

## Roses supply chain management

### Gestão da cadeia logística de rosas

**Mariela Carmignani Grisotto\*, José Vicente Caixeta Filho**

Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo (ESALQ-USP),  
Piracicaba, SP, Brazil

#### ABSTRACT

The present article presents a study of the main elements of a Brazilian rose grower cooperative's logistics chain, which includes customers, producers, transport companies, and the cooperative itself. The intent of the study was to better understand this chain's organization; evaluate its logistic performance, especially its transportation stages; and assess the cooperative's level of logistics development. Data was collected through interviews and the application of questionnaires. The importance of the cooperative's efficiency in managing the chain is highlighted, as it is the link between producers and consumers and represents a lever that determines the roses' competitive position in the market. In addition, the asymmetry of information among agents as to what represents good rose transportation and handling practices is pointed to as a difficulty hindering efficient chain operation. Another factor highlighted during the analysis was customer communication with and loyalty to the supplier, in this case the producer, since this is an important determinant of product quality: the customer must be able to relate any dissatisfaction with product quality to the producer.

**KEYWORDS:** Rose's logistic chain; Supply chain management; Logistic performance.

#### RESUMO

O presente artigo discute sobre os principais elementos relacionados à gestão da cadeia logística de rosas, procurando entender a organização dessa cadeia fundamentada em uma cooperativa, bem como avaliar as etapas de transporte entre os principais agentes dessa cadeia (clientes, produtores e cooperativa) e a realização de um diagnóstico de desempenho logístico dessa cooperativa. Para inserir a visão dos agentes e práticas comuns desse mercado nos resultados do estudo, foram aplicados questionários a atacadistas, varejistas, transportadoras e também foi realizado um diagnóstico de desempenho logístico de uma cooperativa. Dessa forma, a importância da eficiência da cooperativa em seus processos é destacada, por ser o elo de integração entre produtores e consumidores e também por representar uma alavanca à competitividade das rosas no mercado. Além disso, a assimetria de informação em relação às boas práticas no transporte também é apontada como uma dificuldade a ser enfrentada entre os agentes dessa cadeia. Outro fator relevante a análise, diz respeito à fidelização do cliente ao fornecedor, nesse caso o produtor, por ser este um importante determinante da qualidade do produto, sendo o cliente apto a relacionar a sua insatisfação com a qualidade ao produtor.

**PALAVRAS-CHAVE:** Cadeia logística de rosas; Gestão da cadeia de suprimentos; Desempenho logístico.

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#### \*Mariela Carmignani Grisotto<sup>i</sup>

Master's degree in Business Administration (Agribusiness) from Luiz de Queiroz College of Agriculture, University of São Paulo (ESALQ-USP). Research Analyst of the Agroindustrial Logistics Research and Extension Group (ESALQ-LOG).

Address: Av. Pádua Dias, 11, 13418-260, Piracicaba, SP, Brazil.  
E-mail: mariela.grisotto@usp.br

#### José Vicente Caixeta Filho<sup>ii</sup>

PhD in Transport Engineering from the Polytechnic School of the University of São Paulo and a Post-Doctorate from Christian-Albrechts Universität zu Kiel, Germany, and from the University of Illinois at Urbana-Champaign, USA. Professor in the Department of Economics, Administration and Sociology of the "Luiz de Queiroz" School of Agriculture (ESALQ) and Coordinator of the Agroindustrial Logistics Research and Extension Group (ESALQ-LOG).

E-mail: jose.caixeta@usp.br

## 1 INTRODUCTION

Floriculture for commercial purposes in Brazil began in the 1950s. Producers settled close to large consumer centers due to the urban conglomeration, a factor that favored access to labor, easy access to distribution channels and the country's limited technology to permit storage and distribution over long distances.

The Brazilian flowers and ornamental plants sector, under the strong influence of immigrants, developed and has gained a foothold in the country's economy. In 2014, production and commercialization of the sector's products was responsible for transactions valued at more than R\$ 10 billion, generated 190 thousand direct jobs, and although still very concentrated in the state of São Paulo, is active throughout Brazil (Neves & Pinto, 2015).

An important feature of the flowers and ornamental plants chain is the large number of links, especially with regard to marketing and distribution. Among the main agents involved are farmers, cooperatives, wholesalers, and retailers.

The cooperative is responsible for all logistics in the case of its linked farmers, making it imperative that the cooperative is efficient in the management of these processes. In view of the need to integrate the links in this chain, transportation becomes extremely important as it is used in all stages of the chain's distribution process. In addition, in relation to highly perishable cut flowers, transport is a critical element to ensure the product's final quality.

The main objective of this article is to discuss the main elements related to the management of the rose logistics. To this end, this logistics chain was characterized based on its relationship with a cooperative, and the transportation stages among the chain's main agents (customers, farmers and cooperative) were evaluated to diagnose the cooperative's logistic performance.

## 2 REVIEW OF RELEVANT LITERATURE

### 2.1 The cut flowers logistics chain in Brazil, with an emphasis on roses

Before specifically analyzing the flower logistics chain it is necessary to understand how these products are marketed as well as the market's behavior. According to Caixeta and Marques (2003), the knowledge of an agricultural product's seasonal demand period is extremely important to its marketing, both for the producer and the consumer. An understanding of seasonal demand peaks allows the farmer to organize his production to meet periods of highest demand, which may occur several times during a year.

Roses are susceptible to greenhouse induced production, and therefore their supply may be adjusted to meet predictable Brazilian consumer demand. Moreover, knowing the period of greatest demand, coupled with the availability of technology that facilitates more constant production, can increase the producer's business, even its exports (Caixeta & Marques, 2003).

