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Supply chain planning and management method: the fruit purchasing company case

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Abstract - On the world stage, Brazil is the third largest world fruit producer. However, purchasing fruit companies are suffering from the effects of fluctuations in production and demand, inefficiency in production and information trade, lack of understanding of the dynamics of supply and reduction in profitability for all members of the fruit production chain. The supply chain management has been touted as one of the ways to reduce this volatility and improve outcomes for all involved with the supply chain. However, results of recent researches do not relate it directly to the fruit industry. To solve this problem, the present research aimed to analyze the planning and management of the supply chain of a fruit purchasing company and identify contributions and improvements to the theories and methods related to supply chain management to propose a method for planning and management the supply chain of fruit purchasing companies. It was conducted a case study from a mango fruit purchasing company using interviews with industry experts to assess the applicability, functionality and usefulness from the managerial point of view of the proposed method. Data analysis was done through the cross analysis of the methods of the supply chain management and the description of the case. The results of the study allowed the development of a method for planning and management the supply chain of fruit purchasing company. With the proposition of this method is expected to contribute with a sequence of steps to assist in planning and management of supply chain managers and specialists from a fruit purchasing company.
Index terms: Planning; Supply Management; Methods; Fruits; Case Study.

Método de planejamento e gestão da cadeia de suprimentos: o caso de uma empresa compradora de frutas

Resumo - No cenário mundial, o Brasil ocupa a terceira posição de maior produtor de frutas no mundo. No entanto, as empresas compradoras de frutas estão sofrendo pelo efeito da flutuação da demanda, pela ineficiência na produção e troca de informações, pela falta de compreensão da dinâmica do processo de fornecimento e pela redução na rentabilidade. O gerenciamento de suprimentos tem sido apontado como uma das formas de diminuir esta instabilidade e melhorar os resultados na entrega do produto. No entanto, as pesquisas recentes que suportam esses resultados não estão relacionadas ao setor de frutas. Na tentativa de contribuir com a solução deste problema, o presente estudo tem o objetivo de analisar o planejamento e a gestão da cadeia de suprimento de uma empresa compradora de fruta; identificar contribuições e melhorias; identificar as teorias e os métodos relacionados ao gerenciamento da cadeia de suprimentos para propor um método de planejamento e a gestão da cadeia de suprimentos de empresas compradoras de frutas. Foi utilizado o estudo de caso de uma empresa compradora de manga; utilizando-se de entrevistas com especialistas do setor para avaliar a aplicabilidade, a funcionalidade e a utilidade do ponto de vista gerencial do método proposto. A análise dos dados deu-se por meio da análise cruzada dos métodos com a descrição do caso. Os resultados permitiram a proposição de um método de planejamento e a gestão da cadeia de suprimentos de empresas compradoras de frutas. Com o estudo, espera-se contribuir com uma sequência de passos que auxiliem nas atividades de planejamento e gestão da cadeia de suprimentos por gestores e especialistas de uma empresa compradora de frutas.
Index terms: Planejamento; Gestão do Fornecimento; Métodos; Fruticultura; Estudo de caso.

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Introduction

The business environment has undergone changes in behavior and managerial decisions that have required a new strategic positioning. Among the important sectors for the Brazilian economy, one that stands out is the fruit sector. The fresh fruit market handled more than 40 million tons in 2015 and a harvested area of approximately two million hectares (IBGE, 2015). In the world scenario, Brazil occupies the third largest production of this segment in the world and has accumulated positive trade balances since 1999 (FAULIN; AZEVEDO, 2003; IBRAF, 2010). Fruit production accounted for 10% of the agricultural GDP and 40 million tons of total production in 2005 for the Brazilian market (EMBRAPA, 2011, IBGE, 2011). In Brazil it is estimated the per capita consumption of hortifruti products of 19 kg / inhabitant / year and in European countries this value reaches 120 kg / inhabitant / year (FAULIN; AZEVEDO, 2003).

Representing the fruit sector the Brazilian mango (*Mangifera indica* L.) obtained production of 976.8 thousand tons of which 163.5 thousand tons were exported with value of US $ 195.0 million. (IBGE, 2015; SECEX, 2017). According data from Soares (2012) mango occupies the first place in the export agenda of products originating from Brazilian fruits.

In this agro-industrial environment which includes the fruit sector, the change has also been marked by coordination and cooperation between companies. According to Brandão and Arbage (2016) an increasingly systemic approach has been directed to agribusiness agents with emphasis on partnerships between organizations, production cooperatives, networks of small and medium-sized enterprises, and a wide range of inter organizational arrangements.

However, the fruit market does not always meet consumer expectations. The deterioration of quality along the supply chain, price, availability and high rates of agrochemicals in the production are the main encountered problems (OPERA, 2003; TRIENEKENS et al., 2008).

