

Bromeliads Supply Chain of Paraná State - Brazil

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Abstract— *Bromeliads are a group of native species of ornamental plants from Paraná Coast which have significant commercial value, however in recent decades has seen the exodus of producers in the activity. Thus, in order to support a better understanding of the current situation, it sought to identify how the production, distribution and trade processes were established in the supply chain, as well as identifying what were the strategies adopted in each segment (production, wholesale and retail) that resulted in competitive advantage in bromeliads supply chain. It was accomplished a descriptive exploratory research with different actors involved in all segments of the supply chain. It was interviewed, 19 producers distributed in 15 cities, 31 extractors in 12 cities, 18 wholesalers in 8 cities, 160 managers / owners of flowers retail businesses in 31 cities and 211 consumers of bromeliads in 51 cities. Bromeliads producers and extractors showed inadequate conditions of cultivation / extraction which resulted in lower plant quality, and for this reason in part that the high price and the fear of the mosquito that transmits dengue developed in the bromeliads, were the factors that limited the consumption. The bromeliads distribution until the consumer was made by wholesalers and retailers who had a pre-sale system, a factor that minimized the risk of leftovers and losses on the sale of bromeliads. It was not observed the adoption of shared strategies between the segments that resulted in competitive advantage in the bromeliads supply chain in Paraná State.*

Keywords—*Bromeliads, Vegetable production, Ornamental plants, Agribusiness, Family Agriculture, Rural pluri-activity.*

I. INTRODUCTION

The production of bromeliads in Brazil with ornamental purpose is more concentrated in São Paulo State that has become the largest domestic producer, and the regions of Holambra, Atibaia and Campinas are the cities with the greatest production of bromeliads in Brazil, however

although in smaller scale has been registered the appearance of new production centers in Joinville, Garuva and Gravataí (SC), Brasília (DF), Belém (PA) and Vitória (ES) (ANACLETO; NEGRELLE, 2013th; ANACLETO et al, 2014).

Bromeliads in Paraná State initially aggregated economic importance associated strongly to the extractive activities, especially in coastal regions and at Serra do Cadeado in Ortigueira, in these places dozens of families survived for decades from the extraction of forest plants which they commercialized on the banks of the highways, situation still currently shown (ANACLETO; NEGRELLE, 2013b).

The pressure to reduce environmental damage in the forests, and the action of protection and supervision agencies as IBAMA, has raised in various cities of the state, cultivation that were benefited by the favorable climatic and soil conditions, the proximity to major consumer centers, and heavy flow of tourists in these regions. (ANACLETO et al, 2008; NEGRELLE; MITCHELL, ANACLETO, 2011).

Paraná since the 1990s has held prominent on the national scene in the bromeliads production and trade, and it was registered in 2000s the third largest production in Brazil, result from 114 producers in the activity in 32 cities that distributed 250,000 plants in Brazilian trade (BITTENCOURT et al, 2002; NEGRELLE; MITCHELL, ANACLETO, 2011).

Despite strong tradition in production and trade of bromeliads, recent studies reveal that the Paraná production has suffered a decrease in the production area, quantity produced and the number of producers, whose decline was over 60% (ANACLETO 2011; NEGRELLE; MITCHELL; ANACLETO 2011, ANACLETO; NEGRELLE, 2013b).

Bromeliads have economic, social and environmental importance in Paraná State due to the fact that families who survive from the cultivation or extraction, and the most part on them is operating in poor communities or vulnerable residents in the vicinity of forest areas

(NEGRELLE; MITCHELL; ANACLETO, 201; ANACLETO; NEGRELLE, 2013a), and many species with ornamental potential have high aggregate financial value (MACHADO NETO et al, 2013) and may represent an important economic alternative to these families.

The bromeliads supply chain is part of the agro-industrial system of flowers and ornamental plants, according to BITTENCOURT et al., (2011) an agro-industrial system is more embracing than the supply chain.

The supply chain can be defined as a set of activities with the purpose of a production of a given product encompassing all kinds of necessary materials, from seeds, fertilizers, various machines, production structures, as well as wholesalers, retailers and distribution logistics until the finalized product reaches the final consumer.

The supply chains have a succession of processing operations, able to be separated, but at the same time they are interconnected by a technical chaining aiming to produce a product (HUGHES, 2001; CLEAR, CLEAR, HAGELAAR, 2006).

Thus, after the product being able to be sold to the consumer, the supply chain presents a series of trade and financial relations, this market flow among many inserted suppliers and customers assign to each segment the relevance in the supply chain (HUGHES 2001, BITTENCOURT et al., 2011).

Every segment of a supply chain has its own systematic, being the result of inter-relationships that are beyond economic transactions, and also add the technical, social and political relations, in which the degree of commitment among the components determines the structure and the coordination, being the governance the result of this set of reciprocal relationships, sustained on common and complementary interests of the segments within the supply chain (HUGHES, 2000 BEGNI; ESTIVALETE and PEDROZO, 2007).

The reciprocity is an essential resource for the competitiveness of a supply chain, knowledge management, production and technology should be shared on a network perspective, giving to the actors involved a competitive ability to acquire, store and renew tacit knowledge in a dynamic way, promoting that all participants of the segment and the supply chain improve with common results. (HUGHES, 2000; VASCONCELOS, MILAGRES, NASCIMENTO, 2005).

The collaborative and coordinated environment should be imperative among the segments of a supply chain, the processes must be properly articulated, in order to think together the set to be benefited. The competitiveness and sustainability of the supply chain can be sustained only if the work is guided by a governance model that benefits all segments (HUGHES, 2001; CLEAR, CLEAR, HAGELAAR, 2006).

