

A Proposal of a Method for the Input Supply Chain Planning and Management based on the Fresh Fruit Business

1 Introduction¹

The Brazilian fruit industry over the years is preparing to compete more actively in the international market and increase its participation in the economy of the country. According to the Brazilian Fruit Institute (IBRAF), the national fruit handled \$ 5.8 million only with fresh products and \$ 12.2 billion when considering all derived from fruits. According to data from the Brazilian Institute of Geography and Statistics (IBGE), the Brazilian fruit sector represents around 11.5% of Gross Domestic Product (GDP) and 0.625% of farm country.

The industry of fruits in Brazil is among the main generators of income, employment and rural development in the Brazilian agribusiness. The levels of productivity and business results achieved in recent harvests are factors that not only demonstrate the vitality and the potential of this segment of production. Currently, there are, at least, 30 large clusters of fruit production throughout the country. In addition, the Brazilian fruit industry is an activity with a high multiplier effect of income and, therefore, with sufficient force to boost local economies and stagnant with few alternatives for development.

However, the realization of the social and productive potential of Brazilian fruit industry depends on a better organization of industry, modernization of marketing and incentives for technological innovation and value.

This article proposes to conduct a study on how the supply chain management of fruits can be managed as one of the ways the search for constant improvement in the process of developing the sector. Rao and Holt (2005) mentioned that the supply chain management promotes synergy and efficiency between business partners and contributes to increase environmental performance, minimizing waste and helping to save costs.

According to these authors, this synergy may promote an increase in corporate image, competitive advantage and marketing exposure. The authors also point out some positive arguments related to such integration as reducing operating costs, the integration of suppliers' integration in the processes of decision making, differentiated purchasing strategies, waste reduction, material substitution and raw materials, reduction of greenhouse gases, improved use of natural resources, more efficient development of new products and innovation.

Therefore the purpose of this paper is to form an understanding of how the processes are related in fruit supply chain management, which are the problems and services demanded for each stage of the product network, and finally to propose a method for fruit supply chain coordination. This research uses a literature review and in-depth interviews. The interviewed were Brazilians fruit companies that operate on a global basis in fruit exportation. Empirical data have been collected mainly with key persons representing senior and middle management in the selected companies.

2 - Literature review

2.1 Supply chain management

¹ This is a draft version yet, lacking a final English review and also some parts of literature review. It is for IFAMA Conference Shanghai.

The supply chain management (SCM) is a definition used to describe how the material and services flows are managed to integrate supply and demand interaction across all companies on a supply chain (Ballou, 2007). Furthermore, its importance was observed in mid-sixties by Heskett et al. (1964), who state the positive relationship of the coordination of the supply and demand through different organizations in the entire channel.

By the point of view of the organization, the SCM could be described as the mutual efforts across all its internal functional areas (e.g. marketing, finance, engineering, information systems, and operations) with the suppliers and consumers (Ballou, 2000). Which are defend by many authors as successful strategies to increase competitiveness by increasing the information flows with the consumers, reducing costs, articulating with others supply chains, in a global scale as the market condition evolved (Chopra and Meindl, 2001; Coyle et al., 2003; Kim 2005, Kumar et al., Reichhart and Holweg, 2007; Bhatnagar and Theo, 2009).

2.1 Analysis of previously proposed supply chain (inputs purchasing) coordination methods

Coordination is the by definition the management of dependencies across related activities (Malone and Crowston, 1994). By that, the task to coordinate a supply chain comprehends a great variability of relationships which need to be flexible in order to better adapt assets or utilizes resources in a particular chain (Soon and Udin, 2011). And one of the most important issues regarding it is the analysis of different analytical approach of the supply chain structure (Ballou, 2001). To explore this affirmative, and to refine which is the best solution for the fruit supply distribution chain, we will discuss in the incoming paragraphs methods existing in the literature.