The mango consumer seeks characteristic palatability, aroma and coloring; nutritional values and the therapeutic effects (BEZERRA et al., 2011). However, these authors point out that, due to their seasonality of production a possible solution is the industrialization and production of pulp with the aim of improving the utilization and reducing production losses.

The mango consumption as an input purchased by the dairy, ice cream and candy industries is expanding (KUSKOSKI et al., 2006). Bezerra et al. (2011) affirm that inadequate processing, transportation and storage practices compromise the quality of sold pulps and cause damages to fruit producers, industry and consumers. Researches show the advance to solve technical problems, such as selection of more productive and resistant varieties to diseases, transportation and management (BALLY, 2011). However, there is a gap when looking at the problem from the point of view of how to manage this problem.

One of the way to solve these problems of scarcity or excess of products and lack of suitability and consequently variations in demand is to add efforts to establish an improvement of logistics, production planning, and quality control (VOLLMANN et al. al., 2006), that integrate the input companies and the retail companies. These interactions have been successful in sharing skills, facilitating innovations, maintaining focus on sustainability and competitive viability (PALUDO; CASAROTTO; MINUZZI, 2008).

In this sense, these demands point out to the study of supply chain management.

A common definition is that the supply chain encompasses all the activities of the companies involved in the entry of a product since the raw material, industrialization and assembly, stock and tracking, order management and sequencing, distribution by all channels, delivery to the costumers until the information systems that monitor all these activities. On the other hand, supply chain management is responsible for the coordination and integration of all these activities in a more simplified process (CHOPRA; MEINDL, 2007; BALLOU, 2006; SELLITTO; MENDES, 2006; SUPPLY CHAIN COUNCIL, 2005; SCAVARDA; HAMACHER, 2001; LUMMUS; VOKURKA, 1999; COX; BLACKSTONE, 1995).

Studies in logistics, production planning, quality and control carried out in Brazil and abroad indicate that supply chain management can minimize the effect of fluctuating demand, increase the efficiency between the information exchanges and products of chain members, helping to understand the dynamics of the process and increase the profitability of all. Among the scholars in these areas, the authors stand out: Ballou (2007), Chopra and Meindl (2007), Lambert, Cooper and Pagh (1998), but their studies do not apply to the characteristics of supply chain management for fruits and are related to other realities than the Brazilian one.

The concepts presented by above mentioned authors help in understanding the factors and the dynamics of a supply chain. However, these concepts apply in general to the procedures for implementing supply chain planning and management practices. Thus, the literature also presents models and methods that contribute to the management of the supply chain as a reference of elements, processes and essential structures or a sequence of processes and activities.

The methods of the supply chain management of several authors are efficient for industries of technological, automotive and engineering sectors for the European and American market: Maloni and Benton (1997); Krause, Handfield and Scannell (1998); Lambert, Cooper and

Pagh (1998); Van Hoek (1998); Hicks (1999); Agarwal and Shankar (2002); Huang, Sheoran and Keskar (2005); Stadtler and Kilger (2005); Supply Chain Council (2005); Ketchen Jr et al. (2008); Asbjornslett (2009); Monczka et al. (2009).

For Brazil, several studies of supply chain management prove feasible to minimize or solve these problems when analyzing the automotive sectors; computing; drinks; cereals and animal protein: Scavarda and Hamacher (2001); Parra and Pires (2003), Alves Filho et al. (2004); Conceição and Quintão (2004); Talamini, Pedrozo and Silva (2005); Sellitto and Mendes (2006); Maçada, Feldens and Santos (2007); Brandão and Arbage (2016); Puga, Delfim, Scandiuzzi (2016). However, it is considered that there are not studies that prove its applicability to the planning and management on the supply chain of fruit purchasing companies in Brazil.

Due to the lack of specialized studies of models and management methods on supply chains applied in the fruit sector, among these the mango, it identified the need to investigate what are companies evaluating to plan and manage the supply chain on buying fruit in view of the Brazilian reality.

Material and Methods

The present study was conducted through a descriptive and qualitative research using a case study method of a company involved in coordinating the management of the supply chain on fruit purchases in Brazil.

The study was carried out in two phases. The first phase was to realize semi-structured interviews with organizations directly linked to the sector to characterize the fruit supply chain. The second was to realize a case study on the planning and management of the supply chain of a fruit purchasing company. For the elaboration of the case, 23 organizations were interviewed that are directly related to the company "Alfa", 13 fruit pulp producers, eight research entities and technical assistance and 5 producers and / or mango producers' associations.

