The logistics and barriers involved in coffee production chain

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Abstract: Agribusiness is highlighted in world economics as one of the main economic activities, especially in developing countries. Brazil is the world's largest producer and exporter of green coffee, exporting 40% of all coffee consumed in the world. This article aims to study the influence of logistics on coffee production and market, highlighting the impasses faced by producers for the export of beans. The methodology adopted was exploratory and descriptive of the coffee production chain, combining different methods to decrease the disadvantages of one technique through the benefits of another. As results stand out (1) the main Brazilian producing state Minas Gerais, (2) Germany is the main Brazilian importer and reexports the grains after processing, (3) the most important criterion when marketing the product is Marketing, this brings advantages to the producer who can devote himself to the premium market.

Keywords: Coffee Productive Chain; Grain Export Network; Agribusiness; Coffee Trade; Logistics.

1. Introduction

Agribusiness is one of the most important human activities. For developing countries, it ensures food for these populations and contributes to gross domestic product (GDP) (MARANHÃO; VIEIRA FILHO, 2017).

In Brazil, for instance, the agricultural sector has a 21.1% stake in GDP (Brazilian Institute of Geography and Statistics - (IBGE, 2016), Center for Advanced Studies in Applied Economics - (CEPEA - ESALQ/USP, 2019)). The country is a relevant exporter of grains, fruits and cereals, and more is considered the world's largest producer and exporter of green coffee (Council of Coffee Exporters of Brazil - (CECAFÉ, 2019), Ministry of Agriculture, Livestock and Supply - (MAPA, 2019)).

Brazilian coffee bean is internationally recognized for its quality and represents 40% of all coffee consumed in the world (ANGELONI et al., 2019), International Coffee Organization - (ICO, 2019). It is commercialized as a

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commodity, and importers are the player that adds value to the grain and markets globally (BARJOLLE et al., 2017; CECAFÉ, 2019).

Coffee usually faces adversity such as tax and logistical issues that make hard to roast inside the country. It is known that roasting is the process that enhances the bean in its specificities being allied when preparing the blends of several producers. Without the proper roast the grain loses its commercial value (CECAFÉ, 2019).

On the other hand, Germany is the country which internalizes the appropriation of values through roasting at the time of preparing blends, increasing in 70% of the value of the good with this. The country has a 34% of the market share in volume sold all over the world, without local grain production. Participates in the European Union market with 53% and consumes 20% of the beverage in Europe (Centre for the Promotion of Imports from Developing Countries - (CBI, 2019a).

To understand the complexity of the coffee production chain, it is necessary to understand that logistics plays a decisive role in the supply chain. Therefore, this article aims to study the role of logistics and how its influence can improve production processes and trade in the sector, making the suggestions of improvements to increase the competitiveness of Brazilian coffee. To accomplish the proposed objective, the methodology adopted was an exploratory and descriptive research of the coffee production chain.

This article is divided into sections. First, the introduction brings a global picture of the coffee trade. Then, in section 2, a literature review will be presented on the subject and its main actors. After, section 3 presents the methodology developed and the steps followed in the construction of the work. The fourth section shows the results and discussions. Finally, in section 5, the final considerations and perspectives are observed.

2. Literature review

2.1 Coffee history and its consumption around the world

There are numerous legends about the origin of coffee. The best known is about a shepherd from Ethiopia who observed that his camels were excited after consuming the fruits and leaves of coffee. The monks of the region, observing this fact, began to prepare an infusion with the fruit and consume it frequently to make them awake during the long nights in prayer. The most logical legend is related to Islamic pilgrims from the Ethiopian region who used coffee seeds to become more active on long journeys to Mecca (RUFINO, 2006; BICHO et al., 2011; DUTRA, 2020; MARTINS, 2020)

Some legends point to the effects that coffee drink causes on the body. At first, coffee was ingested raw or as a fermented beverage from the fruit, probably by accident the grain was roasted and gave rise to the current drink. The spread of consumption around the world is related to the health benefits and as coffee became known, its cultivation and marketing were expanded in the same proportion (ROMEIRO; DELGADO, 2012; DUTRA, 2020).

The consumption of the coffee drink was related to the slave trade. During the long journeys from their villages to the port the slaves consumed the seeds to endure the long walks. The seeds may have germinated along the path or may

still have been purchased for planting (BICHO et al., 2011; FERRÃO, 2013; DUTRA, 2020;; MARTINS, 2020).

