Position in the value chain
			service providers. Relevant retailers for the study: Reimer´s Feed Mill, Quality Feed Mill, National Treat Mill, Mid-west Agro Supplies, Sugar Industry Research and Development (SIRDI), and Belagro.		
44	Reimer's Feed Mill	Private	A Belizean company specializing in the production and supply of high-quality animal feed for livestock, including cattle, poultry, and other farm animals.	Information about inputs: Sustainable feed products Prices Cattle farmers preferences	Input Supplier
45	Sugar Industry	Private	An organization focused on advancing research, technology, and development in the sugar industry to enhance productivity and sustainability.	Information about inputs: Sustainable feed products Prices Cattle farmers preferences	Input Supplier
46	Midwest Hardware	Private	A supplier that offers agricultural products and services, including fertilizers, seeds, and pest control solutions, to support the farming industry, including cattle farming.	Information about inputs: Sustainable feed products Prices Cattle farmers preferences	Input Supplier

Source: Authors' elaboration.

ANNEX No.2. Cost and investment information

1) CALF COW OPERATIONS ARDEN EDWARDS STARTING PRODUCTION

Cost of Pasture Establishment and purchasing of Breeding stock				
Description			Unit Cost	
land clearing	50	acres	$ 300.00	$ 15,000.00
weed control	5	gallons	$ 100.00	$ 500.00
labour for weed control	10	days	$ 50.00	$ 500.00
grass seeds (4lbs per acre)	200	lbs	$ 30.00	$ 6,000.00
broadcasting of grass seeds	6	days	$ 300.00	$ 1,800.00
purchase of 10 females (500 lbs	5000		$ 2.30	$ 11,500.00
Breeding bulls	1		$ 3,000.00	$ 3,000.00
Fence post	800	post	$ 5.00	$ 4,000.00
planting of post	32	days	$ 50.00	$ 1,600.00
Fence wire	40	roll	$ 135.00	$ 5,400.00
1 coral out of bush stick	1		$ 2,000.00	$ 2,000.00
labour cost (2 person for 6 days	12	days	$ 40.00	$ 480.00
Total Cost				**$ 51,780.00**



5 year plan for breeding stock

	Year 1	Unit cost	total	Profit/loss
10 heifers (10 months)	22 months old at end of year 1			
18 -22 months all heifers are pregnant				
Total animals 11 (10 cow and 1 pen bull)			$ 21,400.00	
labour cost (52 weeks - 11 animals)	52	$ 50.00	$ 2,600.00	
vet medication ($15.00 per animal)	11	$ 15.00	$ 165.00	
Chemical - Weed control (5 work days)	5	$ 50.00	$ 250.00	
Total			$ 3,015.00	$ 18,385.00

	Year 2	Unit cost	total
10 cows	34 months old at the end of year 2		
At 31 months old 10 calf born (5 bulls 5 females)			
at 34 months 10 mother cows are pregnant			
Total number of animals 21 (10 mother cow, 5 bulls and 5 heifer, 1 pen bull)			
10 Mother cow (800 lbs per cow @ 1.70)			$ 13,600.00
1 pen bull	1	$ 3,000.00	$ 3,000.00
5 young bulls	5	$ 500.00	$ 2,500.00
5 heifers	5	$ 400.00	$ 2,000.00
vet medication ($15.00 per animal)	21	$ 15.00	$ 315.00
labour cost (52 weeks - 11 animals)	52	$ 50.00	$ 2,600.00
Chemical - Weed control (5 work days)	5	$ 50.00	$ 250.00

Total			$ 3,165.00	$ 17,935.00

	Year 3	Unit cost	total
10 mother cow give birth at 43 months 10 calf born - (5 males 5 females)	46 months old at the end of year 3		
Mother cow get pregnant at 46 months			
10 Mother cow (800 lbs per cow @ 1.70)			$ 13,600.00
1 pen bull	1	$ 3,000.00	$ 3,000.00
5 young bulls (800 lbs @2.70)	5	$ 2,160.00	$ 10,800.00
5 young bulls	5	$ 500.00	$ 2,500.00
5 heifers (650 lbs @ 2.25)	5	$ 1,462.50	$ 7,312.50
5 Heifer - 15 months old at end of year 3 (650 lbs)	3250	$ 2.25	$ 7,312.50
sales of 5 bulls (800 lbs)	4000	$ 2.70	$ 10,800.00
Total number of animals after sale of bulls 31 (10 mother cows, 10 heifer, 10 bulls, 1 pen bull)			
vet medication ($15.00 per animal)	21	$ 15.00	$ 315.00
labour cost (52 weeks - 11 animals)	52	$ 100.00	$ 5,200.00
Chemical - Weed control (5 work days)	5	$ 50.00	$ 250.00