When evaluating the seasonal behavior of the volumes and prices practiced in São Paulo for roses at following major flower wholesaling sites, such as the Veilling Holambra cooperative (SP), CEAGESP-SP and at CEASA-Campinas (SP) (CEAGESP and CEASA are importante warehouses handled by São Paulo State government), Caixeta and Marques (2003) emphasize the existence of volume marketing and price peaks throughout the year.

According to research by Caixeta and Marques (2003), the volume of goods traded at CEAGESP-SP peaks twice a year, during the October to December period and in May, probably linked to the Day of the Dead, to the end of year Brazilian holidays and to the Mother's Day. The volume of roses marketed by the cooperative under study peaks every 3 months; at CEASA-Campinas (SP), those peaks are reached every 6 months.

Regarding rose prices, repeated peaks were observed every year at the three warehouses analyzed in the months of May, June and July, a factor probably due to Mother's Day, the Bridal Month, and Valentine's Day falling in these months, confirming the widespread habit of buying roses as gifts for women (Caixeta & Marques, 2003).

In relation to the flows in the rose supply chain, according to Tomé (2004), this begins with the acquisition of inputs and raw materials. Among the main items related to this initial stage are the materials for greenhouses: pots for planting, fertilizers, packaging materials, and the purchase of seedlings of different species.

Following this, the production process consists of propagation, cultivation and post-harvest. Propagation consists in sprouting the seedlings to be planted, while the cultivation refers to every stage from the preparation of the soil to the cutting of the rose, a period that can last from four to eight months. Post-harvest, in turn, is a step that requires speed, considering that this is a product with a short life span. After the cut, ideally the roses should be quickly taken to post-harvest chambers, so that their temperatures drop to 4°C to guarantee a longer shelf life. After this stage, the roses are dipped in a chlorine solution, selected by size and quality and packaged in 20-button packages. These packages should contain information related to the product and a bar code (Tomé, 2004).

The distribution step comprises transporting the product from the farmer to the final consumer, which can be local, regional, national or international. Starting from an analysis of the distribution chain, it is necessary to identify the main links of this chain, their relations and their characteristics and peculiarities.

With regard to the domestic market, according to Neves and Pinto (2015), the flower and ornamental plant production chain in Brazil uses direct sales between the producer and the final consumer, retailer and specialized wholesaler as its main distribution channels.

The wholesale market is the most representative link in flower marketing (Neves and Pinto, 2015). The wholesaler normally has a physical space and facilities to carry out the marketing activities of one or several products in large quantities or may buy, handle and store products in large volumes to be commercialized later in smaller quantities.

The study developed by Torres (2015) based on information from IBRAFLOR classifies wholesalers according to the type of service provided and the type of customer served. From IBRAFLOR's classification, wholesalers can be described as distribution centers, which buy directly from farmers and cooperatives to supply other wholesalers and CEASA; garden center wholesalers, who buy from different farmers but target garden center products, such as supplies and accessories for landscaping; cash and carry wholesalers, who buy in large quantities to market in other cities, focusing on smaller customers and distributors; and line wholesalers, which have a line of marketing and distribution connected directly to their customers. In addition to these flower marketers, there are flower brokers responsible for brokering between customers and cooperatives, commercial representatives acting in the purchase and distribution to other wholesalers, retailers (flower shops and supermarkets), commissioners that make purchases for smaller companies and have not registered with cooperatives, and carriers who are solely in charge of the transport and distribution of the flowers. However, according to Torres (2015), some companies act in more than one of these marketing roles.

In this sense, Neves and Pinto (2015) highlight wholesalers as agents of extreme importance in the production chain. This is because the productive system is predominantly composed of small farmers, with wholesalers being fundamentally important in the dissemination of flowers and ornamental plants.

Even if there is a direct market link between the farmer and the consumer, and also between the wholesale and the consumer, retailing still stands out as the main channel of commercialization to the final consumer, especially flower shops, self-services (supermarkets), and decorators. In regards to flower sales, 54% are to decorators, 22% are to flower shops, 15% are to landscapers and 9% are to self-service outlets, according to Neves and Pinto (2015).

In an analysis with emphasis on the floriculture commercialization, it is highlighted that in the past it was primarily dedicated to the sale of flowers and ornamental plants; however, this scenario has changed recently. Floriculturists have sought to add value to their activities by marketing products such as teddy bears, chocolates, etc. In this regard, they have offered services such as signature flowers, online sales and decoration. Among the main difficulties faced by floriculture is

the challenge of high labor costs resulting not only from increased remuneration but also from the shortage of skilled labor (Neves & Pinto, 2015).

Regarding marketing in supermarkets (self-service), it can be said that this has stimulated the consumption of flowers and plants due to the convenience. As a result, Holambra cooperatives have developed areas within supermarkets to meet these needs (Neves and Pinto, 2015).

Finally, decorators and landscapers, who were characterized in 2014 as the mainly connected with the retail sector because they have as a main characteristic the delivery of a service that uses flowers and ornamental plants as their main input. Landscapers acting in the development of a project and its execution and maintenance represent a constant demand for a product that needs to be periodically replaced. On the other hand, decorators, because they work on unique projects, use as their main purchase channel commercial centers and the cooperatives, when nearby; and when distant, they place orders for their flower needs and wholesalers make this delivery (Neves & Pinto, 2015).

Transportation is a critical link in the cut flower logistic chain, mainly because it is needed to guarantee the product's final quality (Torres, 2015). Due to the need for refrigerated trucks, Claro and Santos (1998) found that producers use their own trucks or contracted transport services.

## **2.2 Advances and good practices in the Brazilian flower logistics chain**

As in the main flower producing countries, Brazilian floriculture has also been trying to develop and innovate, gaining productive efficiency and competitiveness in world terms.