The sampling carried out in the study was non-probabilistic by trial of mango producers, research entities and technical assistance to producers and companies producing pulp fruit which reached some minimum selection criteria described in Table1.

From the definition of sampling, the interviews were conducted with farm managers, production managers, purchasing managers, and other executives who have relevant knowledge about the fruit chain related to input companies, fruit producers and retailers, who preferred not be identified.

Data collection: The case study was limited to the private domain of a company purchasing mango that allowed the researcher to understand the characteristics of real-life events which, for the study, can be defined in the way fruit purchasing companies, realize the planning and management of the mango supply. The selection of those involved in the study took into consideration the sampling criteria highlighted in the previous topic.

To ensure that these procedures were followed during data collection, the activities to be performed were listed in a case study protocol based on the studies by Campomar (1991) and Yin (2010).

In order to establish the case it was proceeded a collect in a six-step sequence, presented in Figure 1, and the interview questions are indicated in Table 2 to evaluate the planning and management of the supply chain of a company and propose an action plan for improvements in this purchase process.

Table 1. Example of issues and actions to be taken in each of the steps in the supply chain planning and management method.

Sample	Criteria
Producers and / or producers' association of mango	The producer and / or association should be nominated through experts from pulp-producing companies and research and technical assistance entities.
Research and technical assistance agencies	The entity should focus on the development of mango production.
Companies producing pulp fruit	The company should produce pulp for the supply of other companies (B2B), and should meet specifications of production capacity, soluble solids content (°Brix) and way of preserving the raw material

Table 2. Example of issues and actions to be taken in each of the steps in the supply chain planning and management method.

Phases	Questions and actions
1 – Understand the structure of the chain whether company supplies	What are the main inputs (products or services) acquired or produced internally? What are the costs involved (acquisition, handling, transaction, storage, etc.)? What are the involved processes in production? What are the productive cycles?
2 – Conduct market research on the main inputs purchased by the company	Description of market characteristics and the operation of the main inputs. How many suppliers, products, brands, channels, prices? What services are offered to suppliers? What are the risks involved on location and macro-environmental?
3 – Conduct the diagnosis of each input in the company supply chain	What is the ratio of resources used X benefits? Choose from single supplier X multiple suppliers. What is the degree of sophistication on the relationships? What is the dependence degree on specific suppliers? What are the involved vulnerabilities and risks? Establishment of a priorities list for intervention in the chain. What are the global goals and the tradition of the company in the chain? Is there internal resistance to changes in the organization (cultural aspects and barriers)?
4 – Propose the structuring of the governance on each input in the company supplies chain	Analyze the economic margins of each agent in the supply chain. Identify and describe possible forms of capture value. Measure the gains of specialization. Build barriers to entry of new competitors. Promote development and inclusion using government credit lines
5 – Elaborate the contract (relationship)	Negotiate a “win-win” agreement within the supply chain. Describe the flow of products, services, communication, payment and information. Analyze the specificities of investments and the risks of these investments. Promote incentives and share the results of the chain’s competitive gains.
6 – Conduct relationship management	Establish forms of governance with Council. Go through the evaluation of external commissions. Constantly seek reduction in transaction costs. Explore the innovation gains and share them in the supply chain. Benefit from the experience curve Continue with the benchmark process and the evaluation of alternatives (e.g. exportation). Seek innovation and avoid the risks of accommodation. Improve services and support. Share the open communication platforms. Be flexible and responsive. Promote collaboration and cooperation between different suppliers. Permanently increase confidence in the chain.