The supply chains that involve small farmers, can be seen as tacit forms of business alliances, because their constitution and performance also depend on, the performance of each partner in the chain links, and the cooperative and reliable behavior, however, it is known that not always this occurs because, individually, the actors seek to maximize their benefits, being financial or not (BEGNI; ESTIVALETE and PEDROZO, 2007).

The conflicts can arise within a supply chain when they seek for profitability or market, contrary to the postulates of collective development, and independent the degree of coordination of a supply chain, the actors self-interest and opportunism can lead to the dismantling or weakening existing links, collapsing the model of business-type relationship "win win", when all the actors of the various segments are benefited (CLARO, CLARO, HAGELAAR, 2006; BEGNI; ESTIVALETE and PEDROZO, 2007).

The proposal of a collaborative governance model based on inter-organizational relationships, can only be applied based on a characteristics diagnosis of each chain segment, and the understanding of partnership and integration relationships among the segments. (HUGHES, 2000; BEGNI; ESTIVALETE, and PEDROZO, 2007).

Thus to understand the flowers supply chain complexity as well as the adaptability of each segment to the agribusiness system and also the external environment chain, it is decisive to conduct a situational diagnoses (HUGHES, 2001; CLARO, CLARO, HAGELAAR, 2006).

The supply chain diagnosis is a solid basis for institutional sustainability, enables the design of the behavior systematic variables in the organizational environment and it is relevant to define the future directions and strategies.

The diagnosis should identify the various actors in the production and trade process, the innovation capability, social concern with the use of environmental factors, the need for changes in infrastructure, inter-business and inter-segments relationships, the need for changes in the structure, organization and governance model (HUGHES, 2000; HUGHES, 2001; CLARO, CLARO, HAGELAAR, 2006; ANACLETO et al., 2014).

Thus, in order to support a better understanding of the current scenario of the bromeliads supply chain in Paraná State and diagnose the reasons for the exodus of the activity, it is presented the results of the research that sought to answer the following questions:

- a) Identify how the production, distribution and trade processes were established, in bromeliads supply chain in Paraná State.
- b) Identify in each segment which were the strategies adopted that resulted in competitive advantage to the supply chain.

c) Discuss the implications of the reality observed in the context of bromeliads supply chain, and propose alternatives that might result in a collaborative governance model among several actors.

II. MATERIAL AND METHOD

In order to identify the existence of producers and extractors of bromeliads, it was filed a questionnaire in the central and regional departments of EMATER Paraná, SEAB (Agriculture and Supply Secretary of Paraná) and IAP (Environmental Institute of Paraná).

The retailers and wholesalers were identified in the Paraná State Trade Association and regional yellow pages, and subsequently it was carried out visits to make the interviews by accessibility and responsiveness.

Additionally, seeking to identify the involvement in bromeliads supply chain, it was also interviewed the managers of input suppliers companies (n = 6), municipal governments (n = 6), Banks and development agencies (n = 4), universities (n = 4) and non-governmental organizations (n = 4).

When we are able to identify some elements of the study target population in each segment, these indicated others who might also be interviewed and so on, in a process called "snow-ball" or self-generated sampling (KOTLER, KELLER, 2012).

The bromeliads consumer profile according to Anacleto et al. (2014) had data collection made from semi structured interviews and sampling was based on the population distribution in classes of income according to Brazil Criterion (ASSOCIAÇÃO BRASILEIRA DE EMPRESAS DE PESQUISAS, 2015).

It was classified, in this type, people who, according to ANACLETO et al., (2014), bought bromeliads at least once in the last twelve months. It was sought to investigate the bromeliad consumer profile in Paraná related to age, income, gender, as well as characterize the behavior of consumers, indicating the reasons for purchasing, preferred periods for acquisition, preferred locations for purchasing and purchasing intensity (ASSOCIAÇÃO BRASILEIRA DE EMPRESAS DE PESQUISAS, 2008). The face-to-face interviews were conducted, from visits to flower stores, at a time when people were buying bromeliads.

The data survey of all segments and consumer profile occurred from a predefined and tested script, and data collection was performed from April 2011 to October 2011, and then from June 2017 to March 2018 there was new data collection to update and supplement information, this long-term data collection was accomplished because of the depth of data collection that was intended and the high number of interviews.

The descriptive exploratory study included field visits, participant observation and semi-structured interviews in

all segments, and it was performed in accordance to Negrelle and Anacleto (2012) and Anacleto and Negrelle (2013b; 2013a).

In order to identify how production, distribution and trade processes were established, in bromeliads supply chain in Paraná State, as well as identifying in each segment which were the strategies adopted that resulted in supply chain competitive advantage, it was interviewed 19 producers in 15 cities, 31 extractors in 12 cities, 18 wholesalers in 8 cities and 160 managers or owners of flowers retail establishments distributed in 31 cities and 211 consumers of bromeliads in 51 cities.

III. RESULTS

Bromeliads Production in Parana State

The bromeliad cultivation registered in Paraná was carried out by 19 small producers who lived near urban areas (n = 8) and rural areas (n = 11).

The bromeliad cultivation generated little labor offer, generally only the owner was responsible for the cultivation (n = 14) and in only two properties occurred the hiring of temporary workers to assist in the bromeliad production activity.

In all farms visited the bromeliads production was inserted in a rural pluriactivity context, encouraging small farmers to increase their family income.

The cities Guaratuba (n = 3) and Colombo (n = 3) concentrated the highest number of producers, and in other municipalities were verified isolated production areas (FIGURE 1).