The work of Caixeta, Swaay and Lopes (2000) had as its main objective the development of a computational tool supported by mathematical optimization models to assist the decision making of a representative lily producer linked with a cooperative in the region of Holambra in the Brazilian state of São Paulo. Up to this point, optimization modeling had had not been employed by traditional floriculturists. According to the authors, the producer should not remain oblivious to the advances in the market in which it operates, which necessitates the use of tools that aid in decision making to make good deals, reduce costs and improve quality.

The starting points of lily production planning was found to be estimating the amount of lilies that could be sold per week, detailing the minimum and maximum quantities needed (contracts), and average prices per variety. From this, a comparison was made between the sales estimates and the needs of the particular lily species (such as number of buds produced by bulbs, loss index, productivity and cost of production). A model was designed capable of generating these combinations as well as suggesting an optimized production plan, respecting the producer's technical and operational feasibility limits (Caixeta, Swaay, & Lopes, 2000).

The optimization system contained not only the sales planning mathematical model but also the levels of occupation of the greenhouses, use of stock, pending lots of planting in progress, sales tags among other considerations. According a producer, the use of this tool increased revenues by 16% through improved profit margins. The system also provided a basis for the producer's budget, including sales and input purchases. Proper use of this system makes it possible to increase anticipated sales, eliminate deficient varieties, improve planning flexibility, identify bottlenecks, and improve monitoring (Caixeta et al., 2000).

Analyzing the efficiency of flower and ornamental plants distribution systems, Smorigo and Jank (2001) determined key indicators in this process, namely: idle time per man, total area billing, contribution of distribution systems to maintaining product, and degree of consumer satisfaction. The data referring to these key indicators were obtained from the application of qualitative questionnaires, which were then compared among the main distribution systems.

Distribution systems linked directly to the producers allied with the cooperatives in Holambra, and Veilling São Paulo and FLORANET (a company created with the objective of developing an electronic platform to organize sales and marketing information) have proved to be more efficient in terms of billing per installed area as well as maintaining product quality maintenance and customer satisfaction. This is mainly due to the adoption of good practices and methods to reduce mechanical

damage, as well as increased use of cold rooms, air-conditioned patios and a post-harvest analysis laboratory (Smorigo & Jank, 2001).

Finally, Smorigo and Jank (2001) emphasize the importance of taking a comprehensive approach and looking synergistic efficiency measures. The creation of efficiency indicators, in the view of the authors, allows the manager of each distribution system to identify which aspects are inefficient and seek performance improvements.

According to Torres (2015), when constructing possible scenarios for the flowers and ornamental plants wholesale sector based on the use and implementation of technology, it is extremely important to understand not only the market's dynamics but its actors and the technology available. For the author, the inclusion of innovative technologies will increase sector competitiveness and aid in decision making.

In the case of transport, a critical element to guarantee the product's final quality is the ability to use measurements and indicators that help in the strategic planning of logistics processes and identify and solve problems (Torres, 2015).

Cut flowers are part of the group of products within the segment of flowers and ornamental plants more susceptible to variations in temperatures after harvest, making temperature control indispensable to ensure a quality product will be delivered to customers. In this sense, according to the results presented by Torres (2015), 77% of the companies in the segment use methods to control the internal transport environment; however, no temperature measurements are taken inside the trucks. The study shows that only 15% of wholesalers have the necessary technological tools to control and report temperature variations suffered by the goods during transit.

In regards to delivery planning, according to Torres (2015), only 13% of the wholesale cut flower distribution companies interviewed have a specialized logistics team to carry out delivery planning and no technologies are directed at delivery routing. The author found that the critical point in supply chain is quality monitoring, yet only 15% of companies monitor the quality of their refrigeration processes, and even these companies have no established standard temperature and do not use specific measurement tools.

Finally, as far as wholesalers are concerned, storage and distribution centers are essential if centralized flower producers are to offer quality products in the most remote parts of the country (Torres, 2015).

### 3 METHODOLOGY

The initial literature review was carried out to survey existing secondary data related to the Brazilian cut flowers logistic chain. This review helps to identify and define the agents to be interviewed during field research and the primary data needed to meet the study's objectives. According to Creswell (2003), generally, qualitative interviews can help explain the research response, and the first stage of research assists in the selection of respondents as well as the types of questions that will be asked the participants.

The research was considered exploratory and followed methodology developed for studies carried out by the Agroindustrial Logistics Research and Extension Group (ESALQ-LOG). Construction of the questionnaire followed an approach designed by ESALQ researchers Rocha, Bartholomeu, Péra, Caixeta and Rodríguez (2015). The questions follow a logical sequence that started with simple general questions and ended with the more specific ones. The intent was to gather a large amount of information without influencing the respondents.

Still following Rocha et al. (2015), according to the interviewed agents' characteristics two different interview scripts were elaborated, the first script was applied to 15 wholesalers and 20 retailers and the second to 5 carriers. All those interviewed acted in the rose logistics chain.

The questionnaire questions applied to wholesalers and retailers addressed three distinct factors involving the rose logistics chain: a) transportation, receiving and storage; b) losses and c) loyalty to the supplier. The questions asked of the carriers were intended to identify specific rose

transportation characteristics, as well as give an indication of individuals' performance as carriers in regards to their concept of losses and good practices in the transportation of roses.

This performance information is extremely important in the determination of management strategies. Bowersox and Closs (2001) found that competitive advantage is based on logistic competence, and this necessitates that the companies involved develop suitable strategies. Customer service alone can provide substantial added value advantages to the entire supply chain.