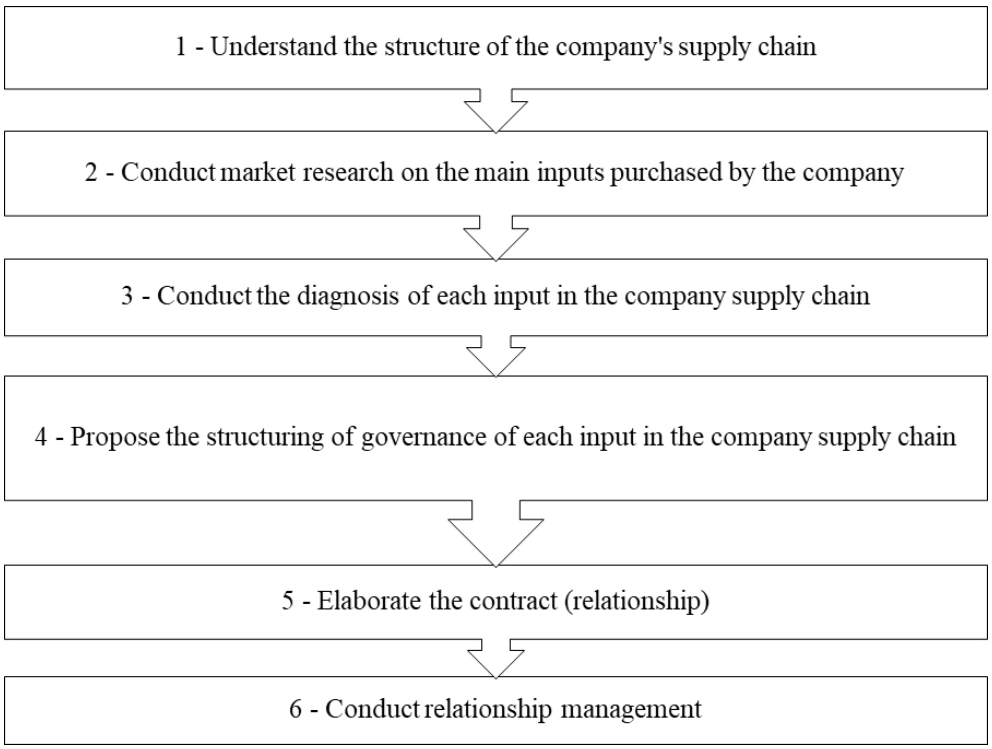

Figure 1. Method for planning and managing the supply chain of a company based on experience with fruit chain.

Results and Discussion

The case of the mango purchasing company in Brazil

The analysis of the case was made through a logical model of the organizational level of a mango purchasing company which was also described as "Alfa" company, and has the following characteristics: pulp and nectar industry in Brazil and a Brazilian branch of a multinational industry that has the capacity to process more than 100 million liters of juice / pulp and nectar per year.

The unit of the analyzed case can be represented in Figure 2 and the description will be presented in the following topics.

1. General characterization of the production in Brazil

The mango is the main product of the export agenda on Brazilian fruitculture (EMBRAPA 2004). Brazil was the 7th largest mango producer in the world in 2012, even with a small planted area in relation to the other countries, 70,000 ha (FAO, 2015). The Brazilian production is mainly located in the Northeast and Southeast from 1980 to 2007; mango grew strongly in Brazil, mainly in irrigated areas (IBGE, 2015; SEAGRI-BA, 2010). The profitability of the crop was impaired by the increase on input costs and the increase in the produced volume which pushed prices down. The variety that was more commercialized, Tommy Atkins, has been replaced mainly by Palmer with better flavor and less susceptible to diseases (SEAGRI-BA, 2010).

2. Characterization of production in major producing States

Data from IBGE (2015) which can be observed in Figure 3 indicate that the main producing States of Brazil are Bahia, São Paulo, Pernambuco and Minas Gerais. In addition to these, we add the importance of the State of Espírito Santo which produces mango to meet the industrial demand for pulp and nectar production.

Based on the identification of the main producing States, the market gathered information from local production agents for understanding the commercial dynamics presented in these mango production markets.

3. Detail of the State production

Technical characterization of production

II In order to ensure that besides being a State capable of producing mango with a tradition on cultivation and with sufficient volume to serve the industry, this step sought to investigate whether the technical characteristics of the mango produced in the State were in accordance with the requirement of the company. In this way, we investigated the predominant cultivation varieties, the main technical vulnerabilities and the forms found to minimize these vulnerabilities. This information has been consolidated and can be seen in Table 3 below.

Table 3. Market information of the main mango producing States in Brazil.Source: Prepared from EMBRAPA, 2004; FAO, 2015; IBGE, 2015; SEAGRI-BA, 2012.

State	Market information
BA and PE	Concentrated production at Polo Petrolina / Juazeiro and focused on the foreign market and table consumption. At the peak of the harvest, which coincides with production in the State of São Paulo occurs a supply surplus that is not absorbed by the market and is directed to the industry.
SP	Production focused on the domestic market and industry. The fruit is perceived as of poorer quality than in the Northeast, mainly due to postharvest problems, due to the high incidence of anthracnose resulted to the higher rainfall at harvest time.
MG	Production concentrated in the region of Janaúba and focused on the domestic market. The main variety offered in the State is Palmer. The mango from the state is produced in the offseason of the mango from the Northeastern Brazil and the State of Sao Paulo with the aid of irrigation. The State is also the main producer of Ubá mango, variety widely appreciated for industrialization.
ES	Production focused on the industry. The main variety produced in the State is Ubá. Production through small producers and low technology use.

The analysis of the three factors listed above - varieties, vulnerabilities and mitigation - may help the fruit buyer to invest in the supply partnership with one of the analyzed regions.

During the interviews with the fruit-purchase industry evidenced the concern with the variety of fruit produced in the region, since, depending on the variety the flavor and the amount of fibers in the juice can be affected, characteristics that are essential for the consumer preference. The industry currently has preference for Ubá variety followed by Tommy and Palmer.