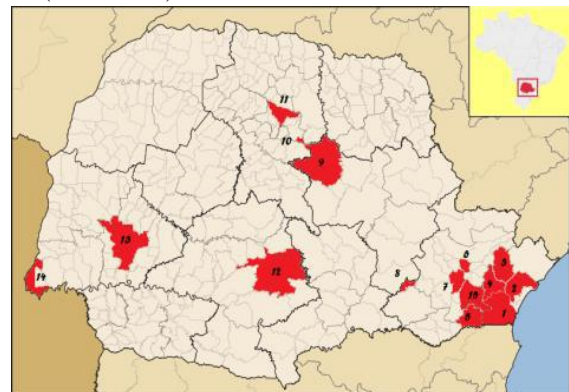


Fig.1: Cities that produce bromeliads in Paraná State: Guaratuba (1), Paranaguá (2), Morretes (3), Antonina (4), Tijucas do Sul (5), Colombo (6) Curitiba (7), Porto Amazonas (8), Ortigueira (9), Mauá da Serra (10), Apucarana (11), Guarapuava (12), Cascavel (13), Foz do Iguaçu (14) e São Jose dos Pinhais (15).

There was production of 30 species of bromeliads, from seven genres, and the *Vriesia* genre stood out both for greater diversity (n = 12 spp.) and more farmers who cultivate the flowers (n = 19) (Table 1).

The most part of cultivated species (n = 25) was the native species from Atlantic Forest, which according to the respondents (n = 13), due to the shape of plants and

different colors from the traditional found in the market satisfied the consumers and facilitated trade (Table 1).

Table.1: Generality on the species and characteristics bromeliads cultivation in Paraná State.

	Vulnerability ¹	Production Unit	Producers (n)	Representativeness (%)	Cultivation Structure ²	Used propagation ³
<i>Aechmea caudata</i> Lindm.	N V	560	4	1,5 4	R=3 /D=1	S
<i>Aechmea chantini</i> (Carriere)	N V	500	2	1,3 7	R=2	S/MP
<i>Aechmea fasciata</i> (Lindl.)	N V	500	2	1,3 7	R=2	S/DT /MP
<i>Aechmea gamosepala</i> W.	N V	500	2	1,3 7	D=2	S/DT
<i>Aechmea nudicaulis</i> (L)	V U	140 0	5	3,8 5	E=1/R =2/D= 2	S/DT
<i>Aechmea ornata</i> Baker	N V	550	4	1,5 1	R=2/D =2	S/DT /
<i>Alcantarea Imperialis</i> C. H.	E P	120 0	5	3,3 0	E=2/R =3	S
<i>Criptantus</i> spp	N I	500	1	1,3 7	E=1	MP/ DT
<i>Guzmania blassii</i> Rauh	E E	500	1	1,3 7	E=1	MP
<i>Guzmania lingulata</i> (L.) Mez	E E	300	1	0,8 2	E=1	MP
<i>Guzmania scherzeriana</i> M.	E E	500	1	1,3 7	E=1	MP
<i>Neoregelia carolinae</i> L. B.	N V	550	4	1,5 1	R=2/D =2	S/DT /MP
<i>Neoregelia compacta</i> (Mez) L.B.	E P	600	4	1,6 5	R=2/D =2	S
<i>Neoregelia cruenta</i> L.B.	V U	240 0	9	6,6 1	E=2/R =2/D= 4	S/DT
<i>Nidularium innocentii</i> Lem.	E P	300 0	1 4	8,2 6	E=3/R =7/D= 4	S/DT
<i>Nidularium procerum</i> L.	N V	200 0	9	5,5 1	E=1/R =4/D= 4	S/DT
<i>Tillandsia stricta</i> Solander	N V	125 0	5	3,4 4	R=3/D =2	S

<i>Tillandsia cyanea</i> Linden	E E	300	1	0,8 2	E=1	MP
<i>Vriesia atra</i> Mez.	N V	600	5	1,6 5	R=4/D =1	S
<i>Vriesia carinata</i> Wawra.	N V	250 0	9	6,8 8	E=2/R =8	S
<i>Vriesia flammea</i> L.B. SM	E P	850	5	2,3 4	E=2/R =3	S
<i>Vriesia friburgensis</i> Mez.	V U	680	5	1,8 7	R=3/D =2	S
<i>Vriesia gigantea</i> Gaud.	V U	100 0	5	2,7 5	R=3/D =2	S/DT
<i>Vriesea hieroglyphica</i> Mor	C R	500	2	1,3 7	R=1/D =1	S/DT
<i>Vriesia incurvata</i> Gaud.	V U	600 0	1 9	16, 6	E=7/R =8/D= 4	S/DT
<i>Vriesia inflata</i> Wawra	N V	240 0	9	6,6 1	E=2/R =3/D= 4	S
<i>Vriesia platynema</i> Gaud.	V U	250 0	1 2	6,8 8	E=3/R =5/D= 4	S/DT
<i>Vriesia philippocoburgi</i> i W	V U	900	5	2,4 8	R=2	S/DT
<i>Vriesia rodigasiana</i> Mor.	V U	650	5	1,7 9	R=4/D =1	S
<i>Vriesia splendens</i> Len.	E E	600	4	1,6 5	E=2/R =2	S
		362 90				

¹Vulnerability in relation to the nature inventories: Critically Endangered (CR) *; Endangered (EP) *; Vulnerable (VU) *; Not vulnerable (NV); Exotic Species (EE); Unidentified (NI) * According to Martineli et al. (2008).

