CHAPTER 2: PROFILE OF CHARACTERISTICS OF DRY HARD CORN AND THE ACTORS OF THE VALUE CHAIN

2.1. Introduction

The value chain concept appeared when companies' success depended on the interaction between the flow of information, materials, money and labour (Ribas & Companys, 2014). With the growing importance of global value chains, trade has become a driving force for international trade (Suárez et al., 2016; Pérez, 2019). Today intermediate inputs constitute 60% of world trade, according to the Inter-American Development Bank (IDB, 2018). In the case of South America, it is expected to make possible the productive interrelationships in the various stages of the production process that include regional chains (Lámbarry, 2016; Niembro, 2017), that is, the aggregation of South American inputs (from more than one country) in the production process of another South American country (ECLAC-IPEA, 2016). In Ecuador, grain classification is governed by quality standards imposed by the market and the State, of which there are two types: standards and statutory bases. Regarding the nodes, the problem of the different links in the value chain, and their impact on the consumption of healthy foods, is of particular relevance in the provinces with the potential to produce dry corn. According to the type of work we found, a structure of sections has been identified and proposed to describe areas or patterns with problems in the chain, and we will briefly describe some of the works found that are considered the most representative of the state of the art. art.

The global value chain approach was flourishing in the 1990s (García et al., 2019), based on the literature, cost economics, production networks, and technological capacity and learning at the business level (Li et al., 2016; Ortega-Santos et al., 2021), developed by those who focus on the study of relationships and participation in fragmented value chains, giving rise to the "global production chains" approach. Gereffi et al. (2005) postulate the types of governance of the hierarchical global chain, from the captive, relational and modular to the market. However, the understanding of the governance of supply chains, existing the possibility of transferring processes between countries and emerging new business opportunities (Feenstra, 1998; Vergara-Romero, 2011), demanding changes in the institutional environments and economic growth of developing countries (De Vasconcellos et al., 2015; Olea et al., 2016).

The agri-food value chain is a network of organizations that work together, in different processes and activities, in order to bring agricultural products from the farm to the table and meet the demands of consumers (Ramírez Molina et al., 2021; Sanabria et al., 2017), the added value generates profitability or increased productivity and growth (Fuentes et al., 2016; Vergara-Romero et al., 2021). The growing interest in the study of supply chain management has occurred in parallel with the trends in world trade. Today internationally successful companies source from the part of the world that offers them the best comparative advantages manufacture their products in countries where they can achieve low operating costs, and sell in multiple markets in search of maximizing their income (Sarache et al., 2009).

The growth of companies and supplies has shown positive growth, the result of integrated work processes and continuous improvement, which leads to a configuration of new value chains (Hanclova et al., 2021; Vergara-Romero, 2022b). The Ecuadorian agricultural sector still has disadvantages related to efficiency and yield, technology and post-harvest management, and aspects related to competitiveness such as production costs about other countries, the diversity of climate, soil, and genetics. Where it is linked to the social, economic and institutional aspects must have comprehensive responses.

In the value chain, four primary functions are distinguished: production, grouping, elaboration and distribution, being essential the efficient grouping and storage due to the minimum volumes of product coming from small farmers, many of them scattered and with little availability of mobilization, being a challenge essential to overcome. The planning, evaluation and control of inventories are activities of transcendental importance for the fulfilment of the objectives of a company, especially in the manufacturing industry. Therefore, these activities must be supported by adequate optimization and simulation models to obtain the best results (Valencia et al., 2015; Martinez-Valero et al., 2021; Vergara-Romero, 2021b). The idea is to connect the planning domain of each of the organizations to exchange relevant information for the global planning process (Ribas & Companys, 2014; Sed'a et al., 2021).

From the perspective of governance, agricultural value chains in Ecuador have not been extensively studied. The governance research of the corn value chain from a socioeconomic approach allows understanding of the relationship between actors, which allows assimilating the relationship in the different links of the chain in terms of the distribution of the value created and, therefore, of the relationships of power that are formalized.