Singh (2011) pointed out six categories assessing the supply chain coordination (i.e. management commitment, organizational factors, mutual understanding, information flow, relationship, decision making and responsiveness). Although, this method emerges because of power dependence in small and medium enterprises, which should not be generalized for larger organizations, that might be able to align the supply chain in a more precise manner.

Complementary, the method of Piplani and Fu (2004) explores the importance of establish a align mechanism by sharing costs and service level contracts. The model relates three stages for the chain' coordination which are defined as: multi-agent technology coordination theory and optimization technology. Besides, the author stressed that it became a proper solution to integrate dependencies amongst the supply chain organizations.

Other important aspect, defended by Arishinder and Deshmukh (2007) is that the coordination method arises from a bound of dependence in which are involved different strategies, culture, structure and technology between the organizations. The authors observed this method should be systemic in order to meet the need for each member to actually coordinate which each other for every activity and process in the supply chain.

As for Manuj and Sahin (2009) the method for supply chain coordination should focus the knowledge and skills of professionals in multiple functional areas to overcome its internal and external complexity. The proposal is to understand the main drivers that lead to necessity of management and to design strategies to reduce complexity negative consequences by identifying key performance indicators, appropriate metrics, assessing performance, identifying causes and then, purposing corrective actions.

The supply chain coordination could also perceive as an innovative way to increase transactional value for goods being sold (Tokman and Beitelspacher, 2011). By

coordinating the supply chain, it becomes easier to link economic actors with organizations and technologies to offer services that can even increase the product value.

2.2 How to organize a supply chain coordination method

Thompson (1967) stated that a coordination method was the characterization of a determined pattern between forms of task interdependence amongst organizations. In addition, many authors enhanced his definition. Galbraith (1973) and Van der Ven *et al.* (1976) highlighted the great uncertainty of process coordination. Malone and Crowston (1994) separated the coordination activities in two: those which contribute to the output of the process or task, and those which manage interdependencies between activities and resources. Finally, Adler (1995) and Bailetti *et al.* (1994) developed coordination as a broad set of responsibility interdependencies affecting all actors of the chain.

To study a supply chain coordination method, as observed by Fawcett and Magnan (2002) and by Ballou (2007), it also must be observed the multiples companies of the supply chain that reach the potential of theoretical integration. The authors pointed out that one third of the organizations try to integrate with the first-tier suppliers only, which results in limitations on competition and difficulties of collaboration of supply chain.

Once the process is observed in a proper environment, the last step is to decompose the main information and products' flows into several divided activities (Sorrór *et al.*, 2009). After that, it must be analyzed the interdependence flow across the divisions and arranged the interface in a shared view of responsibility.

3 - Research method

This research aims to develop an understanding of the fruit chain, and then to purpose a method for its coordination. The subject was studied through seven in depth interviews, supported by a literature review of SCC. The chosen approach of this research is defined as exploratory qualitative analysis of primary data (Malhotra, 2006).

Furthermore, in-depth interview was chosen since the research aim to purpose a method from the explanations and descriptions of the empirical data on the authors' observations. In those interviews it was expect to explore beyond initial responses, surpass any resistance to answer a difficult question and also to clarify all the statements given by the respondents (Yin, 2003).

In this study, we collect data from seven companies in the fruit chain in Brazil and Europe through in-depth personal interviews. These companies were selected because of its importance to global fruit trade, particularly to exportation and market size. In this regard, this study selected companies that represent various participants in the supply chain, including producers/exporters/packing-houses (Alpha and Beta companies), juice/pulp and nectar industry (Gamma company), branded fruit companies, (Delta, Epsilon and Zeta company) and certification company (Eta company), which had their names altered to retain anonymity. This wide diversity in sample increases the possibility of generalizing the results and exploring patterns in the fruit chain. The profiles of the participating companies are show in Table 1.

The participants in this study were product managers, general managers, supply chain managers, and other executives who possessed relevant knowledge of the fruit chain. Personal interviews were arranged in the length of one to two hours and used the focused interview format, in which the interviewer follows a set of predetermined questions. All the important topics discussed by the participants were recorded by the interviewer in hand-written notes, which were sent via e-mail to check for errors and to evaluate the validity of our interpretation and description.