In the interviews carried out with the carriers, the primary aim was to understand how the roses are transported and their transport particularities, the good practices adopted in relation to the maintenance of product quality, and how relations between the carriers and the farmer/cooperative take place, addressing issues related to the existence of contracts between agents and the responsibility for physical and quality losses.

In order to achieve the objectives of the study in terms of the characterization of the rose logistic chain, the information made available by the cooperative and by producers were also of paramount importance, especially regarding the stages of commercialization and distribution.

OTIMIZA-LOG, a logistics performance evaluation tool developed the ESALQ-LOG group, was used to appraise logistics system performance and indicate areas where that system could be improved. The tool contains four question modules, the first module addresses the adoption (or not) of 14 practices and methods to manage logistics; the second and third modules are used to identify a company in relation to its area of business and its staff's involvement with logistics management; and finally the fourth module is used to identify what is needed to improve logistics and optimize processes.

The results from the OTIMIZA-LOG, together with information related to improvements and good practices in the floriculture segment addressed in the literature review, served as a basis for signaling alternatives to improvement the floriculture management process.

## 4 RESULTS

### 4.1 Characterization of rose logistics chain

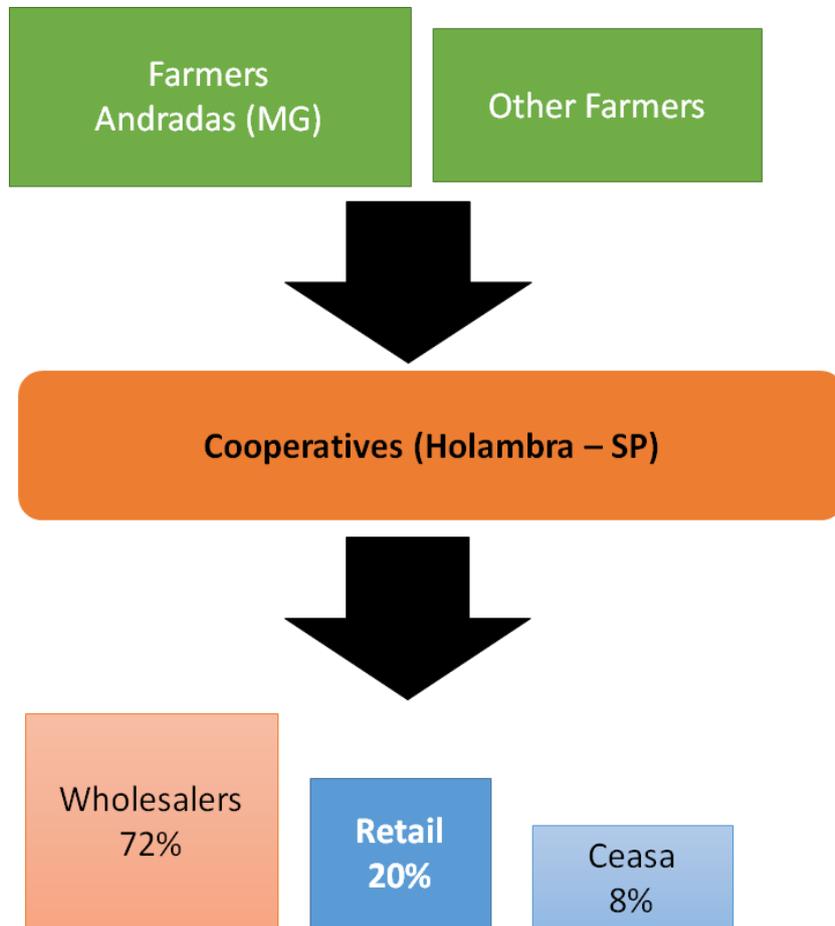
For characterization of the rose logistics chain it is necessary to know the marketing characteristics of these products as well as the behavior of this market. In addition, the collection of information regarding the product's seasonal period is extremely important to its marketing system, as it benefits both producers and consumers. For the farmer, the knowledge of the seasonal peaks makes it possible to organize production to take advantage of demand peaks that occur several times during a year. For the consumer, producer awareness of the periods of peak demand should better insure that consumer demand will be met.

Farmers are the first link among the main agents involved in the roses supply chain, as illustrated in Figure 1. Rose cultivation requires special climatic conditions, mainly related to altitude and temperature, which over time has concentrated the producers in regions that meet these characteristics. In this sense, most of the roses that arrive at the studied cooperative come from Andradas (MG). The Serra de Ibiapaba in Ceará region also has climatic conditions that favor roses, and this region has shown an annual rose production increase. Transport from the farmers to the cooperative is carried out by companies contracted by the cooperative and, in some cases, by the farmer's own trucks.

After arrival at the cooperative, the roses are sent to the clients and also to the cooperative's units located in Brasília, São Paulo and Paranapanema. About 72% of the roses are delivered to wholesalers to be marketed and delivered to the final consumer later. The cooperative sells approximately 20% of the total number of roses received directly into the retail market. Its main retail customers are supermarkets (such as Grupo Pão de Açúcar) and to CEASA-Campinas (a warehouse located in Campinas – SP) decorators, which receive about 8%. Roses are transported between the cooperative and its customers in two ways: 1) through carriers contracted by the