Islam was a great propagator of coffee drink consumption. When there was a ban on the consumption of alcoholic beverages, the adherents of the religion multiplied the planting and consumption of coffee in the territories linked to the religion, especially in Turkey (DUTRA, 2020; MARTINS, 2020). The process of roasting and grinding the grains arose in Turkey. The powder was put in water and boiled for a few minutes, decanted and consumed in family and social meetings (FERRÃO, 2009; MARTINS, 2020).

With the spread of coffee drink consumption around the world, trades specializing in selling beans and beverages have become usual place. There was the association of the benefits of the drink with healing power, causing its consumption to be increased and consequently there was an increase in sales prices (BICHO et al., 2011; MARTINS, 2020).

Houses which sold coffee became commonplace and were regularly frequented by politicians, artists and literary. In these places it was possible to talk and create in a welcoming environment and undoubtedly important decisions were made at their tables (BICHO et al., 2011; RODRIGUES; DIAS; TEIXEIRA, 2015; ICO, 2020a; MARTINS, 2020).

In Brazil, the first seedlings were brought to the northern region of the country at the beginning of the 18th century. After a few years of the beginning of planting in the country the climate and relief conditions of the southeast region were evident and are recognized to this day as the most suitable for the grain (SIQUEIRA, 2006; FERRÃO, 2013; BOAVENTURA et al., 2018; MARTINS, 2020).

2.2 Types of coffee grown and their agricultural production

The coffee plant is a shrub of the *Rubiaceae* family, being the most economically important genus the *Coffea*. Within this genus four species are explored: *Coffea arabica*, known as Arabica coffee; *Coffea canephora*, known as robusta coffee, responsible for about 99% of world production; and in a smaller volume: *Coffea liberica*, known as libérica coffee and *Coffea dewevrei*, known as coffee excelsa (CLIFFORD; WILLSON, 1985; SCHULTES, 1986; IMPACTO; CAFEICULTURA, 2005; BICHO et al., 2011; ICO, 2020b; MARTINS, 2020).

After obtaining the coffee seedlings, the soil needs to be prepared for planting with chemical or organic additives. The appropriate time for planting is the rainy months. The shrub takes about 2 years to start producing (SCHULTES, 1986; EMBRAPA, 2004; LUNZ, 2006; CARVALHO, 2007; FERRÃO, 2012; MARTINS, 2020). The harvest can be carried out mechanically or manually, the choice of technique is directly related to the chosen market niche (BICHO et al., 2011; FERRÃO, 2012; MESQUITA, 2016).

With the harvest of cherry coffee, it is necessary to process the fruit to obtain the coffee bean. One can use the dry or damp route, at the end of the process one gets green coffee, a form that is marketed (EMBRAPA, 2004; SANTOS, 2005; ARRUDA et al., 2011). The quality of the coffee bean is linked to the fact that the bean is harvested in a ripe state and processed quickly to prevent its deterioration (EMBRAPA, 2004; ARRUDA et al., 2011; MESQUITA, 2016).

The procedures performed to benefit coffee beans are to eliminate impurities, peel, remove the defective beans and separate the beans of different sizes to obtain the green coffee, which is the commercialized grain (EMBRAPA, 2004; MESQUITA, 2016).

3. Materials and methods

This article is composed of an exploratory and descriptive research of the coffee production chain, through a qualitative and quantitative approach. The association of different methods of interpretation allows the description of the coffee chain and analysis of the production of the main states, to understand the logistics of the sector and highlight the obstacles faced by producers.

By combining the methods, it is possible to mitigate the disadvantages of one technique with the benefits of another, so that the study is more complete (CAUCHICK-MIGUEL et al., 2018; MARCONI; LAKATOS, 2020). Exploratory research was used to familiarize the study problem of the coffee production chain (CAUCHICK-MIGUEL et al., 2018; KOKOL; BLAŽUN VOŠNER, 2019).

The literature review was based on indexed scientific articles from databases such as Science Direct, Emerald, Scopus, Wiley, Francis &Taylor, Scielo and others, as well as dissertations and theses on the subject. The data used were collected from Brazilian federal government databases (MAPA, IBGE, MDIC, CONAB, EMBRAPA e CEPEA) and other national and international bases of associations (ICO, CECAFE, SINDICAFE-MG e FEDECAFE).

To answer the proposed research problem, an exploratory and descriptive research was adopted. Research is an act to investigate theoretical or practical problems through scientific methods that evolves to the presentation of the results (KÖCHE, 2015; MARCONI; LAKATOS, 2020).