Regarding to vulnerabilities, the fruit purchase industry is concerned that some vulnerability in the region may make the supply partnership unfeasible in the future harming investments and supply.

Predominant producer profile

After the survey of the varieties, vulnerabilities and mitigation followed the producers' characterization on irrigation use, the technical assistance and the target market for the production. For the fruit purchase industry, it may be beneficial the relationship with small producers and the use of irrigation, since such practices may include social and environmental sustainability issues. In addition, it tried to show if the producers receive technical assistance that helps in the cultivation and the choice on the production target market. Technical assistance can help solve problems during production and the product characteristics are related to the production target market.

Regarding the target market, the interviewees stated that the production directed to the consumers' table has much higher added value than the production focused on the industry, which may make it unfeasible to purchase the input.

Average Operating Production Cost and Average Productivity

As discussed earlier, the product cost may compromise the ability of the fruit purchase industry to supply it. Thus, we investigated the characteristics of production cost and average productivity on visited regions presented in Table 5 below.

For the interviewees, as greater the adoption of technology, greater the impact on productivity which can reach values of 45 t / ha, about six times the average productivity identified in Colatina (ES), region with the lowest average productivity among the four analyzed.

In addition, one must also analyze the investment made in the crop in relation to its purpose and possible return on investment. For the purchasing industry, the production cost can also be an indicator for the establishment of a partnership, being a comparison point for the value that the company considers viable for the fruit acquisition.

Table 4. Production cost and average productivity in the main mango producing States in Brazil. Source: Elaborated from the interview.

Items	BA and PE	BA	SP	ES
Average operating cost	R$ 10,000 to R$ 12,000	R$ 5,000 to R$ 7,000	R$ 5,000 to R$ 7,000	R$ 1,000 to R$ 2,000
Average Productivity	35-45 t/ha	10-20 t/ha	10-20 t/ha	5-10 t/ha

Production Destination

The fruit productive areas in Brazil have the characteristic of production that seeks to meet the consumer demand on fresh fruit (table market) and the consumer of jellies, juices, sweets etc. (industry). And depending on the region, the producers already establish quantity of their production for each of these demands. For the fruit-buying industry, the greater the targeting of agricultural production for the production of juice, pulp and derivatives, greater is the supply availability.

4. Production Sustainability

Continuity of Culture

The next relevant topic for a company's supply chain was the continuity of culture in the researched regions. During the interviews it was shown that the mango was being affected by competition of the planted area by the substitution for other crops and also that the availability of labor and working conditions in the producing regions could hamper production in the future.

Phytosanitary

In addition to the characteristics of competition and the availability of labor, natural factors and their controls can affect the continuity of the crop in the region. Thus, we sought to investigate among the interviewees the presence of limiting natural factors and it was identified that pests and diseases were the main natural factors that could be controlled.

Pest and disease factors may be limiting to the production on the region, since control by the registered products may be inefficient. With regard to the use of PPE, this is fundamental to the safety of the producers and can generate labor lawsuits for the employers and even come to harm the image of the buyer industry. And regarding to the packaging disposal there is a law regulating this activity, and noncompliance can generate even more burden.

Environmental aspects

In addition to competition, labor characteristics and phytosanitary issues, other factors that the interviewees claimed to affect the continuity of the crop are the environmental aspects. In relation to these aspects were highlighted the issues of catchment and use of water and soil conservation.

The catchment and use of water were highlighted as extremely relevant to fruit production, since, according to the interviewees, fruits are highly dependent on water to express their productive potential. In addition, the issue of soil conservation is important because it affects the availability of nutrients to the plant and also its production capacity.

It is noted that the use of micro sprinkler irrigation is one of the measures adopted for the best use of water and that in Petrolina / Juazeiro and Itaberaba there is an institution that assists in the supply of water to the producers that can encourage fruit production in the region. In relation to the soil there are mainly problems with the availability of nutrients and erosion, negatively affecting the production.

5. Marketing characterization

Average Price Paid to the Producer and Price Formation

Another essential factor for the guarantee of fruit supply of a company is the understanding of the price paid for the input and the price formation mechanism of the region. During the interviews it was shown that the main characteristics for mango and other fruits in general is that there is a price for production during the harvest and outside the harvest.

The off-season period is considered by producers as the one in which there is little fruit on the market, either because of production losses or because of the seasonality of the harvest. It was also noted that the price of fruit for the table market is higher than the price of fruit for the industry, since the producers claim to demand more resources for table fruits. For the price formation mechanism in most regions, the price paid for the mango is dictated by the relationship between supply and demand. Only for the region that has its production oriented towards the industry (Colatina - ES) there is an agreement between the industry and the producers to establish the prices by reason of the production cost.