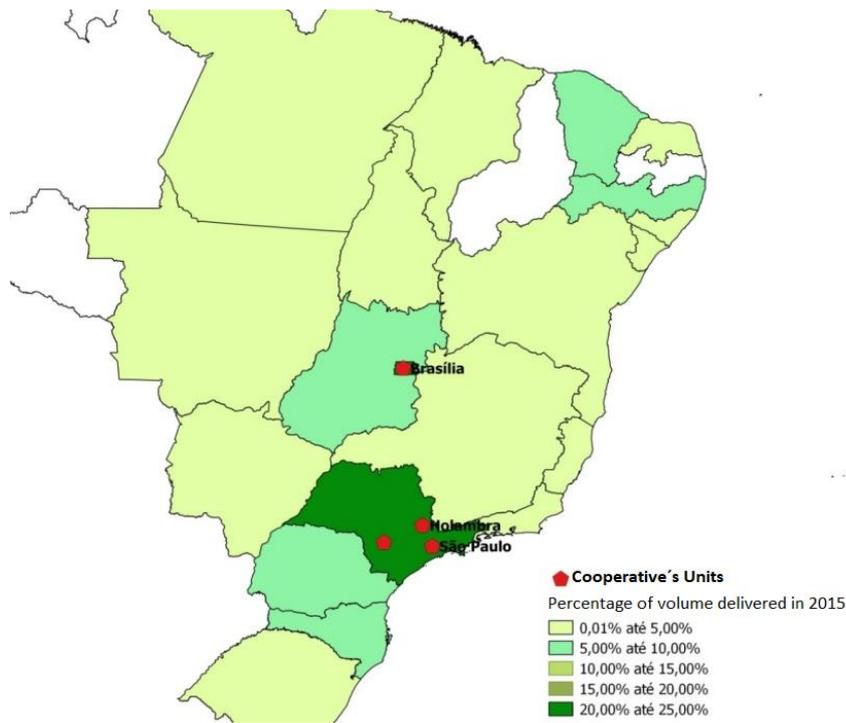
cooperative and 2) wholesalers withdrawing their products directly from the cooperative using their own vehicles.

Aiming to illustrate rose marketing in the country, as well as the share of production destined to wholesalers, retailers and decorators, marketing data for the years 2014 and 2015 from one of the largest producers linked with the cooperative were analyzed. The producer's property is located in the Serra de Ibiapaba (CE).



**Figure 1** – Rose's distribution chain  
 Source: Prepared from information provided by the agents.

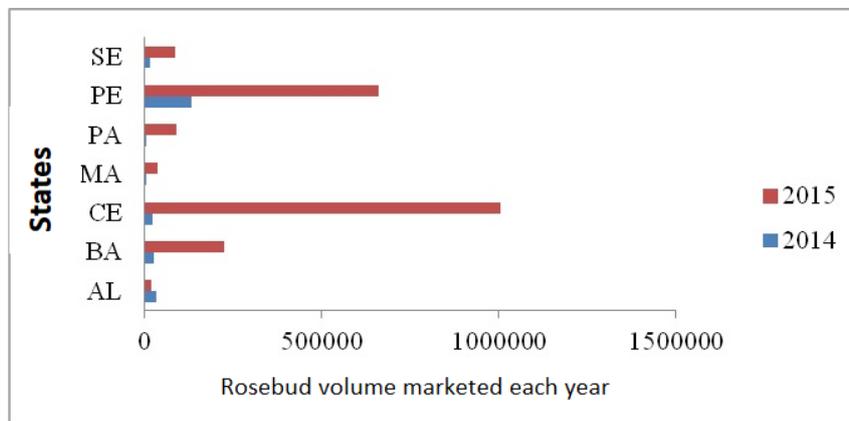
Figure 2 illustrates the percentage of the total volume of roses traded in 2015 in each Brazilian state. It is noteworthy that, in line with the distribution of cooperatives in the country, the state of São Paulo and the Federal District receive about 50% of this producer's roses. Other important destinations are Santa Catarina, Paraná, Goiás, Ceará and Pernambuco that each represent 5 to 10% of this producer's sales volume. Other states receive from 0.01 to 5% of the producer's roses.



**Figure 2** – Roses distribution

Source: Prepared from information provided by the agentes.

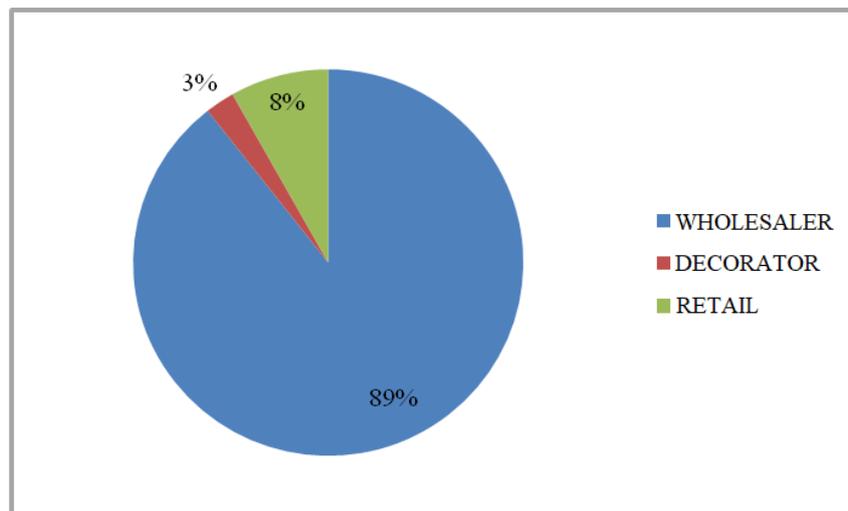
After analyzed volume variation by state between 2014 and 2015, it is noted that demand growth is strongly observed in Brazil’s northeastern states, mainly Bahia (BA), Ceará (CE), Pará (PA) and Pernambuco (PE). The volume sold in 2015 was much higher than the 2014, as shown in Figure 3.