Field research was conducted to experience the reality of the coffee production chain:

- Cooperativa dos Agricultores Familiares de Poço Fundo e Região LTDA – COOPFAM (Poço Fundo/ MG) - July 2019
- Exportadora de Café de Guaxupé LTDA (Guaxupé/MG) - July 2019
- Cooperativa Regional de Cafeicultores em Guaxupé LTDA - COOXUPÉ (Guaxupé/ MG) - July 2019
- Trade Office of COOXUPÉ in Santos/SP - November 2019

This study was submitted to the ethics and research committee, all necessary information and documents were presented. No pending issues have been identified. The description of objectives, research method and questionnaire allowed the evaluation of ethical restrictions as non-existent. It was approved under the Opinion Number: 3,889,252.

4. Results and discussion

The coffee production chain involves several stages related to grain production, but with a focus on trade. By detailing this chain one can understand its direct relationship with Production Engineering addressing production

management, quality control, logistics, supply chains and so on (JESUS; COSTA, 2014; NETO et al., 2019).

Currently, the organization of the coffee sector makes it considered a true industry formed from the systematization of production processes (FARÍAS; ANGÉLICA, 2019).

Production Engineering guides the processes so that they are more efficient, in such a way there is no waste, so rework is avoided, with the aim of handling and transportation are directed to the customer (NETO et al., 2019). These processes are linked to logistics, which mainly considers the humidity and climatic conditions to which the grains are exposed. For example, when planting, sowing arrangement, fertilization and the use of pesticides, fruit harvesting, drying, packaging and storage stages, separation by grain size, sealing of packaging for export and or shipping to the domestic market are processes directly linked to logistics (FARÍAS; ANGÉLICA, 2019).

The logistics processes exposed tend to lead to industrial development with grain traceability, reduction of transportation and handling costs, making the coffee industry more competitive.

Figure 1 provides a diagram of the steps which the grain goes through until it reaches the final consumer. The Figure is divided into four steps which are represented by different colors. The first step is INPUTS, represented by blue color. All that is needed to start a coffee plantation such as agricultural implements and machining, seedling production and, defending and fertilizers. Step two is PRODUCTION, highlighted in green color. Here it is related to the planting of the grain, the choice of the type of grain that will be grown, it is here also that the producer decides what type of market he wants to reach. Each type of market requires specific care.

The INDUSTRY stage, represented in yellow color, relates the actors of the coffee industry. In this sector the performance of cooperatives is something rooted and very present. Independent brokers also play an important role in the negotiations. However, it is the cooperatives, most often, that carry out the processes of analysis, separation, negotiation, and sale. It is observed that other actors also participate as the roasters and soluble coffee industry.

The final step, which shows whether all the effort in grain production was successful is TRADE, represented in orange color. It is at this point that the grains will be destined for the domestic or foreign market.