The material of interviews were compiled and edited by the research team and confirmed in a workshop with the interviewers, which generated the consolidated analysis. The three researchers of this study jointly discussed the material to identify the key themes relating to the research topic under study. These themes are presented and discussed in Sections 4 and 5.

Table 1 – Background information on the companies in the exploratory study.

Company	Market and location	Description
Alpha	Producer / exporter / packing-house in Brazil	Exported over 20,000 tons of fruit, which included mango and grape on 1.200 hectares at <i>Vale do Rio São Francisco</i> , backlands of <i>Pernambuco</i> and <i>Bahia</i>
Beta	Producer / exporter / packing-house in Brazil	Exported over 15,000 tons of fruit, which included mango and grape More on 700 hectares at <i>Vale do Rio São Francisco</i> , backlands of <i>Pernambuco</i> and <i>Bahia</i> .
Gamma	Juice/pulp and nectar industry in Brazil	Brazilian branch of a Multinational industry that that have the capacity to process over 100 million liters of juice/pulp and nectar in one year
Delta	Branded fruit companies in U.S.	Producer, distributor and marketer of branded food for the retail market, generating approximately US\$3.5 billion in net sales in one year
Epsilon	Branded fruit companies in Europe	Producer, distributor and marketer of branded fresh food for the retail market, which generate approximately €3.0 billion in net sales in one year
Zeta	Branded fruit companies in Europe	Producer, distributor and marketer of branded fresh food for the retail market, which generate approximately €1.5 billion in net sales in one year
Eta	Global Certification company	Certification designed to support the sustainable development of small producer organizations and agricultural workers in the world.

4 - Research findings

This section discusses the major research findings and the resulting analysis, i.e. standard fruit chain, satellite of fruit's chain difficulties and inefficiencies, and services demanded.

4.1 Designing a standard and complete fruit chain

The initial phase for the buyer's supply chain coordination was to describe all the agents that have an active function in the whole chain, from raw material suppliers to final consumers (Neves; Zuurbier & Campomar, 2001). A primary model was performed

through the authors' general overview of the main companies operating in the chain, which were testified by the interviewees and are illustrated in the Figure 1.