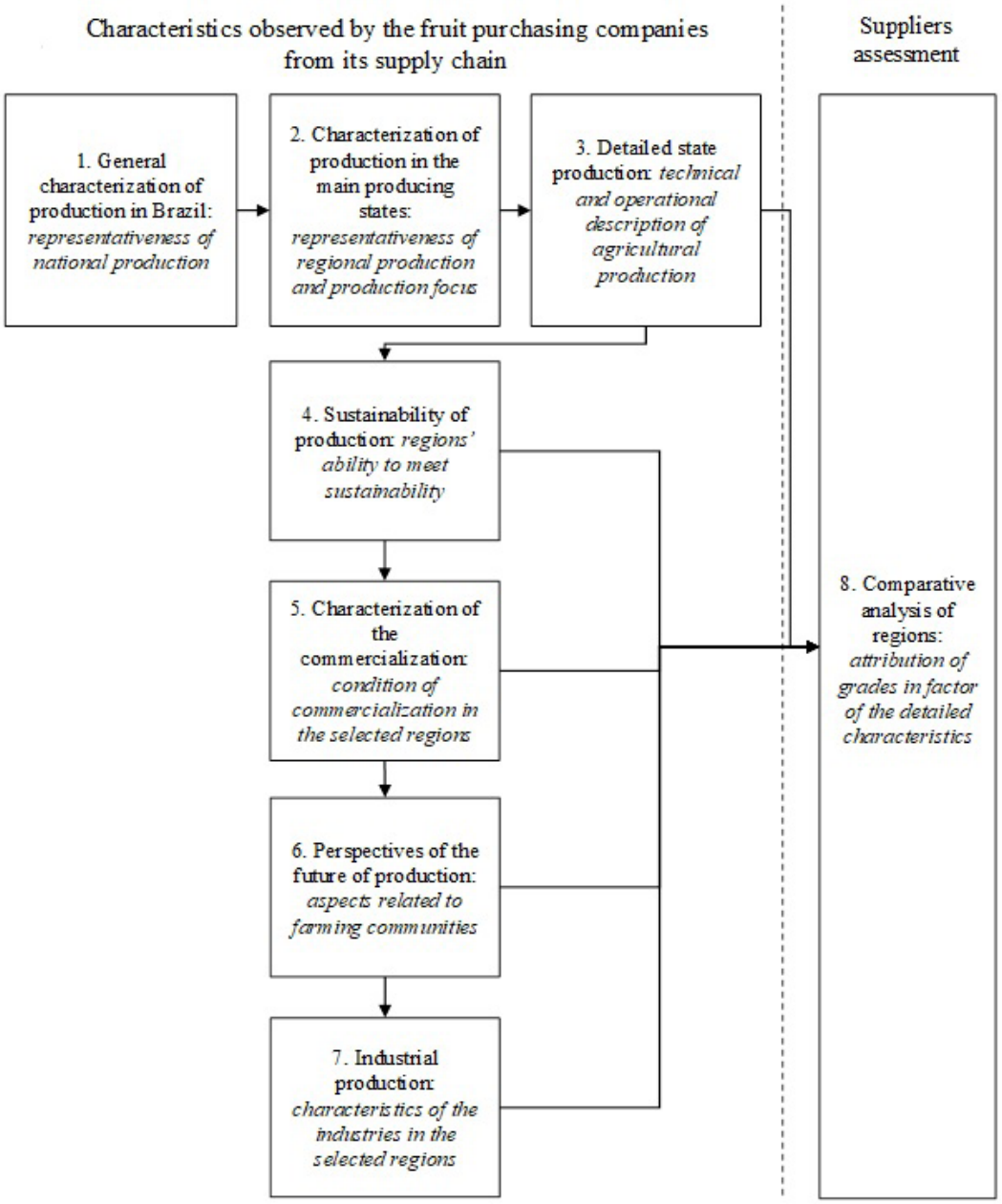

Figure 2. Unit of analysis on the case of the fruit purchasing companies.