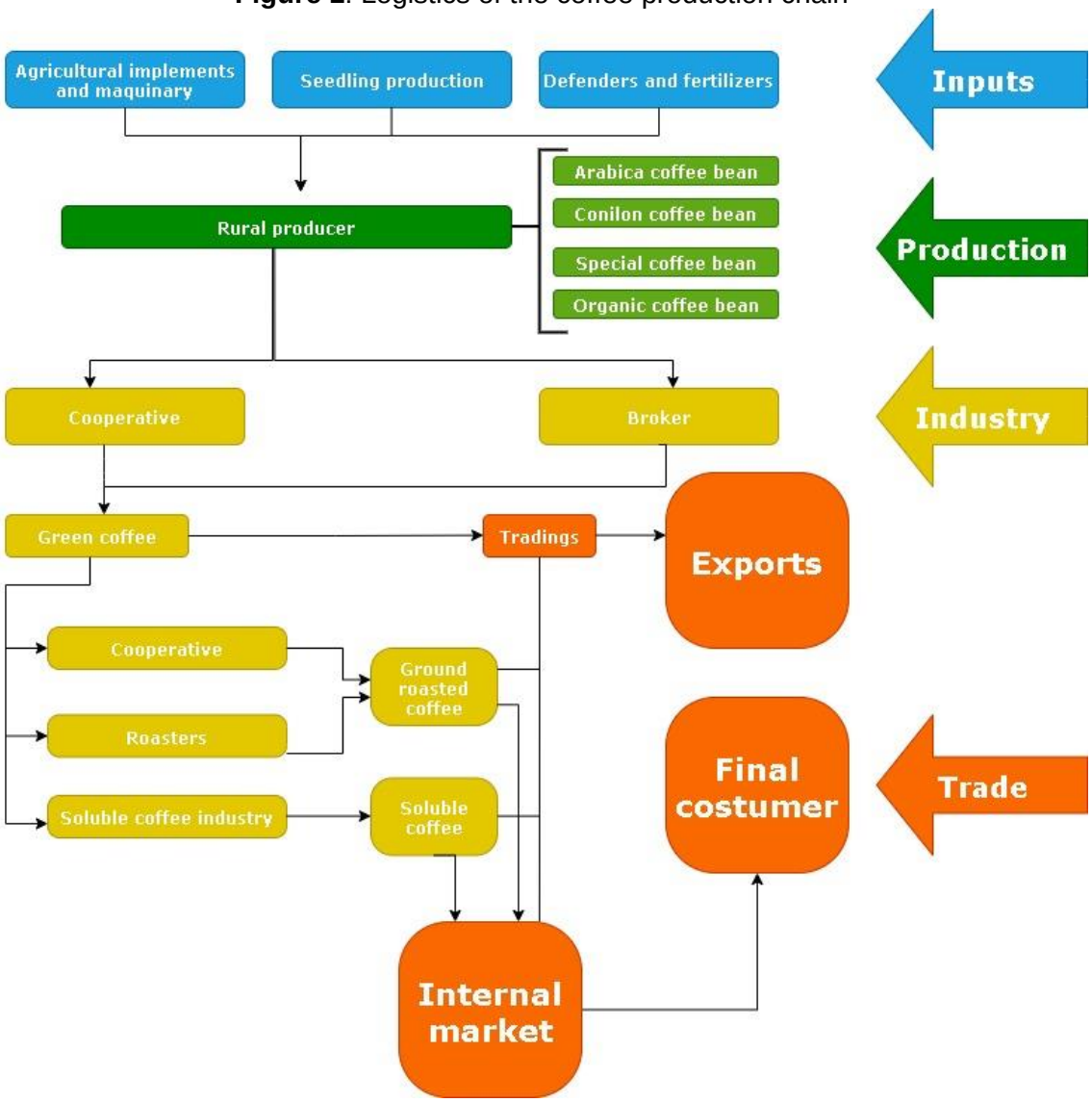
By definition of the Council of Supply Chain Management Professionals – CSCMP (CSCMP, 2020) logistics management covers the entry and exit of vehicles, fleet management, handling and storage, fulfillment of orders, integration of logistics from all sectors, inventory, supply and demand, and the management of outsourced workers. In different sectors it covers the offer and acquisition, planning and scheduling of production, packaging, and customer relationship.

It is observed that logistics is involved in all levels of operational, tactical, and strategic planning. And it integrates different activities in order to optimize them. Moreover, it integrates marketing, sales, finance and information technology (CSCMP, 2020).

In everyday life, the integrations of activities are not explored in their entirety, that is, it does not meet all the needs of the industry. Even with the coffee sector presenting good examples (FARÍAS; ANGÉLICA, 2019) the small

producer does not always have access to the same infrastructure as the large producer.

Figure 1: Logistics of the coffee production chain



Source: Authors, 2021.

Study conducted by Takeshima; Hatzenbuehler; Edeh, 2020 points out the impact of agricultural mechanization with regard to increasing the level of production, showing the advantages associated with the costs involved. The study is considered one of the first that addresses this theme.

A considerable volume of green coffee that is exported comes from small producers. All the machinery available to optimize planting and harvesting has a high cost, making it difficult to small producers to acquire it. These in turn make adaptations to optimize their work and increase their competitiveness.

One last point that is worth mentioning is the internalization of roasting in the sector. Brazil shows no intention in improving the country's roasting techniques and benefiting grains that can add up to 70% value to the product (BARJOLLE et al., 2017; CBI, 2019a, 2019b; CECAFÉ, 2019).

Logistics is a useful tool to optimize processes and increase the competitiveness of the sector in the foreign market. The efforts made in the sector

directly reflect on sales, mainly in the foreign market and in the specialty coffee market. Internalizing the roast is undoubtedly a way to maximize competitiveness and improve gains in the segment.

5. Finals remarks and outlooks

This work aimed to study the role of logistics to improve production processes and trade in the coffee sector through an exploratory and descriptive research of the coffee production chain. Understanding the coffee production chain leads to Production Engineering, emphasizing that the main actor is logistics.

Logistics is a major part of the studied segment. Its association with grain quality makes Brazil the largest producer and exporter in the world. It is evident that the sector needs investments in technologies to internalize grain roasting in order to export a benefited product.

Another investment to be considered would be the machinery used in the sector. Machines that cater from small to large producer and with affordable price.

For future work, it is suggested to study the role of logistics with quantitative approach to verify the costs of each stage of the coffee production process and propose improvements to optimize the sector.

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