Total			$ 5,765.00	$ 38,760.00

	Year 4	Unit cost	total
10 mother cows pregnant at 46 months	58 months old (mother cow)		
5 heifers pregnant at 27 months old	27 months old at end of year 4 and 5 months pregnant		
15 months 5 young bulls and 5 young heifers 15 months old			
Total number of animals 36 (1 pen bull, 10 cow, 5 pregnant heifer, 10 heifers, 10 bulls)			
10 Mother cow (800 lbs per cow @ 1.70)			$ 13,600.00
1 pen bull	1	$ 3,000.00	$ 3,000.00
5 young bulls (800 lbs @2.70)	5	$ 2,160.00	$ 10,800.00
5 young bulls	5	$ 500.00	$ 2,500.00
15 heifers (650 lbs @ 2.25)	15	$ 1,462.50	$ 21,937.50
sales of 5 bulls (800 lbs)	4000	$ 2.70	$ 10,800.00
vet medication ($15.00 per animal)	21	$ 15.00	$ 315.00
labour cost (52 weeks - 11 animals)	52	$ 100.00	$ 5,200.00
Chemical - Weed control (5 work days)	5	$ 50.00	$ 250.00
Total			$ 5,765.00 $ 46,072.50

	Year 5	Unit cost	total
10 mother 58 months	Mother Cow - 70 months at end of year 5		
5 heifer - 39 months old	2nd set mother cow 51 months at end of year 5		
15 pregnant cow 5 pregnant heifer			
15 months 5 young bulls and 5 young heifers 15 months old			
15 Mother cow (800 lbs per cow @ 1.70)			$ 20,400.00
1 pen bull	1	$ 3,000.00	$ 3,000.00
5 young bulls (800 lbs @2.70)	5	$ 2,160.00	$ 10,800.00
7 young bulls	7	$ 500.00	$ 3,500.00
13 heifers (650 lbs @ 2.25)	13	$ 1,462.50	$ 19,012.50
5 Heifer - 15 months old at end of year 3 (650 lbs)	3250	$ 2.25	$ 7,312.50
Total number of animals 46 (1 pen bull, 15 cow, 5 pregnant heifers, 13 young heifer, 12 bulls)			
sales of 5 bulls (800 lbs)	4000	$ 2.70	$ 10,800.00
vet medication ($15.00 per animal)	21	$ 15.00	$ 315.00
labour cost (52 weeks - 11 animals)	52	$ 150.00	$ 7,800.00
Chemical - Weed control (5 work days)	5	$ 50.00	$ 250.00
Total			$ 8,365.00 $ 55,660.00
Total Expenditure (5 years)			**$ 26,075.00**

2) COP beef cattle 50 acres Daniel Juan University of Belize

Typical 50 acre beef cattle farm
Expenses

1	Land tax	Annually	Unit cost	18	Acres 50	Total 900,00	Remarks $/acre
2	Vaccines						
	Rabies	Annually		2	64	128,00	$2/dose
	Blackleg	Annually		3	64	192,00	$3/dose
	Needles & syringes	Annually		0,25	150	37,50	
3	Mineral salts	Monthly		65	12	780,00	50 lb. Sacs
4	BLR	Bi annually		20	25	500,00	$10/tag/animal + movement permits
5	Medications/tick control	Monthly		50	12	600,00	Standard costs of Bayticol or equivalent
6	Vet fees	Annually		1	300	300,00	Varies by availability of vet
7	Corral & fence repairs & maintenance	Monthly		200	12	2 400,00	
8	Labour	Monthly		5,5	1460	8 030,00	Family labour at $5.5/hr @ 4hrs/day
9	Weed control	Monthly		75	36	2 700,00	$75/hr. Bush-hog @ 3hrs per month
10	Equipment	Monthly		100	12	1 200,00	Knapsack sprayer, machete, files, etc.
						17 767,50	