Studying the socioeconomic and competitive importance of the agricultural maize chain is necessary to know its position as a fundamental part of the growth of the region, measured through the economic indicator of the Gross Domestic Product (GDP). For the State, it is a strategy to dictate policies that encourage the permanence of successful chains, but also for those that need investment and technological innovations to make them competitive (Sánchez at al., 2013; Souto-Anido et al., 2020).

All those farms and companies, as well as their subsequent activities that add value in a coordinated manner, produce certain agricultural raw materials and transform them into specific food products that are sold to final consumers and are discarded after use, so that is profitable at all times, provides broad benefits to society, and does not permanently consume natural resources (Neven, 2015).

This paper presents an existing bibliographic review on the subject seeking to achieve the objective of distinguishing and identifying the typology of the value chain of hard corn in Manabí, knowing the nature of the chaining processes individually and in groups. The corn value chain has received special attention from various sectors due to the agricultural structure, availability of irrigation water, agricultural insurance, and market price instability.

2.2. Materials and methods

The study of the structure of the corn agrifood network was carried out in Ecuador, in the coastal area of the Province of Manabí, from the second quarter of 2018 to the last quarter of 2019.

2.2.1 Description of the methodology

A value chain comprises a wide variety of activities that are essential for the product to transit and remain from conception to final disposal in the consumer. The analysis focuses on the contribution of the steps or links, the socioeconomic aspects, and the production until the final use. The relationship between links and actors with the denomination of homogeneity or heterogeneity within the key elements and the generation of specific public policies.

The appropriation of added value, not all links or actors, have the same space within the same link, or the ability to appropriate added value within manufactured products, such as research, development, sales and marketing.

The governance of the chain, to analyze the mechanisms of processes and regulations in companies, producers together with the government and other actors, to know the behaviour of the actors and their type of link and conduct.

The methodology focuses on solving the problems or bottlenecks present in the chain, which can be reflected in the improvement of the articulation of the links, the incorporation of new alternatives of new actors and economic and social improvements, reflected in the productive transformation of the product. Bibliometric analysis is a technique that makes it possible to provide a macroscopic view of large amounts of academic literature through a quantitative analysis of the information on the publication history (Mendieta-Cepeda et al., 2021; Valenzo et al., 2012).

Studies that used governance mechanisms that influence the chain were considered as follows:

1. Mapping of the food chain, considering the dry hard corn as a reference, is considered the leading social actor for the investigation.

2. Identify actors in the hard dry corn value chain using information from the census carried out by the Ministry of Agriculture and Livestock (MAG).

3. Secondary data collection, complementary to the investigation, a series of surveys and interviews were carried out with interested actors such as producers, entrepreneurs, and experts on the subject. Based on investigative work and information collected in workshops, the survey was constructed and validated using the Cronbach's Alpha test, obtaining a general value of 0.685, confirming the instrument's reliability (Hernández-Rojas et al., 2021; Jimber del Río et al., 2020).

4. Descriptive analysis

5. Governance identification.

2.3. Analysis and Results

In the last decade, the agricultural sector in Ecuador had modest participation in the economy, around 10% of GDP, or 14% if the agribusiness sector is also taken into account.

However, it is still an essential source of employment for the rural sector since more than two-thirds of the economically active rural population work in the sector (Egas et al., 2018; Pozo-Estupiñan et al., 2021b).

According to the reports of the Agricultural Public Information System (SIPA), the national area planted in hectares (has) of dry hard corn (dry grain) in 2018 was 255,376, with production in tons (t) of 1,513,635 and a yield (t/ha) of 5.93. The same report shows the prices for the dry hard corn producer (qq) between 2017 and 2018 it was 13.44 and 14.04, respectively, with a variation of 4% reaching 15.25 as the Minimum Price of Sustainability, with the requirement of having 13% humidity and 1% impurities at the time of delivery to the warehouse-vendor “collection center” (Ministry of Agriculture and Livestock, 2019). The participation in the total planted area of dry hard corn, and dry grain, according to the National Institute of Statistics and Censuses (INEC-ESPAC, 2019), is in Los Ríos with 38.8%, Manabí with 24.9%, le followed by Guayas with 17.5%, Loja with 12.3% and other provinces with 5.7%, with Manabí's production in metric tons (thousands of metric tons) being 135, 315 and 271 for 2016, 2017 and 2018, respectively.