**Figura 3** – Rosebud volume marketed at Sergipe (SE), Pernambuco (PE), Pará (PA), Maranhão (MA), Ceará (CE), Bahia (BA) e Alagoas (AL)

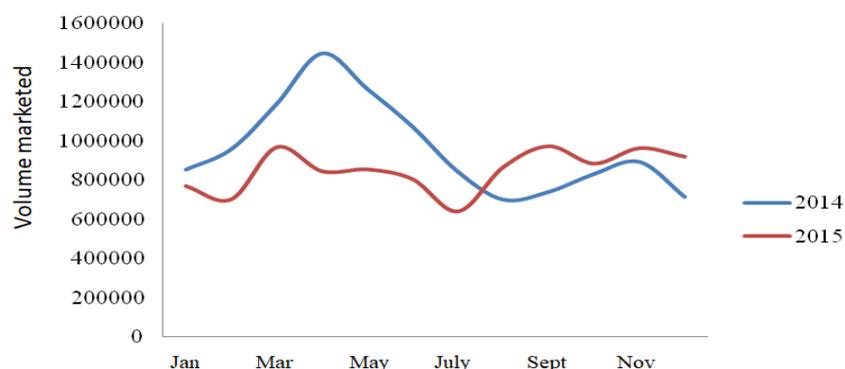
Source: Prepared from information provided by the agentes.

As for the analysis of the market share absorbed by the wholesales, retailers and decorators in the two years analyzed, wholesale is much more significant. Figure 4 illustrates marketing data by segment for the year 2015, showing that wholesalers represented about 89% of the volume traded, with retailers and decorators representing 8% and 3%, respectively.



**Figure 4** –Percentage of total volume traded in each market segment in 2015  
Source: Prepared from information provided by the agents.

Seasonal sales data collected from the farmer selected for analysis, illustrated in Figure 5, show that the volume sold in the first half of 2014 was much higher than in the same period in 2015. However, in the second half of the year, volumes were higher in 2015. Regarding seasonality throughout the year, the volume in both years is high between March and June, a period that includes the Brazilian Women's Day, Mother's Day and Valentine's Day (June 12). Another period of sales growth is observed between the months of October and November, a period that some producers claim to be favorable due to the climatic and productive characteristics.



**Figure 5** – Marketing seasonality over the years 2014 and 2015  
Source: Prepared from data provided by the agents

It is worth noting that seasonality when analyzed for a specific producer is subject not only to variations in demand but is also directly linked to productive characteristics related to climate, pest attacks and diseases peculiar to that property, and even to employee errors and failures. In this sense, not all variations in the volume marketed by a particular producer can be justified by changing demand.

Although restricted to a single producer, the objective of this section was to demonstrate that many benefits can be obtained from the analysis of seasonality and marketing flows that characterize the rose logistics chain. An understanding seasonality's effect not only assists the producer in his planning, it can help the cooperative make important strategic decisions, for example, when to schedule expansion due to demand from new markets and the addition of new units. In addition, the incorporation of logistics planning into strategic management should be able to help reduce losses.

## 4.2 Transport evaluation from the perspective of wholesalers, retailers and carriers

The questionnaire's questions applied to wholesalers and retailers was designed to collect information regarding three distinct factors in the rose logistics chain: a) transportation, receiving and storage; b) losses, and c) loyalty to the supplier.

The first section of questions identified the agents responsible for carrying out and/or contracting transport, whether the cargo was refrigerated or not, the distance from the cooperatives to the customers, and the packaging used. When the cooperative is responsible for transportation, a carrier is hired. Wholesalers use their own vehicles for the task. In relation to the load refrigeration, carriers contracted by the cooperative always use refrigerated transport; however, about 50% of wholesalers using their own vehicles responded that they do not use refrigerated vehicles. Wholesalers who answered that they do not use refrigerated vehicles believe that there is no need for this refrigeration because they are only 200 to 600 km from the cooperative. The distance between cooperative and the all wholesalers interviewed is more varied: 10 km to 900 km.

Regarding transport to the retail market, 100% of the supermarkets interviewed responded that this is the responsibility of the cooperative. However, about 40% of the retail agents responded that the loads they receive are not refrigerated. This shows evidence of information asymmetry at this stage. Most of the employees responsible for roses in supermarkets are unaware of the distance from the cooperative to their region, as well as the origin of the roses.

In relation to the packaging used by the wholesalers interviewed, the majority use returnable plastic baskets. All retailers (supermarkets) said that roses shipped directly from the growers arrive in cardboard boxes and complained about this packaging. Their complaint was that the water reservoirs in the bottom of the box always leaked, which harms not only the flowers in that box, which run out of water, but also roses in the boxes below, which end up being wet during transport. In addition, some have reported that the cardboard box "kneads" the petals of roses that are "out" of the pack.

The second objective was to understand the concept of losses from the transport and storage of roses and if there are estimates of these losses. In both the wholesale and the retail markets, a visual inspection takes place to determine the quality of roses at the time of arrival and at withdrawal from the cooperative. This inspection's goal is to see if the roses are stained or wilted. In addition, some take the opportunity to look at roses that are more deeply within the pack, as they may present inferior quality to those on the outside.

At the wholesalers, after receiving the roses, the roses are separated by final destination, and distributed to other trucks for delivery or separated for customer pick-up. Some wholesaler's purchase only what has already been sold, others buy a little more and try and sell them throughout the week. At this stage, all interviewed wholesalers who store roses use refrigerated chambers. The roses marketed by the wholesalers are still subjected to another stage of transportation to their end customers. Usually, their customers are nearby, but some said that their final consumer can be up to 100 km away. Roses for the retail market are immediately sent to the purchasers (supermarkets) since about 90% of the wholesalers do not have a refrigerated space to keep roses for the retail market.