²Cultivation structure type: Greenhouse (E); Rustic structure (R); Cultivation under canopy (D) (NOTE * Some producers have two types of cultivation)

³Propagation: Seed (S), Clump Division (DT); Micro propagation (MP)

Source: Adapted from Anacleto and Negrelle (2013).

A significant portion of the total cultivated species (n = 39%) were included in IBAMA list categorized in situations of danger or vulnerability. Thus one of the highly positive factors of Paraná bromeliads production, is that the commercialization of these species resulting

from cultivation, certainly relieves extractive pressures (Table 1).

The bromeliads cultivation in Paraná was identified in three ways (Table 1): the first kind of cultivation occurred under canopy in forest areas, it was practiced in four farms, being characterized by bromeliads cultivation in small clearings after deforestation, according to Anacleto and Negrelle (2013), this type of bromeliad cultivation is usually carried out for low-income families without possibility of investment in production structures.

The seedlings used in this kind of cultivation were harvested in forested areas and transplanted directly into the soil and remaining at this location until the bloom, when they were transferred to the final vases. The planting was done in piles containing organic fertilizer available in the properties, but there was no control on the amounts for application.

The bromeliads were not irrigated, and hand weeding was done only in the lines. The tearing caused by fall from the branches of the tree was the biggest problem of this kind of cultivation, however still according to the respondents, the bromeliads showed good acceptance by consumers.

The second type of cultivation occurred in rustic structures built with eucalyptus, bamboo or wood, and it was performed in eight properties concurrently with other kinds of crops.

The totality of the production units visited in this kind, showed problems in the production process due to the low height of the greenhouses (± 170 cm), and inadequate material used in the coverage that heat a lot the production systems. The seedlings were often obtained the direct from the sprouts or seeds collection in the forest environment around the properties or from matrices available in the farm.

The main problems verified in this production system referred were the frequent damage and tearing in the leaves, small size of the plants which resulted in lower prices than those practiced by the market, being the average selling price USD 1.55 per unit.

The third kind was referring to the cultivation protected with plastic films (greenhouses), and it was practiced by nine producers, in these cases occurred the use of structures with adequate technology standard as described by Anacleto and Negrelle (2013).

Even according to Anacleto and Negrelle (2013), the seedlings used were generated by micro-propagation and additionally it was accomplished on these properties the propagation by seed mother plants.

The irrigation was performed by spraying. The weed control was manual, the pest control was performed by a broad-spectrum insecticide in monthly or biweekly applications.

The use of shading showed different shading levels (50% and 70%), the plants arising from this kind of cultivation evidenced satisfactory quality standard.

The substrate used in bromeliads crops in Paraná was in the most of cases ($n = 16$) prepared on the properties with materials that were available. The materials commonly used were the ground litter, sphagnum moss, pine bark, humus, carbonized rice husk, milled coconut shell, besides sheep and cattle manure and others of easily obtainment on the properties, however increased with formulated fertilizers (NPK).

The bromeliads growth fertilization occurred with the use of NPK fertilizers 10-10-10 and 4-14-8, usual average of one teaspoon per plant in monthly or bimonthly disposal on the ground.

It was not registered any kind of disease in all the farms visited. However the occurrence of pests was recorded in all visited crops ($n = 19$), mentioning aphids, slugs, ants, beetles, thrips, and cochineal, and on a smaller scale ($n = 4$ properties) beetles in the bromeliads nucleos (*Metamasius calizoma* and *Metamasius quadrilineatus*).

The preparation for the trade consisted in cleaning the vase and then the removal of old, stained or broken leaves.

Overall, the bromeliads crops in Parana, could be classified as low-tech standard and being in the most of time at odds with agronomic recommendations available in the relevant technical literature as described by Anacleto and Negrelle (2013).

The amount of plants in nurseries in Paraná available to trade was 21,360 units and the cultivation resulted in plants that met the demands required by the trade. But considering that the average cycle of bromeliads crops in Paraná producers is four years, the current production represented the inclusion of approximately 5340 units per year in the regional market, however according to Anacleto and Negrelle (2013) the amount was insufficient to meet the demand among the wholesalers and retailers interviewed, which was estimated in 27,800 units year.

The production commercialization was often made by producers in their own marketing structures in the sting sale system directly to the consumer, the rest was directed to landscapers and retailers nearby who traveled to the properties and made the acquisitions, being the average price USD 1.55 for retailers and landscapers and USD 3.01 in the sting sale system.

Bromeliads Extraction in Paraná State

The bromeliads extraction in Paraná State was identified in 12 cities encompassing 31 families. The largest number of extractors was located in Guaratuba (10), then in Ortigueira (5), Tijucas do Sul (4), Mauá da Serra (2), Reserva (2), Curitiba (1), Telêmaco Borba (1), Manoel Ribas (1), Matinhos (1), Paranaguá (1), São José dos Pinhais (1), Antonina ($n=1$) e Morretes (1).

The most part of extractors lived in nearby areas where they practiced the extraction, and they self-characterized as subsistence farmers and not as extractors, since they considered the extraction of bromeliads a complementary activity income on the property.

Only thirteen extractors were owners of the land where they lived and grew and the average size of the land was about 3.0 ha. Ten of the respondents did not have the ownership of the land, being considered areas squatters with an average size of 0.7 hectares per family unit. In all cases, the properties presented environmental restrictions because they were placed in areas under protection or environmental preservation.

The collection was every fifteen days for the majority of respondents (n = 14) in a smaller scale, in a monthly basis (n = 6) or when there was demand with external orders.