Parameters
Soil cover approx. 80% = 40 acres of pasture available
40 acres @ 1 A.U. per acre = 35 adult cows + 1 bull
(35 cows)(80% conception rate) = 28 calves/yr.
(28 calves)(90% pre-weaning survival) = 25 calves weaned

25 weaners approx. 12 heifers & 13 bulls
Approx. 15% replacement of cows = 5 replacement heifers

Income

					Income ($)
A	(13 bulls)(480lbs. Live wt. @ 6.5 m)($2.80/lb. Live wt.) =	13	480	2,8	17472
B	(7 heifers)(470 lbs. Live wt. @ 6.5 m)($2.60/lb. Live wt.)	7	460	2,6	8372
C	(5 cull cows)(1100 lbs. Live wt.)($1.6/lb. Live wt.)	5	1100	1,6	8800
					34644

Live weight production / year

	Category	No. of animals	Units/animal	Units (lbs.)
1	Weaner bulls	13	480	6240
2	Weaner heifers	7	460	3220
3	Cull cows	5	1100	5500

14960 This represents the total pounds sold per year

Cost of production per pound
Total expenses / total pounds produced per year

(17767.5) / (14960) = **$ 1.20 / lb. Live wt.**

So it is costing the typical farmer who has 50 acres of land with 35 cows & 1 bull approximately $ 1.20 / lb. Live wt.

3) Cost analysis for cattle production 100 acres John Guillet

Value chain analysis for cattle production.

Basis:100 acres

- Pounds beef per acre live weight: 600 lbs
- Wire and posts life span 10 yrs.
- Grass life span 7 yrs

Expenditure:

1)	Posts 30000@$5 per post	$150000
2)	Wire. 200 rolls @140 per roll	$28000
3)	Land preparation	$25000
4)	Seeds	$8000
5)	Water source ($ per yr)	$5000
6)	Vitamins /minerals and other agro chemicals per/yr	$10000
7)	Labour per yr.	$50000
8)	Misc	$20000

Therefore,

I. Operational Cost per yr:

1)	Posts	$15000
2)	Wire.	$2800
3)	Land prep	$3500
4)	Seeds.	$1200
5)	Water.	$5000
6)	Vitamins etc	$10000
7)	Labour.	$50000
8)	Misc.	$20000

Total Cost per yr **$108,500**

II. Revenue per yr:

- Total lbs beef produced 60000 lbs
- Then cost per lb beef is 108500/60000
- Or approximately $1.80 per lb.

Note: Cost for individuals and production per acre may very.

- Average Price per lb = $2.50

Total Revenue = 60000 x 2.5 = **$150,000**

III. Profit

- 150,000 – 108,500 = **$41,500**

4) **Cost of operating 35 cow-calf operation**

Cost of operating 35 cow calf operation

1) 50 acres land @ $2000	$100,000
2) Clearing land and planting Grass @1000 per acre	$50,000
3) Permanent Exterior Fence ○ Dep @10 years = $950 per year	$9,500
4) Electric Fence System and supplies ○ Dep @ 5 years= $600 per year	$3,000
5) Corrals ○ Dep @10years = $1000 per year	$10,000
6) Weedeater ○ $10 gas per day = $3650	$500
7) Labor @50 pet day ○ extra labor $1000	$18,250
8) Tags @10 per tag	$350
9) Minerals	$1,440
10) Vaccines and meds	$1,000
11) Water system ○ dep @ 5 years =$1000 per year	$5,000
12) Scales @ $5 per head	$160
13) 35 cows @ 1000lbs @ 1.30 per lb = ○ Dep @10% per year = $4550	$45,500

I. EXPENSES Listed

a)	Cow Dep	$4,550
b)	Corral Dep	$1,000
c)	Labor	$19,250
d)	Fence Dep	$950
e)	Electric Fence Dep	$600
f)	Vaccines	$1,000
g)	Minerals	$1,440
h)	Tags	$350
i)	Scales	$160
j)	Weedeater and gas	$4,150
k)	Water Dep	$1,000
Total Cost		**$34,450**