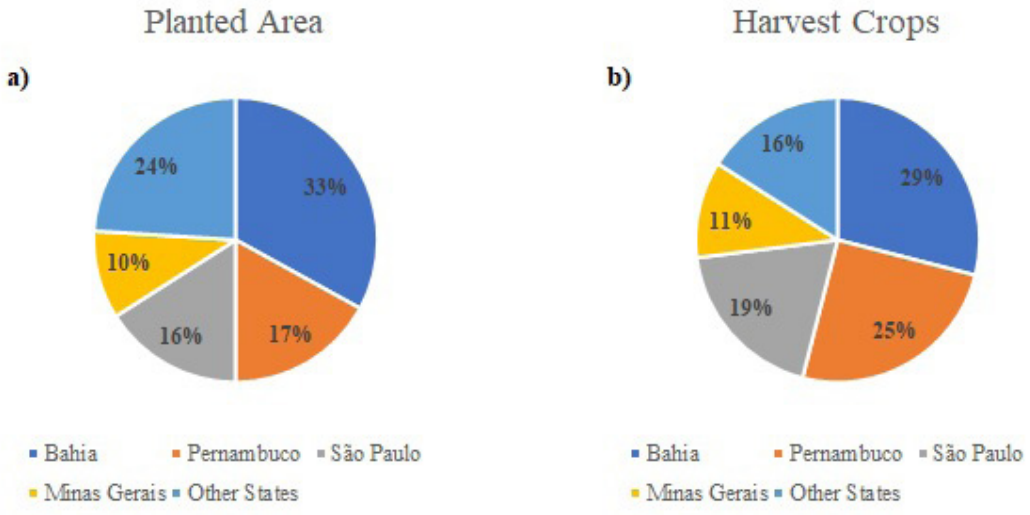

Figure 3. Percentage participation in planted area (a) and harvested production (b) of the main producing States on total mango production in Brazil. Source: adapted from IBGE, 2015.

Governance Structure

After the study of prices and pricing mechanisms, it was followed the study of the structure of governance between producer and buyer of fruits in the regions. The interviewees pointed out that in most of the regions there is no formal supply contract and that the purchase of fruit is carried out in the market by cash (*spot*) including the presence of intermediaries that concentrate the production volume of the small producers to meet the greater demands. Even in regions where production is focused on the industry there is still a degree of informality that may hinder the planning and management of the company supply chain.

6. Prospects for the future production

Yet in relation to the characteristics of mango production in the selected regions, another point addressed to the planning and management of the supply chain of a fruit purchasing company was the expectation of local agents regarding the continuity of the culture in the region.

The interviews pointed to relevant considerations in the aspects of national and international market trends, climatic problems and the adoption and development of technology. It is noted that the expectations of the local agents can be an important driver for the planning on the suppliers' development in the analyzed regions.

7. Industrial production

Characterization and Capacity of Factories in Regions

The analysis of mango production characteristics in the surveyed regions was an important tool for understanding the input for industrial production. And during the interviews we observed that besides the fruit producing regions there are small industries close to these regions and that are also source of supply of other industries closer to the consumer centers.

Thus, in this topic we sought to highlight the characteristics of these smaller factories to assist in the process of planning and management of the supply chain of a fruit purchasing company both in the primary input item, mango, and in the supply of a secondary input, pulp fruit for the production of nectar, sweet and other. Table 5 below shows the surveyed industries that, in addition to being source of data through the interview of their managers and executives can also be a source of supply of fruit buying companies. The names of the factories were preserved at the request of the interviewees.

Table 5. Characterization and capacity of factories in the analyzed regions.

Factory	Local	Main input	Concentrator	Processing capacity	Other fruits of interest
Factory A	Aracati (CE)	Cashew	Yes	29 thousand t / year	Pineapple, guava and mango
	Araguari(MG)	Passion fruit	Yes	27 thousand t / year	
Factory B	João Pessoa (PB)	Pineapple	Yes	100 thousand t / year	Cashew, guava, mango and passion fruit
Factory C	Petrolina (PE)	Multi fruits	No	40 thousand t / year	Pineapple, cashew, guava, mango and passion fruit
Factory D	Petrolina (PE)	Acerola	Yes	21 thousand t / year	Cashew, guava, mango and passion fruit
Factory E	Petrolina (PE)	Mango	Yes	24 thousand t / year	Pineapple, cashew, guava, mango and passion fruit
Factory F	Vista Alegre do Alto (SP)	Guava	Yes	12 thousand t / year	Mango
Factory G	Matão (SP)	Guava	Yes	80 thousand t / year	Mango
Factory H	Uberlândia (MG)	Multi fruits	No	5 thousand t / year	Pineapple, cashew, guava, mango and passion fruit
Factory I	Cabreúva (SP)	Strawberry	No	5 thousand t / year	Pineapple, cashew, guava, mango and passion fruit
Factory J	Jaíba (MG)	Multi fruits	Yes	15 thousand t / year	Pineapple, guava, mango and passion fruit
Factory K	Nova Soure (BA)	Multi fruits	Yes	20 thousand t / year	Cashew, guava, mango and passion fruit
Factory L	Linhares (ES)	Mango	Yes	16 thousand t / year	Guava, mango and passion fruit
Factory M	Petrolina (PE)	Grape	Yes	70 thousand t / year	Mango

Logistic cost to the industrial consumer

The cost of seeking supplies in the fruit producing regions is other important information for the industries. In this way, it tried to highlight the value charged from the producing region or the factories until the possible delivery place.