The collection of bromeliads was performed an average radius between 11 and 25 km from the area of residence, and was directed only to plants with inflorescence already issued or pre-inflorescence. The activities were initiated after four a.m, even overnight with the return to their homes between three or four p.m, returning an average of 14 bromeliads, and in the end of the month each producer collected about 100 units which generated an average income of USD 128,54 per month.

After the extraction, the bromeliads were put in pots, and deposited in greenhouses until they were sold. The main form of commercialization was on the property, however it was also verified the sale to wholesalers and retailers from Curitiba, Londrina, Ponta Grossa and Telemaco Borba in Paraná State, as well as Guaramirin, Garuva and Joinville, in Santa Catarina State, and the kind of these places were garden centers (n = 8), the most cited in the selling process, followed by flower shops (n = 5).

The most part of the respondents had no collection authorization (n=28), part of them (n=5) were unaware of the need for this practice legalization, and other part (n = 5) reported that they had tried to get the license for extraction but failed due to the lack of land ownership and the small size of their properties.

The most part of the respondents (n = 21) did not have bromeliads cultivation, and, among the reasons for the absence of these crops they talked about the lack of resources for the construction of nurseries and greenhouses (n = 6), they said that the time bromeliads take to be produced is up to 4 years (n = 22) and high availability of bromeliads in the forest that in their perception did not need to cultivate because they were available for collection (n = 12) as also described by Negrelle and Anacleto (2012).

In all, it was identified 21 collected species throughout the year, being the most frequently collected: *Vriesia incurvata* commercialized by 90% of the respondents,

Nidularium innocentii (77%), *Vriesia platynema* (67%), *Tillandsia stricta* (55%) and *Vriesia carinata* (55%).

Other species were mentioned in the extraction process in less quantity by the respondents (10% or less extractors), they are: *Aechmea caudata* Lindm., *Aechmea distichantha* Lem., *Aechmea gamosepala* Wittm., *Aechmea nudicaulis* (L.) Griseb., *Aechmea ornata* Baker, *Neoregelia cruenta* (Graham) L.B. Sm., *Nidularium procerum* Lindm., *Tillandsia usneoides* (L.) L., *Vriesea atra* Mez, *Vriesea flammea* L.B. Sm., *Vriesea friburgensis* Mez, *Vriesea gigantea* Mart. ex Schult. f., *Vriesea hieroglyphica* (Carrière) E. Morren, *Vriesea inflata* (Wawra) Wawra, *Vriesea philippocoburgii* Wawra e *Vriesea rodigasiana* E. Morren.

Bromeliad Retailer Trade in Paraná State

The retail trade promoted the link between producers and wholesalers to the final consumer, the average of bromeliads sold was 10 units per month.

The species of bromeliads most sold in the visited establishments (n = 156) was *Aechmea fasciata* Baker and *lingulata* Gusmania, and the retail stores average size was around 80m².

The definition of retailer on the bromeliad buying reasons to resell to the consumers obeyed the main criterion of the lowest price (n = 142), then other less important factors in the perception of retailers were also reported as the quality of the flowers (n = 68), the agility of the supplier in the replacement of orders (n = 63) and it was also cited the convenience in buying the bromeliads when the supplier delivers the bromeliads in retail establishments (n = 63).

Bromeliads purchases for resale occurred commonly on a monthly basis (n = 110) and priority local to purchase bromeliads by retailers was quoted concomitantly the direct purchasing from Paraná wholesalers (n = 111), buying at Veiling from Holambra (n = 21), purchasing from São Paulo wholesalers (n = 17) and Ceesa in Campinas (n = 9). They also mentioned wholesalers from Santa Catarina and Paraná producers (n = 4).

The purchase of bromeliads from local wholesalers, besides the previously mentioned factors, also happened because the bromeliads were a part of the other products composition mix and they give discounts for volume of purchasing.

The purchase at Veiling from Holambra was made with outsourced professional, and payment of the 5% commission on the purchase volume, and the reason for outsourcing was to avoid the retailer's trip to Holambra. Another way to purchase at Veiling was in collective buying by groups of three to five retailers that reduced costs in average of 12%.

Only three retailers from Curitiba and Paranaguá reported that they buy bromeliad direct from Paraná producers, and

the species acquired were *Vriesia incurvata* Gaud, *Vriesia platynema* Gaud, *Vriesia inflata*, *Vriesia Wawra* and *Vriesia carinata* Wawra. Other interviewed retailers (n = 23) revealed that they did not buy bromeliads from local producers, because according to them the flowers did not look good.

Bromeliads local production only had space on the shelves according to the retailers if they showed price equal to or less than wholesalers from São Paulo State (n = 134), production quality (n = 86) and delivery capacity during the year.

The bromeliads for use in interior decoration represented 90% of total sales by retailers and the average price paid by retailers in the acquisition of plants in São Paulo depending on the species ranged from USD 2.05 to USD 3.59 the unit. The bromeliads purchased by retailers from Santa Catarina were costing on average USD 2.57 and from Paraná, from USD 1.55 to USD 2.05.

The higher cost of bromeliads acquisition was for the retailer when purchasing from wholesalers which cost on average USD 4.62, delivered in the retail store, and despite the higher price paid, thus there was no expenditure of time and travel cost to purchase elsewhere. The resale price to the final consumer was always greater than 100% of the bromeliad cost.

Bromeliads Wholesale Trade in Paraná State

The wholesalers that promoted bromeliads distribution in Paraná in the various regions of the state, the highest concentration in Paraná State was in Curitiba (n = 10), which also represented 54% of all sales of bromeliads.