Wholesalers with cold storage capabilities highlighted practices they use to maintain the quality of roses in cold storage, such as the changing the water and removing old leaves and petals. However, these practices are not often necessary, because it is not common for roses to stay in the cold rooms for more than three days, due to the high demand. No follow-up study of the costs involved in these quality maintenance processes is conducted; however, the employees who performs this work used for other activities. The greatest cost from rose storage, according to the responders, is related to the electric power used by the cold chamber, At supermarkets, where the roses are exposed for a longer time, most of the respondents answered that they do not have any procedures to maintain rose quality.

Wholesale product turnover is much higher than retail turnover, with the wholesale product being received two to three times a week and distributed to the final customer between two and

three days after receipt. Retailers received roses only once a week, and it can take up to four days to be sell them.

The main complaint related to damage caused by pests and diseases that affect rose quality concerns yellowish spots caused by the fungus *Botrytis Cinerea*. According to the respondents, once the stain appears, the rose has to be discarded, because in addition to the bad visual aspect the fungus can contaminate adjacent buttons. Another difficulty highlighted by the agents is that these spots can not always be seen immediately upon receipt of the roses, appearing, in most cases, between the second and third day after receipt.

In the questions related to transport losses, it was observed that the incidence of physical losses is very low, only occurring if the box falls during transportation or is knocked down during unloading (100% of respondents said that this rarely occurs).

Losses are more frequent during storage and commercialization due to appearance damage caused by diseases. If this is discovered within the first 24 hours after receipt, it is possible to complain to the cooperative and receive compensation for the value of the producer involved. After that period, there is no compensation possible. For those interviewed who market and distribute roses in the more distant regions, mainly Brazil's northeast and mid-west, this is a major problem, since transport can take from one to two days so that when the product arrives at its destination, the compensation window has closed. However, 70% of respondents do not see any relationship between transportation practices and product quality. The few interviewees who believe that transport can influence product quality emphasize that these difficulties are influenced mainly by the large number of links in the chain (producer, cooperative, distribution center), transportation failures, and distances to be covered. Respondents also point out that rose variety is also an important factor affecting losses, as some varieties are more susceptible to diseases and are also less durable.

Finally, when loyalty and customer satisfaction is addressed, according to the agents interviewed, the main determinant of rose quality and durability—as well as losses—is the producer. Thus, 80% of those interviewed, mainly wholesalers, stated that they correlate the information on the packaging, the product code and the site of origin, with the quality of the products received to guide their future requests and avoid ordering roses from lower quality sites, unless looking for a lower price. However, they said that most of the time it is preferable to pay a higher price for a better quality product.

Another factor that may influence the price-quality ratio, according to 30% of respondents, concerns the purpose of the product. Some wholesalers have said that when roses are used for party decorations and events, they look for those with lower prices though usually of inferior quality because they will be used for only a short period of time (two days at most) and then discarded. However, when roses are for gifts, marketed in flower shops for example, suppliers prioritize products of better quality, even if the price is a little higher, to maintain customer loyalty.

According to the agents involved, the time between cutting and delivery should be not more than four to seven days. If delivered to the final consumer within that time period the rose still look good—for a few days.

The flowers and ornamental plant carriers were asked a second group of questions to identify specific characteristics of rose transport and to gain an understanding of their concept of losses and good practices related to rose transportation. None of the contactors contacted were exclusively dedicated to the transport of roses, but were generally in the business of transporting flowers. In addition, long-haul carriers, for example those that transport roses to the northern Brazilian state of Ceará, also end up working with other types of refrigerated cargo transport, such as dairy products, and transport freight on both legs of the journey.

It was unanimous among the carriers that transporting refrigerated loads increases transport costs 30% to 35% because the truck's refrigeration unit consumes an average of 3 liters of diesel per hour. Profitability itself is not influenced by the type of flower carried or the volume of flowers in the truck, since freight is usually paid for by the length of the journey rather than volume. For carriers that are dedicated to the transport of flowers, the load is mounted on site in trolleys, and these are

taken to the final customer. The trolleys return empty to the cooperative or to producers to be used again for further shipments. However, carriers that normally carry other types of products on the outward journey do not use trolleys, as empty trolleys occupy the whole truck and make the transport of other products infeasible; therefore, the load of roses is mounted on boards in the truck.

Carriers that operate in this segment have been in this industry for many years, a factor that, according to the interviewees, dispenses with the need for handling contracts with producers. Thus, agreements with producers are oral, only with cooperatives are signed formal contracts required. The volume of flowers being transported is not disclosed by either cooperatives or producers; the carrier only has to know which routes to be taken.

Regarding physical losses during transport, wholesalers and retailers affirmed that this is very rare. The number of boxes loaded at the origin is almost always the same as the number of boxes unloaded at the destination. If any carton falls during transport or at the time of unloading, it will be necessary to analyze if the failure was the carrier's responsibility and, if it was, the value of that box will be deducted from the shipping cost; however, such events are not frequent.

There is a great divergence between carriers in relation to the average age of their fleets and the frequency with which fleet renewal occurs. The average age of long haul (up to 3,000 km) carriers' fleets is 3 years, while those transporting to sites near Holambra (around 100 km) have fleets with an average age of up to 11 years. The quality of the highways is a factor that, according to the responders, makes renewing the fleet very cost prohibitive for short haul carriers because having to often travel over the sites' access roads damages the vehicles, making periodic maintenance more advantageous than fleet renewal. It is important to note that most short haul rose transport is carried out by trucks and drivers belonging to the rose supplier, and trucks and drivers are only hired during seasonal demand peaks.