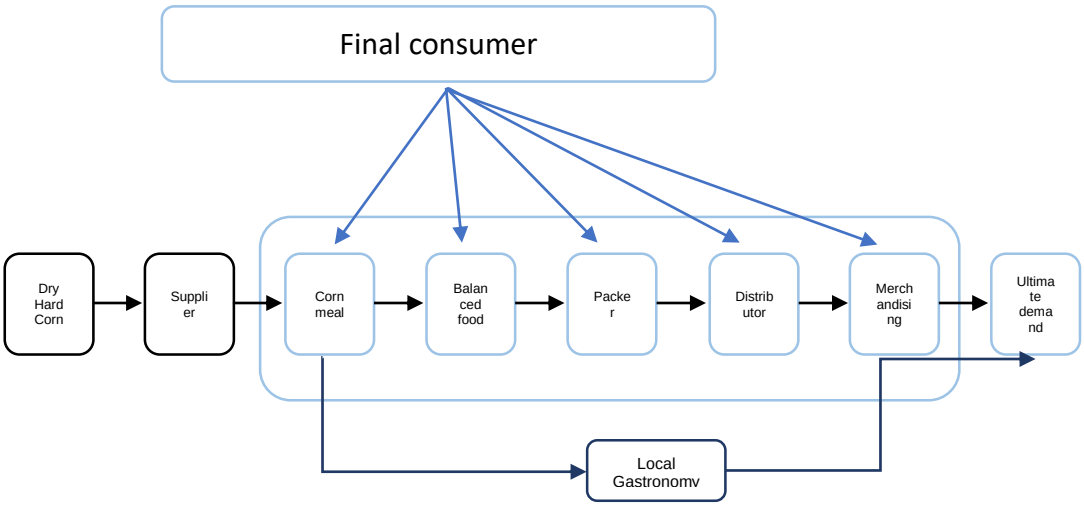
The corn value chain in Manabí presents a complex structure characterized by a high degree of intra-link heterogeneity and marked inter-regional differences; production and productivity levels vary throughout the regional geography, with some excluded links in specific sectors, such as the sectors of Santa Ana.

2.2.2 Food Chain Mapping

The core of the dry hard corn value chain comprises producers and industrial corn processing companies, which are companies dedicated to preparing feed for some animal species and flour. From this, two backward links were identified: the producers and suppliers of inputs and three forward links that culminate in the final consumer (see Figure 5). In a simplified way, the general characteristics of the links and their links are highlighted.

Figure 5.

Value chain of dry hard corn



2.2.3 Production

In the characterization of complex corn production in winter 2018, it was as follows: sowing begins between January and February, the density of ears/ha is 48,257, of which 93% was certified seed, with an average weight of ear of 134 grams, the varieties used at this time were: Dekalb 7088, Triunfo & Somma, the perception of the problem being the lack of irrigation water, pests such as the armyworm and leaf spot (MAG, 2018).

The production of dry hard corn can be classified into three systems, according to the extension of sowing, technology and availability of infrastructure and irrigation water: i) technified facilities; ii) standard or semi-technified installations; and iii) non-technician rural systems. There is significant productive heterogeneity among the three (see table 3). Each activity in the value chain has a different potential to catalyze economic development and productive transformation (Kim, 2017; Márquez-Sánchez et al., 2022).

Table 3.