It was also found and interviewed the wholesalers from São José dos Pinhais (n = 2), Porto Amazonas (n = 1), Arapongas (n = 1), Cascavel (n = 1), Foz do Iguaçu (n = 1) Morretes (n = 1) and Londrina (n = 1), the total sales volume in the State was about 18,325 bromeliads sold annually, from them 80% was related to the sale of only two species *Aechmea fasciata* Baker and *Gusmania lingulata*.

The purchase of bromeliads occurred every week for the most part of wholesalers, and São Paulo State was the main place for shopping from local wholesalers (Veiling from Holambra = 72%, Campinas producers = 22%).

Most wholesalers (n = 18) never bought bromeliad from Paraná producers, and reported the possibility of buying since the price and quality were similar to those charged by their current suppliers, in addition to ensure regular deliveries and replacement the orders in the requested deadlines.

The "Garden Centers" (n = 43%) and the flowers shops (n = 41%) were the main sales channels of wholesalers, however other segments were also cited as gardening companies (n = 5%), supermarkets (n = 5%), companies

that organize events (n = 3%) and shopping centers (n = 3%).

The average price paid by wholesalers to purchase bromeliads varied from USD 2.05 to USD 3.08, and the average profit margin on sales was 100% on the purchase price. The sales were made in cash, or credit card with an average term of 30 days for payment.

The sale of bromeliads by wholesalers occurred based sales routes traveled every week or every fifteen days by the wholesalers, and sales in inner cities occurred always grounded in pre-sales by phone or Internet.

Bromeliads Consumer Profile and Behaviour in Paraná State

Women with an average age between 36 and 50 years were the majority (n = 88.7%) among consumers of bromeliads, however the most influential factor in the consumption of bromeliads is the income (Table 2), the higher the economic income the greater was the consumption of bromeliads, and the lower income classes the consumption of bromeliads was just incipient.

Table.2: bromeliads consumption in Paraná related to income

Income distribution according to Brazilian criterion		
Class	Income	% Consumption
A1	9.733	21,2
A2	6.564	28,8
B1	3.479	31,2
B2	2.013	16,5
C1	1.195	2,3
C2	726	0
D	485	0
E	277	0

The higher consumption of bromeliads in Paraná was registered in Curitiba (n = 25%), followed by Londrina (n = 16.5%), Cascavel (n = 9.9%) and Maringa (n = 9.4%), and the preferred locations for consumers to buy bromeliads was the flowers shops (n = 58%), garden centers (n = 33%) and supermarkets (n = 24.1%).

The purchase of bromeliads had three purposes, home decoration (n = 52.5%), gardens (31%) and office decoration (n = 11.8%), and the species was chosen because the beauty of the plant (n = 65.6%), strength and durability of flowers (n = 32%), probably due to the durability of the flowers the purchase was made every six months by 74.1% of respondents.

The main limiting factors to increased consumption among respondents were the price (n = 44%), take care of the plants correctly (n = 22.6%), and confirmation that in fact bromeliads do not proliferate the dengue fever mosquito (n = 18.4%).

Other Actors in Bromeliads Supply Chain in Paraná State

Providers of supplies: A major problem reported by input suppliers to bromeliad cultivation was the absence of specific products for bromeliads culture, and the equipment or inputs or supplies used in the production of bromeliads were the same recommended for orchids since they classified as a similar culture.

The control of pests and insects is an obstacle to this culture, because there are few specific and registered products for use on ornamental bromeliads, being the closest culture with pesticide registration the pineapple culture, which is also considered a bromeliad.

IAPAR: It is an official research department related to the agribusiness from Paraná State Government, and did not develop any research related to bromeliads in the period of the field research.

IAP, EMATER, SEAB: The official institutions of Paraná State Government for the agriculture and agribusiness system in response to 42 filed questionnaires issued by interim of its regional chiefs, who in seven regions knew the occurrence of extraction, and in five regions reported the occurrence of cultivation, however made explicit difficulties in measuring in numbers the supply chain of bromeliads because the activity was not classified as a priority service.

Municipalities: Only Guaratuba (Environment Department) reported to know the situation regarding to the cultivation and extraction of bromeliads, but there was no project planned for the development of the activity.

Unions: The presidents of all the unions of producers, employers or fishing colony in Paraná Coast (n = 9) reported that they did not know the practice of extraction and cultivation of bromeliads among their members.

Trade associations: It was identified 3 associations linked to agriculture, however contacted managers informed that they did not know the practice of extraction and cultivation of bromeliads among their members.

NGO's: There was not identified in Paraná Coast any non-governmental organization that acted directly with the issue of bromeliads production or extraction.

Universidades: A Universidade Federal do Paraná e a Universidade Estadual do Paraná desenvolviam estudos botânicos, agronômicos e de comercialização de bromélias.

Banks and financial institutions: Banco do Brasil with its regional superintendency said that never received any request for funding project concerning bromeliad cultivation.