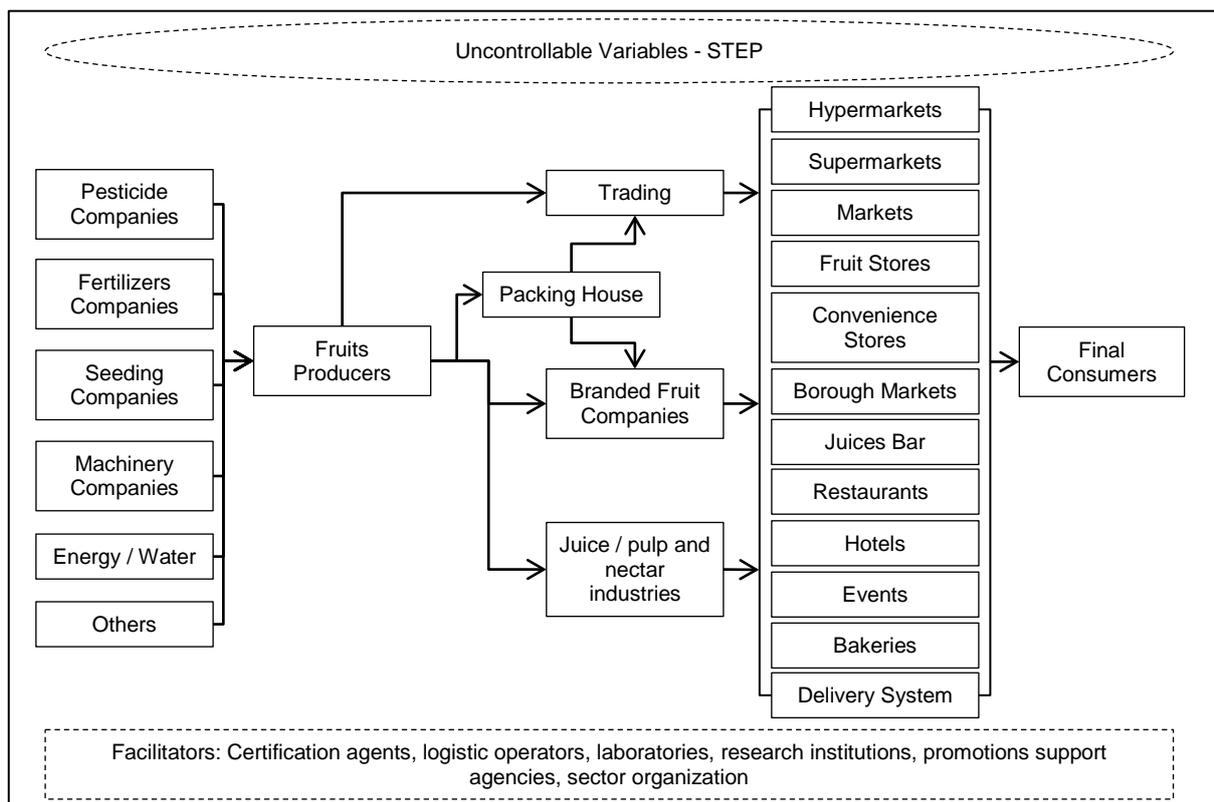


Figure 1 – A standard fruit chain. Source: Authors.

The standard fruit chain describes all the agents that perform negotiation functions at the product flow – i.e. suppliers (pesticide, fertilizers, seeding machinery, energy/water and others companies), farms (fruit producers), industry (packing-house, fruit branded companies and juice/pulp and nectar industries), wholesalers (trading), retailers (markets, fruit stores, juice bar, restaurants etc.), and lastly the final consumer.

Specifically, for fruit chain coordination, it becomes very important to have this complete picture of the whole chain. Companies that were related to fruit production and that exports to mature markets may optimize its efforts, by being able to visualize punctually were and with whom problems could take place.

4.2 Description of fruit chain inefficiencies and difficulties

The description of fruit chain inefficiencies and difficulties were classified on a satellite of production, marketing, tariff barriers, logistic, image and other specificities (Figure 2). All the problems observed by the interviewees were related to one classification (Table 2), this process would make easier to identify and purpose services that could minimize the fruit chain lack of coordination.