- Cost per pound
  - Total lbs = 32 animals x 500lbs = 16,000
  - Cost/lb = 34,450/16000 = $2.15

II. INCOME

- 35 cows 91% calve =32 calves

a)	16 Heifers 500lbs @2.15	$17,200
b)	16 Bulls 500lbs @ 2,60	$20,800
Total Revenue		**$38,000**

III. PROFIT **$3,550**

If the owner is the labourer, then his total wages would be $21,800

Note: land cost was not included because it should hold its value or possibly increase in value

5) Gerhard Penner – Cattle farming expenses (Penner, s.f.)

Below are three tables with expenses to be incurred in 80 acres of land situated in Shipyard Community used for cattle farming:

Land Clearing			
	Number of Acre to be cleared	*Cost per Acre*	*Total*
Tree Removal	80	$ 350.00	$ 28,000.00
Brush Clearing	80	$ 365.00	$ 29,200.00
Stump Removal	80	$ 90.00	$ 7,200.00
Grading	Road and Corral		$ 6,500.00
Plowing	80	$ 125.00	$ 10,000.00
		Sub Total	$ 80,900.00

Growth of Grass			
Material	*(lbs) per acre*	*Acre*	*Total lbs*
Grass Seeds	7	80	560
Material	*Total (lbs)*	*Cost per lbs*	*Total Cost*
Grass Seeds	560	$ 14.50	$ 8,120.00

Worker for Planting Grass			
Number of workers	**Acres**	**Amount per Acre**	**Total**
1	80	$ 35.00	$ 2,800.00

Below is a table shown with the expenses to be incurred at the cattle farm:

Water System			
Source	*Unit (length)*	*Cost Per Unit*	*Total*
Water Well	90	$ 70.00	$ 6,300.00
Pressure Tank	1	$ 2,895.00	$ 2,895.00
Solar Pump	1	$ 875.00	$ 875.00
Pipes	240 of 1inch	$ 20.95	$ 5,028.00
		Sub Total	$ 15,098.00

Water Tanks			
Unit	**Number of tanks**	**Cost per Tank**	**Total**
Tank for water	4	$ 335.00	$ 1,340.00

Below is a table with the expenses to be incurred to build a barbed wire fence as well as an electric fence to secure the cattle.

Fencing			
Type	*Amount*	*Cost per Unit*	*Total*
Barbed Wire	45	$ 138.00	$ 6,210.00
Posts	1250	$ 9.00	$ 11,250.00
		Sub Total	$ 17,460.00

Electric Fencing			
Type	**Amount**	**Cost per Unit**	**Total**
Solar Fence Charger	1	$ 1,675.00	$ 1,675.00
Wire for electric Fence	65 Rolls	$ 190.00	$ 12,350.00
Electric Fence Post	1600	$ 7.50	$ 12,350.00
		Sub Total	$ 26,375.00

Scaling up Climate Ambition on Land Use and Agriculture through Nationally Determined Contributions and National Adaptation Plans (SCALA), funded by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) through the International Climate Initiative (IKI).

SCALA responds to the urgent need for increased action to cope with climate change impacts in the agriculture and land use sectors. The programme will support at least twelve countries in Africa, Asia and Latin America to build adaptive capacity and to implement low emission priorities.

Country support includes strengthening policies, adopting innovative approaches to climate change adaptation and removing barriers related to information gaps, governance, finance, gender mainstreaming and integrated monitoring and reporting. To achieve this shift, the programme will engage the private sector and key national institutions.

SCALA supports countries to develop the capacity to own and lead the process to meet targets set out in their National Adaptation Plans and Nationally Determined Contributions under the Paris Agreement, and to achieve the Sustainable Development Goals. The SCALA initiative builds on another FAO-UNDP led programme, Integrating Agriculture in National Adaptation Plans (2015-2020) which is currently phasing out.

Food and Agriculture Organization of the United Nations www.fao.org/in-action/scala/en

United Nations Development Programme www.adaptation-undp.org/scala

International Climate Initiative (IKI) www.international-climate-initiative.com

German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) www.bmwk.de/Navigation/EN/Home/home.html

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