Simplified Diagram of Bromeliads Supply Chain in Paraná State

The production chain of bromeliads in the State of Paraná, presented the following flow chart:

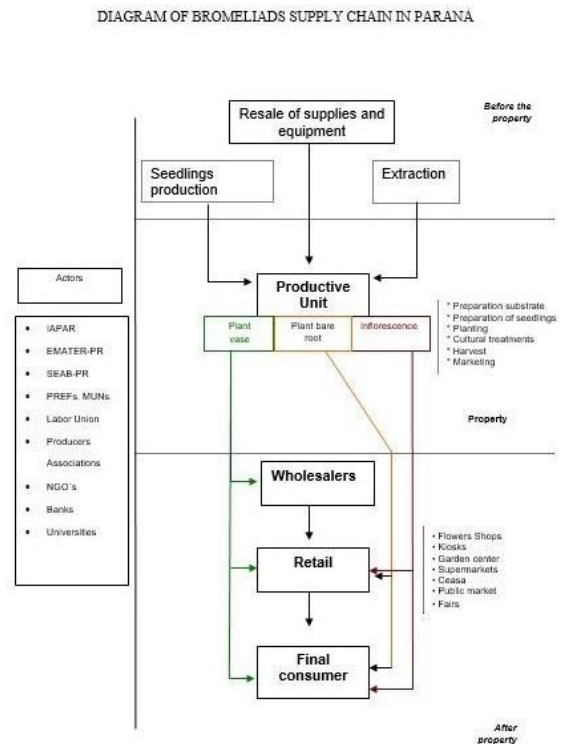


Fig.2: Simplified Diagram of Bromeliads Supply Chain In Paraná.

IV. DISCUSSION

Bromeliads besides the beauty of its inflorescences, also presents significant ecological importance in forest areas. However specifically in Paraná State it also has great economic and social importance in rural areas to small farmers and extractors in various regions that dependent on the commercialization of this species to generate income in the context of rural pluriactivity.

The extraction of bromeliads prohibition has created difficulties of maintaining these families in rural areas, due to the impossibility of economic alternatives and little capacity to invest in crops. According to Negrelle and Anacleto (2012) the extraction of bromeliads in Paraná is yet unknown and also not valued by the authorities, however, it supplies a part of the formal trade of bromeliads in Paraná establishments and in other states.

Also according to Negrelle and Anacleto (2012) the extraction of bromeliads is not prohibited by the Brazilian environmental laws, though the formalization of extraction is a process that needs regulation and standardization at a State level, a fact that has not yet been implemented in Paraná, which prevents the formalization of the extraction what prevent the extractors obtain financial income.

The condition of extractors in a short and medium term is worrying, since low-income families are prevented to extract bromeliads, and without the possibility of investment in production structures, so that determines

the activity exodus and in many cases according to Anacleto and Negrelle (2013a) also the countryside.

In parallel with this situation, a significant portion of bromeliads producers in Paraná have difficulty in production, either for lack of cultivation process technology knowledge, inadequate production structures and disorganization of class on aspects related to marketing and access to funding resources to invest in the crops.

According to Anacleto and Negrelle (2013b), the bromeliads retail and wholesale market in Paraná follow the principles of perfect competition, bringing bromeliads from other producing regions where they receive more attractive offers and higher quality of plants.

Paraná bromeliads production competes unevenly with producers from other regions, especially from São Paulo, which are more organized and show investment capacity and large-scale production and are preferred by trade in the retail and wholesale levels. Although the Paraná production shows lower cost price than plants from other regions, the quality of regional production promotes rejection of bromeliads in the most demanding markets difficult the crops outflow.

Despite the reported difficulties, bromeliad cultivation is an economic activity that could be one of the building blocks to sustainable rural development, although, it is not considered the main economic activity it could be considered its plural character, which facilitates the association of this cultivation to other potential activities on the properties, becoming a strategic factor in enabling income in these rural properties.

The adoption of strategies associated to the plural character and use of natural resources available to producers are effective alternatives if the adoption occurs ruled in structured and planned process, however the economic issue should be considered as a prerequisite and a reference in changing condition of the reality in countryside.

It is clear that given the historical difficulties associated to bromeliads in Paraná, it can be considered that to reach the levels recommended by the sustainable rural development in a broad way in which families can be benefit economically from the resources available in the environment while that promote improvements in social conditions, it constitutes a major challenge.

The scenario portrayed in bromeliads supply chain proves to be challenging since even government agents (EMATER, SEAB) reveal do not have data and indicators on production and trade of bromeliads. However, still other government agents (IAP) promote restraint of extraction with seizures, and many restraints are close to the extractors, so the producers and extractors remain invisible to the State's actions.

Benefit from the adoption of the perfect competition model, merchants of flowers, being wholesalers or retailers, buy flowers from other regions to meet their bromeliads local demand. The consumer without access to better information eventually consumes only what is offered, and the bromeliads supply chain in Paraná, without the mediation of a party does not adopt collaborative governance models.

The scenario presented reveals that producers and extractors are the most vulnerable in all segments of the bromeliads supply chain, and apparently they have difficulties in self-organizational and in search better conditions of production and trade of their bromeliad crops.

The positive change in the scenario of bromeliads supply chain would be made easier, if there is expansion of efficiency in the crops, regarding to the produced species, production technology and preparation for trade, as well as the legalization of extraction and the transformation of extractors in bromeliad farmers.

In this context, two basic principles of the concepts of sustainable rural development deserve special attention.

First is the dialogue among several knowledge involved, when it should be considered the dialogue of producers and extractors and their real needs, with the other social actors in the supply chain, in order to promote the transformation of each situation and the ways to meet the families demands.

Second is the inclusion of intervention actions guided by the triad of sustainability, however it should expand the vision to more organized and planned concepts in economic aspects, otherwise the intervention of external social actors could be characterized in simple grant, and not basing the situation in structured and planned economic processes, results in a scenario that tends to return the genesis.

Intervention should occur in several ways, first with the market guidance to producers by the wholesale and retail segments, promoting the flow of information from the final consumer to the producer and extractor, revealing the consumers desires, what species should be produced and what periods should occur the higher crops to meet seasonal demands. This market orientation model is successful practices in other supply chains, and may be important in the prospection of bromeliads supply chain.