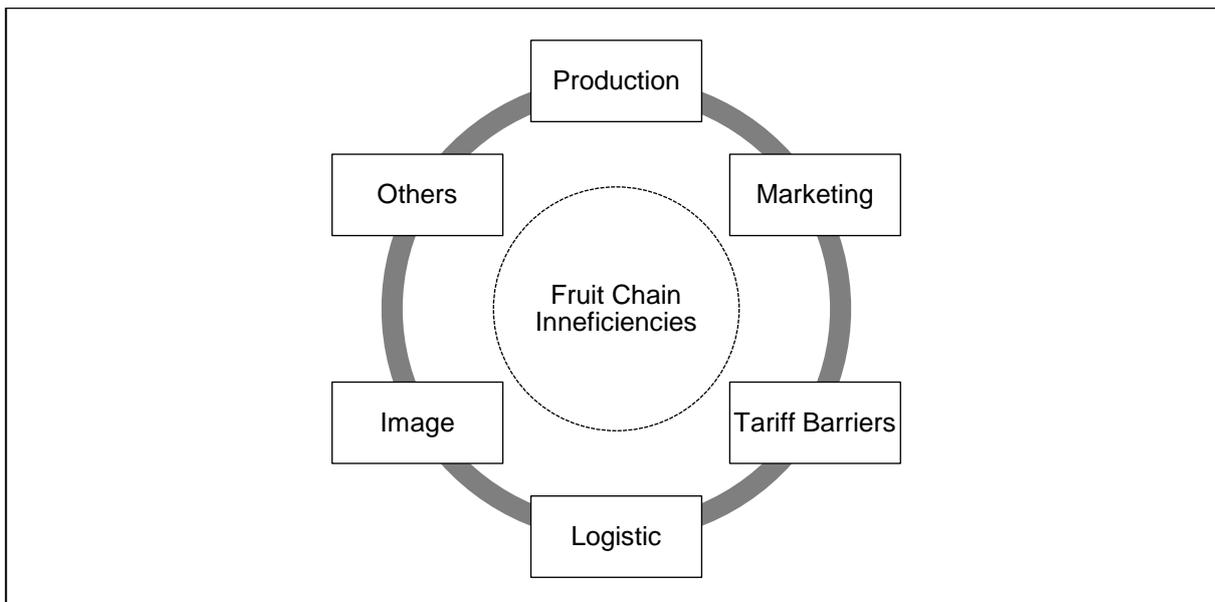


Figure 2 – Satellite of fruit supply chain network inefficiencies and difficulties.

Table 2 – Main problems diagnosed on the fruit chain.

Main problems	
Production	<ul style="list-style-type: none"> • High production costs, mainly the inputs, representing around 30% of the total production costs and labor force, representing 45%; • Lack of registration of some active ingredients used in Brazil; • The MRL (Maximum Residue Limits) is one of requirements of the markets; • Lack of post-harvest products; • Labor was a competitive advantage in Brazil. Current Situation: Labor laws + economy growth = others sectors are absorbing the labor; • Lack of mechanization; • Lack of harvesting and handling techniques; • Low Productivity in some parts of the Brazilian production – there is potential for growth (number of plants/ha and ton/ha); • Producers have difficulties in managing their business, particularly the small and medium producers; • Few producers can do the financial analysis of the their clients, they prefer to sell their production to the large producers, because of the risk involved; • Lack of financial credit alternatives to producers. • Lack of support to producers in terms of regulation aspects and others issues that are required by international buyers; • Different markets and retailers define protocols with different specification; • Difficulties to extend the value of food security; • The python-sanitary aspects for export involve many protocols. Most of the markets requires GLOBALGAP certification; • Globalgap, Tesco, PIF, RainForest are the main certification required; • Certification costs are very high.

Marketing	<ul style="list-style-type: none"> Exports concentrated in few markets/channels; Brazil has low worldwide market share, despite being a large producer – the access to markets is still being developed; Competition with other exporting countries. Some Brazilian fruits, as mango, are still an exotic fruit for European consumers; Sales model based on consignment; Costs with fruit discard are assumed by producers; There is wide variation in fruit prices, bringing risks to all chain agents; Lack of trust between retailers and producers; Internal Market poorly developed – the fruit consumption in Brazil, is still low.
Tariff Barriers	<ul style="list-style-type: none"> Others competitors have lower tariffs to access Europe; Brazil is one of the countries of South America that has no benefits of the free trade agreement with Europe (tariffs more than 14%).
Logistic	<ul style="list-style-type: none"> Logistical Costs in Brazil are not an advantage; Main Ports: Recife, Salvador e Fortaleza; Large distance to Europe; Lack of proper use of the cold storage technology; Lack of a structure in Europe/USA for producers and exporters; Perishability of the mango is high, making the market very sensitive – the shipping takes 30 days to get Europe, for example; Airfreight too expensive
Brazilian image	<ul style="list-style-type: none"> Image of the Brazilian fruit chain is not positive worldwide
Others	<ul style="list-style-type: none"> Exchange Rate is negatively impacting profitability; No formal contracts

4.3 Fruit chain demanded services analysis

The Fruit supply chain demanded services includes all responses to factors that were identified in the mapping of the supply chain. These purposes were the result of an exhausted discussion by the authors in which was included the perception of what the managers would meant as solution fruit supply chain management challenges. The interviewees' responses were analyzed as the services shown in Table 2.