Production Systems

Production system	Size and capacity	Installations	Characteristic	Availability of irrigation water	Main markets
Technified facilities	More extensive than 16 hectares, they represent 45% of the production	Automated, state-of-the-art technology.	Technical preparation of soils, Biosafety Export Vertical integration	Yes	National and international
traditional installations	Between 6 to 15 hectares. They represent 30% of the production	Traditional with a certain degree of technology	average productivity Complete cycle intermediate quality	Something	Provincial
rural system	Less than 5 hectares. They represent 35% of the production	Rudimentary, without technology.	Low quality and low yields local consumption Little technical management	Any	Local

2.2.4 Socioeconomic and production findings

For the analysis of the associative trajectories, we have selected the following organizations: Union of Peasant Organizations of the Southeast of Manabí (UOCSEM), Federation of Peasant Organizations of the South Zone of Manabí (FOCAZSUM), Provincial Union of Peasant Organizations of Manabí (UPOCAM) and the Cooperative of Agricultural Services of the Olmedo Canton (CEDOCAO) according to (Guerrero, 2012; Ochoa-Rico, Vergara-Romero et al., 2022). These offer a range of services such as technical assistance (organic

production), training, and organizational processes of the agricultural sectors. The associativity and empowerment of a joint work serve as a means of sustainable development.

Strategies for value chain programs should be prioritized to identify where value is created and who captures it for the multiplier development of the links.

2.2.5 Findings of distribution and commercialization.

The commercialization of corn is under the action of the intermediaries, this to the weakened organizational and union sector of the farmers, being the merchants the ones who place the product in the market, local or national, this intervention causes an oligopoly and high speculation. It is estimated that 57% of national production goes through intermediaries, followed by the Storage Unit (26%), direct sales to the consumer (9%), stackers (4%) and other channels (4 %) (ECB, 2019). As indicated, some large companies distribute and market their product directly, have transportation (specialized or not), have their portfolio of fixed customers, and some go-to collection centres, supermarkets, and local stores, to supply products. Where they sell them exclusively, other companies, especially the smaller ones, resort to intermediaries (merchants and agents of local and national balanced companies) to buy the direct harvest to distribute and market the product.

2.2.6 Market aspects between demand and supply

The setting of minimum support prices (PMS) began in 1988 in the case of sugarcane and is currently one of the most critical commercial policies for hard yellow corn (MAG, 2016).

Currently, the production of corn covers the needs of the country; the use of hybrid technology, production yields, the cost makes it attractive to bet on the crop. With an increase in production, since 2014, the growth in 5% of the planting area, the variation in prices was between 12 to 15 dollars; therefore, farmers covered the production costs (BCE, 2019).

The smuggling of agricultural products across borders causes severe problems for formal commerce, industry, and national production, causing unfair competition, especially for the agricultural producer of corn.

2.2.7 Identification of governance dynamics

As of the Constitution of the Republic of Ecuador in 2008, the agricultural policy is reorganized together with the National Plans for Good Living and the Whole Life Plan, establishing general guidelines for the design of policies, programs and projects focused on promoting production, food security and sovereignty and rural development. A mandate by which production for the provision of food is one of the critical objectives of the National Plan for Irrigation and Drainage, compliance with which must be linked to the peasant family economy of small and medium plots, framed in the efficient management of irrigation and national drainage.

Public institutions influence the chain's behaviour through the main channels, such as the regulations for managing phytosanitary products and their products and the set of supports that the chain actors can access (SENAGUA, 2019).

Most of the support received by the agricultural value chain comes from the Ministry of Agriculture and Livestock (MAG) and its agencies. The support is granted for the benefit of people dedicated to the production of corn. Among them, the Agricultural Development Program, the Undersecretary of Corn, provide constant training. Other public entities offer support to the chain of value-added to production, among them the National Institute of Agricultural Research-INIAP (Zambrano et al., 2018) together with the International Center for the Improvement of Maize and Wheat (Cimmyt) are working on the creation of laboratories to certify improved corn seed, the Interministerial agreement between the Ministry of Agriculture, Livestock, Aquaculture and Fisheries (MAGAP) and the Ministry of Industries and Productivity (MIPRO), with the Competitive Improvement Plan for the corn chain, whose objective is to achieve sustainable and competitive self-sufficiency of corn to produce balanced feed and animal protein feed at affordable prices for the final consumer, together with the "High-performance seed program" (MAG, 2016).