Producers and extractors may have better results in the activity if they have the State action, especially in vulnerable and impoverished regions. The bromeliad cultivation in Paraná, together with the transformation of the extractors on producers, extends the environmental protection levels in an indirect way, as they will promote the inclusion of a large number of plants in the regional trade and will reduce the dependence on extractive

activities, especially in Paraná Coast and in the region of Ortigueira.

Structured intervention through incentives or subsidy in the change process could help families overcome the lack of economic resources from investment in production technology, thus they could promote forest preservation and social equity, and from this promotion it is necessary to create mechanisms that can ensure the producers "themselves" may transform their reality continuously.

The role of the State in development projects of bromeliad cultivation could result in a new and inclusive scenario that could lead to the breakup of the traditional paradigms, in synergistic actions relying on the help of research, teaching and extension promoting equity actions that consider and respect the customs, culture, knowledge and the interaction of these families to the environment where they live.

Thus, the change in the scenarios of bromeliads production and extraction, is guided by the triad of sustainable rural development, in fact could result in significant progress in mitigating the impoverishment of families involved at the same time strengthens the bromeliads supply chain.

So, it arises the need for a new management model of supply chain, which should be collaborative and conciliatory in order to the secular knowledge of these families are respected, but at the same time it should occur with a focus on dialogue with what is new, and that promotes an adjustment of bromeliads productions in Paraná that require expanded use of technology levels and more professional management in addition to production and trade.

V. CONCLUSION

Bromeliads producers and extractors showed inadequate conditions of cultivation/extraction which determined lower quality plants and less marketing potential.

Although local production is lower than the demand in Paraná, the bromeliads production in Paraná was partially depreciated by retailers and wholesalers because it do not meet the criteria required by the final consumer as price, quality of production and regular deliveries.

In both cases the distribution was based in trade in their own farms. Producers and extractors did not have a strategic model that results in competitive advantage to the bromeliads supply chain in Paraná.

The distribution of flowers until the consumer held by wholesalers and retailers occurred at an early system of pre-sales, which practically eliminated the risk of leftovers and losses on the sale of flowers, this practice associated to cost dilution with the purchase of flowers directly from the producer with low-cost were classified as significant competitive advantage to these segments.

The purchasing system in a collective way that reduced

the cost and extended the profitability was reported as the main segment competitive advantage.

Consumers said that the price of bromeliads was considered high (n = 57.8%) and the fear that the dengue mosquito could develop in bromeliads (n = 34.2%) were some limits to the expansion of bromeliads consumption.

It was not observed the adoption of shared strategies among the segments that resulted in competitive advantage in bromeliads supply chain in Paraná, which demonstrates the urgent need for a new supply chain management model developed collaboratively, inspired by the sustainable management in order to consider the plurality of these properties.

There was the pre-eminent need for a management model that should emerge from a conciliatory dialogue, in which historical conditions are respected, but that is not also disregarded the economic and environmental issues, essential tool in changing and prospecting of the current scenario.

However, the real sustainability of these communities is apparently still far from being achieved, in this context, several aspects should be considered by the actors in various segments, when design a set of harmonious strategies that can lead to a designed social, ecological, and economic planning model and that promotes collaboratively the development of bromeliads supply chain in Paraná, since producers and extractors for low organizational skills are apparently not able to promote this development.

In the face of all argued above, this paper present some recommendations to the other actors involved in the promotion and development of bromeliads supply chain in Paraná, which may result in a collaborative governance model among various actors:

Possible contributions by State Government Agriculture System (SEAB, EMATER, IAPAR)

Promote data collection and diagnosis of expectations and needs of producers and extractors.

Promote meetings for open dialogue among the various segments of bromeliads supply chain in order to have the prospection of the supply chain.

Encourage and collaborate in the organization of formal/informal groups related to the cultivation and extraction of bromeliads in Paraná to exchange experiences.

Create processes to facilitate the legalization of existing cultivation units and promote the legalization studies of extraction practiced by small producers.

Start the process of dialogue among the actors involved in the issue of extraction in order to promote the re-reading of environmental protection legislation that at least prioritizes the repressive and punitive actions and causes the exodus.

Promote the facilitation of the integration of bromeliads producers in the development credit lines available, as BNDES, Fundo de Amparo ao Trabalhador, Banco do Brasil and other development agencies.

Create credit line in State programs, with different proposals that could meet the special needs of producers in poor communities to improve production facilities and investment in production supplies.

Organize technical events together with other institutions aiming the debate about a strategic plan to leverage the bromeliad supply chain in Paraná.

Organize partnerships with entities such as Biology, Agronomy and Forest Engineering Regional Councils, aimed at guidance to producers on technical procedures to improve the quality of crops, as well as SEBRAE, SEAB and EMATER in order to offer training in association, organization, production control, sales techniques and land management.

Organize trade fairs or provide the commercial opportunity for bromeliads producers in existing fairs.

Promote certification feasibility study of the production coming from the State, aiming trends as socially just or ecological production among others, that could benefit low-income families and facilitate trade.

Promote wide dissemination of the correct information about bromeliads and dengue fever.

Possible Contributions by Universities

Expand research on the species of bromeliads with ornamental potential, especially in issues about improving genetic qualities of endemic plants.

Promote studies about organic cultivation and low-cost technologies in bromeliads production.

Set the issue in university environment, as scientific weeks and extension.

Offer to producers, with low-cost, support elements of productive base as soil analysis, micropropagated seedlings and courses focused on production and farm management.

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