Table 3 – Demanded services in the fruit chain.

Stage	Demanded services
Production	<ul style="list-style-type: none"> Training of producers to the protocols of good agricultural practices and national and international opportunities for traceability; Standardization of supply, agricultural production techniques, involving crop management, plant health, assessments, and others; Verification about what kind of products are still needed Brazil (biological control, post-harvest products and others); Support to producers in national and international registration of products used in fruit production; To promote the reduction of fruits losses throughout the production network; Networking development between producers and Embrapa and/or others organization that can study the technical aspects for mango production; Provide support to producers to produce according to MRL, with portfolio of products and application and residual laboratory analysis (partnership); Joint research to increase fruits shelf-life;
Marketing	<ul style="list-style-type: none"> Knowledge of the final consumer; Knowledge of the consumer retail and wholesale (distribution);

	<ul style="list-style-type: none"> • Knowledge of the mango chain and marketing; • Knowledge of trading companies and others agents. What services should be provides? How much could be charged? • Supporting in market access, building contracts; • Opening new distribution channels that are not exploited; • Supporting the promotion of Brazilian fruits; • To capture other opportunities besides the actual export window; • Customization of offerings for different segments of the international markets (value capture); • Offering guaranteed supply to international buyers; • Creation of a new brand, a new concept in the fruit market, from improvements in existing business models and with new positioning - an intimate relationship with buyers; • Management of purchase contracts (volumes, technical features)
Tariff Barriers	<ul style="list-style-type: none"> • Support to Brazilian diplomacy in attempts to reduce tariffs and reach agreements, working with other agencies and IBRAF.
Logistic	<ul style="list-style-type: none"> • Mapping of the logistical processes and costs, in terms of, to find out the best partners for the execution of packaging services, certification, transportation, storage and disposal (if it is necessary); • Eliminating duplicate structures and inefficient processes.
Others	<ul style="list-style-type: none"> • Training of commercial mechanisms of risk management (in mango production); • Barter could be an interesting financial mechanism.

5 - Proposal of a Method for A Company's Supply Chain Planning and Management based on the Fruit Chain Experience

One of the possible ways for a company to increase margins and capture value is looking at its supply chain (inputs needed for production) trying to make it more efficient. From the interview and demanded services analysis it is proposed a sequence of six steps to evaluate the company's integrated supply chain and to propose an action plan for improvements aiming to help in this important process.

The sequence could be divided in six phases, starting with the understanding of the supply chain and the functioning of the markets of its major inputs, then moves to a strategic analysis of the governance of these relationships inside the focus company and finally, proposes new forms for organizing these relationships in order to build safer, cheaper and more reliable supply chains.