In Table 6 below are consolidated the information on the values of the freights surveyed with the transport companies operating in the region.

Table 6. Logistic cost of a refrigerated closed truck from the producing regions to the industrial consumer in Reais (Brazilian currency).

Source	Factory 1 - SP	Factory 2 - ES	Factory - BA
Aracati - CE	5,000-6,000	5,000-6,000	3,000-4,000
João Pessoa - PB	6,000-7,000	4,500-5,500	4,500-5,500
Petrolina - PE	6,500-7,500	4,500-5,500	4,000-5,000
Itaberaba - BA	5,000-6,000	4,000-5,000	2,000-3,000
Livramento de Brumado - BA	4,500-5,500	3,000-4,000	2,000-3,000
Linhares - ES	4,000-5,000	0-1,000	4,500-5,500
Jaíba - MG	3,000-4,000	3,000-4,000	3,000-4,000
Araguari - MG	1,000-2,000	5,000-6,000	6,500-7,500
Frutal - MG	1,000-2,000	5,000-6,000	5,000-6,000
Jaboticabal - SP	2,000-3,000	5,000-6,000	6,500-7,500
Campinas - SP	1,000-2,000	6,500-7,500	6,000-7,000

8. Comparative analysis on different regions

In order to consolidate all the information obtained during the interviews was established a comparative analysis on different surveyed regions. As shown in Table 7 below, it sought to give a score for each identified item in the interviews within the following pattern: 1 - below expected, 2 - within expected and 3 - over expected. The grades were grouped in the categories *Agricultural, Industry and Continuity of Culture*, and for each one of these categories a weight was established that assists in the selection of the supplier that obtains the highest overall grade.

This step of selection by grade was also observed in the proposed methods during the review and the values of each item were assigned according to the researcher's perception. For the mango supply, the region grades are as follows: Petrolina and Juazeiro – PE/BA = 30, Jaboticabal – SP = 26, Livramento – BA = 25, and Colatina – ES = 21.

Table 7. Comparative analysis on different fruit producing regions.

Variables	Petrolina and Juazeiro -PE/BA	Livramento-BA	Jaboticabal-SP	Colatina-ES
Agricultural	***22***	***16***	***18***	***13***
- Operational production cost per kilo	2	1	3	3
- Productivity	3	2	3	1
- Irrigation	3	3	1	1
- Satisfaction with technical assistance	3	1	2	1
- Harvest length	3	2	2	1
- Conviviality with pests and diseases	3	3	3	3
- Existence of a minimum portfolio of registered pesticide	2	2	2	2
- Production volume	3	2	2	1
Industry	***4***	***5***	***5***	***5***
- Governance (contracts and assistance)	1	1	1	1
- Destination of production for industry	2	1	2	3
- Freight cost	1	1	2	1
Continuity of the culture	***4***	***4***	***3***	***3***
- Historical analysis of production	1	3	1	2
- Expectations of local agents	3	1	2	1
Final grade	***30***	***25***	***26***	***21***

Conclusions

The case study showed that it is possible to collect information about the planning and management on supply chains of a fruit purchasing company more specifically the mango.

The case study between the producers and the mango purchasing company in Brazil evidenced the feasibility on collecting the necessary information for the understanding and diagnosis of the mango supply for a company through in-depth interviews and market research. In addition, the case study also demonstrates the effective participation of managers and experts in agricultural and industrial production for the planning and management on fruit supply chain in Brazil.

The consolidation of the results indicated that there are regions with better fruit supply skills than others for industry and depending on the company strategy it can use this data to develop strategies that are aligned with the needs of everyone in the chain.

It was possible to verify with the results, the following analyzes: understanding of the supply chain and the functioning in the market on main inputs, strategic analysis of the relationships within the company focus, and finally, proposal of new forms of organizations to make them safer, reduce their costs and improve the confidence of the entire supply chain.

Regarding the study it was evidenced that for the planning and management of the supply chain it is necessary, in addition to the planning and management itself, to establish a supply partnership, a supplier development strategy, a supply chain control, evaluate the chain, and select the suppliers. Thus, the proposed method encompasses all these activities in a single method that obtained contributions from the case study to guide in its elaboration and viability.

It is worth mentioning that the same analyzes carried out during the interviews and case study should be carried out to understand the supply chain, and it is still necessary to establish a governance structure, develop contracts and manage the defined relationship, so in fact occur the planning and the supply chain management of a company.

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