Involved in the productive activity, the Secretary of Science and Technology (SENESCYT), the Universities present in the province through their research projects and links with the community.

The actors in the chain have a wide range of instruments that they can use to improve their performance. Given the multiplicity of institutions involved and the related activities, there are spaces to improve institutional coordination for the continuous improvement and use of

resources. Currently, the complexity of the procedures to promote dissemination and training campaigns for social actors by some universities in multiple agreements such as the HUBs favours medium and large companies that have their specialists and encourage the emergence of intermediaries whose added value is questioned.

In the macroeconomic field, factors such as government changes are a risk due to the ideology of what should be produced, appearing as a risk to the supplier (Barrientos, 2019), hence the importance of establishing a state policy to opt for diversification as a strategy.

2.2.8 Chaining and links of the actors

The links make up the dry hard corn value chain, presenting significant levels of vertical and horizontal integration, with producers participating in various production phases, such as technified maize growers who make up their chain in the production of balanced feed. There are also medium and large producers responsible for supplying and distributing their products in regions that are even close to countries like Colombia. It is worth mentioning that most corn growers are part of the chain by themselves. In most of the links of the production process, a crucial horizontal integration is observed through associations, among which those already mentioned above stand out. In the Pronaca industrialization sector, the Association of Balanced Food Manufacturers (AFABA) in the production of balanced food in the transformation link, as the last report, the requirement of 3 months of consumption to match the 2015 winter harvest is 50,796 Tm (AFABA, 2015). Specializing in common aspects for its members. The activities are subject to animal health regulations, which are the responsibility of Agrocalidad, and the regulations for products for human consumption through the National Institute for Standardization (INEN).

The general relationships between transformation actors agree on prices, production, volumes, quality and delivery, acting without contracts and market conditions. We must mention that the informality of the producers is a disadvantage compared to medium and large companies, which import raw materials at competitive prices, favouring the ability to negotiate with national raw material suppliers.

2.4. Discussion

Value chains are interdependent systems connected by links, so the acquisition of competitive advantages requires that a company's chain be managed as a system, as mentioned by Mestre (2019).

In-depth agricultural research can be used to support data-driven planning and policy-making through the use of specialized statistical methods. The methods can quantify the relationships between the various characteristics to understand better why farmers make confident decisions and their possible response to specific policy measures.

The process of determining quality is an activity that, despite the evolution of technology in agricultural practices, continues to be carried out manually by specialist laboratory technicians, referred to Saleres (2016).

In Manabí, information barriers are a leading cause for failed attempts to export corn products since potential producers lack knowledge of the international market and also national suppliers have difficulty finding reliable suppliers.

Hence the need not only to increase the participation of small and medium-sized agricultural producers in the most dynamic agro-industrial chains (Rioux et al., 2015) but also to expand the process of generating jobs and non-agricultural income in rural areas. In addition to improving education, health and other public services (CAF/FAO, 2006), the impact and importance of periodic diagnoses throughout the value chain using key indicators (Amjath et al., 2020; Bhattacharjee & Lisauskaite, 2020; Noboa Salazar et al., 2022), should be a regulated governance factor in the functioning of food production systems.

The input-output model, quantifying the exchange relationships between sectors, suppliers and demanders of intermediate inputs, allows identifying those sectors whose relative importance in such interdependencies is significant, according to Schuschny (2005). The idea of impact is that not all intermediate activities have the same capacity to produce a positive and multiplier impact on the foundations of the productive sector. Thus, the key sectors in the transformation or manufacturing activities can stimulate other economic activities, linking the linkages with the growth of industrialization due to the small scale's lack of industrialization and intervention in the sector.