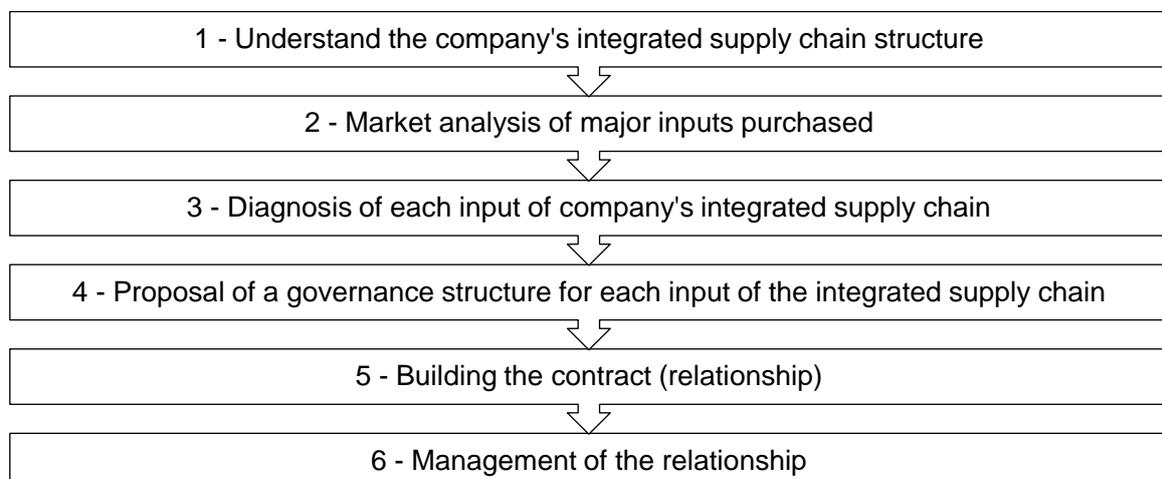


Figure 3 – A Method for A Company's Supply Chain Planning and Management based on the Fruit Chain Experience

(1) Understand the Company's Integrated Supply Chain Structure:

- What are the major inputs (products or services) purchased or internally produced?
- What are the costs involved (procurement, handling, transaction, stocks)?
- What are the processes involved in production?
- What are the seasons of production?

(2) General Market Analysis of Major Inputs Purchased:

- Describe the market characteristics and functioning of major inputs purchased
- Which are the number of suppliers, products, brands, channels, prices?
- Which are the services offered by suppliers?
- What are locational and major macro-environmental risks?

(3) Diagnosis of Each Input of Company's Integrated Supply Chain

- Which are the resources given x benefits?
- Choose among single supplier x multiple suppliers
- What is the degree of sophistication of the relationships?
- What is the degree of dependence on specific suppliers?
- Which vulnerabilities and risks are involved?
- Establish a priority list for interventions.
- What are the long term goals of the Company and traditions?
- There are an internal resistance to change (cultural aspects and barriers)?

(4) Proposal of a Governance Structure for Each Input of the Integrated Supply Chain:

- To analyze the economics and margins of each agent of the Supply Chain.
- To identify and describe value capture possibilities.
- To measure specialization gains.
- To build entry barriers for competitors.
- To promote development and inclusions by official (Governmental) credit lines

(5) Building the Contract (Relationship):

- To negotiate a "win-win" agreement within the Supply Chain.
- To consider macro-environmental changes.
- To describe the flow of products, services, communications, payment and information.
- To analyse the specific investments needed and the risks associated to these investments.
- To promote incentives and share results of competitiveness gains.

(6) Management of the Relationship

- To establish governance forms, with boards.
- To have external evaluation committees.
- To search for continuous transactions costs reductions.
- To benefit from the experience curve.
- To explore innovation gains and share it within the Supply Chain
- To continue the benchmark process and evaluation of alternatives (imports, for instance).
- To bring motivation and avoiding the risk of accommodation
- To improve services and support.
- To share open communication platforms.
- To be flexible and responsive
- To promote networking and cooperation among different suppliers of different products.
- To permanently increase trust

Figure 4 – Examples of questions and actions to be done in each of phases of the Supply Chain Planning and Management Method.

6 - Conclusions and managerial implications

There still exist a broad necessity for studies of the chain and the method proposed here should be conducted to better align all the efforts and necessities of a buying company. This paper provides insights for researcher and practitioners on how to coordinate the supply chain process, giving attention to all the stakeholders needed to be

involved on its management to be able to identify the problems and difficulties on the fruit chain and to archive a solution by proposing and analyzing services demanded.

One of the possible ways for a company to increase margins and capture value is looking at its supply chain (inputs needed for production). The objective here is to offer a sequence of six steps to evaluate the company's integrated supply chain and to propose an action plan for improvements and efficiency of reorganizing the supply chain (Figure 4).

These steps start with the understanding of the supply chain and the markets of its major inputs, then moves to a strategic analysis of the governance of these relationships inside the company and finally, propose new forms of organizing these relationships in order to build safer, cheaper and more reliable supply chains. It may help companies wanting to re-organize supply chains.

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