Regarding the temperature of refrigerated loads, some carriers pointed out that when the load is composed of roses only, the ideal temperature is 5°C; however, when other types of flowers are moved together with the roses, the temperature should be held at 10°C, because the lower temperature can burn other types of flowers. However, the practice of maintaining different temperatures for different products is not universally adhered to.

According to the interviewees, drivers are trained to work with refrigerated trucks and control temperatures. At the end of each trip, temperature reports are generated and recorded within the truck itself. On the other hand, there is no specific driver training regarding the transport of flowers.

Finally, most of the agents consulted in this study reported that the greatest difficulty encountered when transporting flowers in refrigerated loads is related to the lack of firmly held temperature control standards. For example, many cold rooms maintain temperatures that are too high, so when flowers kept in this cold room are loaded on the transport vehicle they increase the entire load's temperature and cause product damage. Even within the same property, there may be partial loads that are refrigerated and others added that are not. According to the carriers interviewed, the role of the truck is to maintain the temperature of the load and not be responsible for cooling it. The same type of problem arises when a load transported between the cooperative and the customer at the proper refrigerated temperature is offloaded at a site that is not refrigerated.

### 4.3 Logistics performance diagnosis

Logistics diagnosis, one of the steps that composed this article, had as its objective an evaluation of the cooperative's logistics system based on its adoption of good practices and proper management process. The diagnosis was accomplished using the OPTIMIZA-LOG tool developed by the ESALQ-LOG group.

The cooperative has three branches operating in the sale and distribution of flowers. The branches are located in the Brazilian cities of Brasília (DF), São Paulo and Paranapanema, and its headquarters is in Holambra (SP). The activities that make up the cooperative's logistics department control the receipt and handling of materials, inventory management, product storage, and product transportation.

To determine the number of good logistics management practices implemented by the cooperative, 16 questions were presented to its logistics manager and their answers were then analyzed. The questions and their analysis sought to ascertain if the logistics manager employed strategic planning, had aligned the logistics area with other corporate areas, had properly managed relationships with suppliers and those that supervise transport and storage, conducted adequate financial analysis, and organized operational performance to make the logistics processes operate optimally. The answers signaled that the cooperative had adopted nine good logistics management practices. Of particular note were the participation of logistics in strategic planning, the level of flexibility when managing customer requests, and the provision for investment to restructure and optimize logistics processes when needed to achieve operational efficiency.

The adoption of a reasonable set of up to date logistics practices indicates that the cooperative considers logistics as part of its strategic plan. However, despite the high degree of commitment to logistics, the system is still undergoing the process of maturation that will continue with the inclusion of new practices and methods.

There was found to be a need for improvement in the relationship and coordination among other areas in the cooperative, such as the departments controlling marketing, sales, production, purchasing and finances. There was also a shortage of indicators to assess the logistics system's performance and the level of customer satisfaction.

When questioned about logistics areas that are in need of improvement, we highlighted need for an indicator that monitors the time taken to return reusable baskets from each customer and the lack of a rolling stock tracking mechanism. In addition, emphasis was placed on improving the internal movement of products; automating product separation; and implementing an automatic electronic identification system, preferably through use of radio frequency monitoring. The highlighted concerns are aligned with the increasing demand that logistics system managers have a deeper understanding of their system's operations through the use of quantitative performance assessment tools and methods that provide more robust and accurate logistics operation data.

The results obtained from this diagnosis should be used when developing future projects. Optimization of the logistics chain that integrates rose producers with rose cooperatives and rose customers is very dependent on the role of cooperative, mainly during the receipt and separation of orders and to insure quality control, customer relationships, and timely distribution to the correct location.

## 5 FINAL CONSIDERATIONS

The logistics chain involved in the marketing and distribution of roses is made up of a large number of existing, active links; and in the case of rose producers associated with cooperatives, the management of all these logistic links is in the hands of the cooperative. For this reason, it is imperative that the cooperative efficiently organize its processes, always seeking improvement, and make strategic decisions that favor these producers' competitive position. The cooperative's management must understand demand seasonality and marketing flow characteristics, such as those regarding new market penetration. The cooperative should also offer advice to assist producer planning, and encourage producer development to increase productivity and improve flower quality.

Transport is an important element in the maintenance of rose quality, due to the need for integration between the chain's links and to efficiently attend to orders. The asymmetry of information among chain agents as to what represents good practices was found to be a difficulty hindering efficient chain operation and negatively affect customer satisfaction and loyalty.

Customer loyalty to the supplier, in this case the producer, was another factor found to affect chain operations. Customer loyalty is achieved through receipt of a high quality product. An unsatisfied customer leads to producer losses in terms of product returns and the loss of future sales, since the customer may buy roses from another producer in the expectation a better quality product.

The receipt of a high quality product does not depend on the producer alone, but also on other logistics chain links, such as transportation. Unfortunately, the asymmetry of information among

chain participants leads to situations in which a client's dissatisfaction with quality is not reported to the producer because the client's complaints are only heard by those involved with downstream chain links. In this way, chain agents do not know the impact all the chain links have on product quality, customer satisfaction, and ultimately, customer loyalty. Authors like Fawcett and Clinton (1996) indicate that the improvement of logistic processes leads to greater operational efficiency and can effectively increase consumer loyalty.

Finally, future projects to improve the rose logistics chain should not focus management processes alone, but also on the need to provide a better quality product; reduce costs through efficiency gains, especially in product delivery; enable reverse logistics of packaging; and rationalize internal processes, something that all agents in the chain tend to benefit from. The proper development of all logistics processes should lead to lower prices and allow delivery of a high quality product better able to compete in the rose market.

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<sup>ii</sup> Advisor to the first author in the development of the Monograph.