The input-output matrix summarizes the relationships between intersectoral supply and demand, which makes it possible to identify the sectors that have the most significant weight in the economy, or how changes in one sector affect the supply and demand of other sectors. of the economy as a whole, explained by Hernández (2014). In Argentina, about 4.4 Mt/year is produced in 37 factories in the biodiesel industry (Díaz et al., 2019).

A strategy to overcome barriers within territorial planning consists of developing effective training programs, workshops, in public-private collaboration since the public sector supports this service, the experience within the agricultural business community, the orientation of the merchants national, the success of agro-industrial companies in the production of corn derivatives, together with professionals related to these areas.

According to the OECD/FAO (2019), agricultural productivity is the strengthening of human and social capital, sometimes facilitating the reduction of transaction costs and improving economic returns in generating added value (Avalo et al., 2016). Improved management skills are complemented by rapid growth in information technology, which improves technical and distributional efficiency.

Address the main regulatory challenges related to innovation, such as the improvement of intellectual property regimes, labour regulation, and competition policies, as well as simplifying other administrative and regulatory procedures (primarily related to the registration and operation of companies) that mainly affect innovative companies (Kim, 2017; Rubalcaba et al., 2017), in addition to environmental and ecological ones by Ardisana et al. (2018) and since the beginning of 2020 with the covid-19 pandemic, the prolonged block in all the links of the value chain (Solomon et al., 2020).

Three key factors contribute to this situation in Latin America: 1) the state of regional integration—with multiple and overlapping agreements—is not conducive to the formation of supply chains throughout the region; 2) the quality of transportation and logistics infrastructure may be inadequate for modern supply chain practices; and 3) the existence of information frictions that keep potential providers on the sidelines (Development, 2018). The local economy shows weaknesses in the chain between the production sectors, and the industrialization, storage, transport and communication sectors significantly influence the demand and supply of products.

Since the beginning of 2020, with the global situation of the Covid-19 pandemic, a decrease in sales and agricultural inputs is likely. It will translate into reduced cash flows for social actors, contributing to a liquidity crisis that may affect the capacity of the intermediary agents, producing a cascade throughout the food production system of this product.

2.5. Conclusions

The interest in value chains has increased due to the importance that they are acquiring in the consumption of dry products and their derivatives around their production. Relevant strategies such as the location of facilities are essential in designing value chains and their distribution and perishable aspects in storage. The topic has been poorly developed, mainly due to the difficulty of modelling, the type of product, and the number of variables to consider in this type of gearing of factors.

Public and private institutions have been involved in the corn production network, and social actors have participated in the production stage, providing seeds, fertilizers, agrochemicals, and financing, among others. The processing and distribution functions in the post-harvest stage of the network are well-differentiated, being the small agricultural companies that strengthen and participate in value-added activities and belong to agricultural organizations or associations. Distribution companies present a sense of associativity.

In the province, a correct location of collection centers, processing companies, and the location of consumers is necessary, which contributes to the formation of the architecture of the management model, incorporating commercial customs and infrastructure flows and distribution characteristics. Among the products derived from corn, there are perishable products, the exact grain in which aspects such as climate, temperature, humidity, storage place, and quality must be taken into account, opening doors for future research that models perishable aspects such as climatic changes, internal and external factors, not only to penalize it with an additional cost for the farmer due to the humidity and state of the grain but also to represent the state and conditions in the trip and transport in the different links of the value chain, what allows this to quantify the cost-benefit relationship between the losses of the product due to decomposition and an increase in the quality of the product.

The lack of infrastructure forces producers to be at the expense of uncertain conditions (rain, irrigation, prices), with technology transfer being a factor in developing this priority sector in the local and national economy, along with financial support.

A strategic plan should be carried out that covers the value chain and the pre-availability of agro-industrial investments in new fields (biofuels) and protect the added value with an in-depth analysis of the territory's socio-economic dynamics.

Finally, the bibliographic information on the value chain in Ecuador is minimal, which could become a pioneering investigation on the subject, in addition to the grouped study using the Leontief adjustment technique for the country.