

## **Milk agro- alimentary chain sustainable development strategy in the conditions of the Ecuadorian Amazon region**

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In the Ecuadorian Amazon region, the milk chain suffers from an insufficient coordination among the delivering actors, that's why the objective of this article is to diagnose the milk agro-alimentary chain in Puyo, Pastaza, in order to propose development strategies. The Strategic Model of Collaborative Planning, as methodology, was used. The main results were focused on the characterization of the chain and the diagnosis of the integration between the actors and their fundamental weaknesses. The limitation in the application was due to the low training and the human potential formation that belong to the chain actors, that allows to propose a strategy of sustainable development. In conclusion, the work has, fundamentally, a practical value, given by the procedure application feasibility the in the supply chains, under the Ecuadorian Amazon conditions.

### **Keywords**

Agrofood chain, milk, dairy products, development strategy.

## **1. Introduction**

Codex Alimentarius defines milk as a product obtained by any milk processing, which may contain food additives and other ingredients functionally necessary in its preparation" (Codex Alimentarius 2016).

Dairy products diversity varies considerably from region to region and among countries in the same region, depending on dietary habits (Uluko, Liu et al. 2016), available processing technologies, market demand and social and cultural circumstances, with a direct impact on the agro-food chain in the milk and its derivatives development (Garcia Guerreiro and Wahren 2016, Ortiz Hernández, Jiménez Vera et al. 2016).

The agro-food chain according to several authors starts with the raw material and ends in the final customer (Hernández, Enriquez et al., 2016, Turkay, Saracoglu et al., 2016(Dreyer, Strandhagen et al. 2016)), through the application of several processes with greater degree of difficulty and innovation (APICS 2015, Muñoz Aguilar and Roldan Zuluaga 2016). It has a linked rings shape, denominated by several authors as links, in order to provide added value to the final product (Naspetti, Lampkin et al. 2011), these processes include direct and indirect actions and include executives, cycles, components and production costs for the subsequent commercialization (Bautista Santos, Martinez Flores et al., 2015), and it also includes traceability procedures since the raw material or product is in cultivation, passing to its harvesting stage and transportation and then reaching the transformation stage with the aim of obtaining products with added value, which will be offered to the market (Fernandez Lambert, Aguilar-Lasserre et al., 2015, Ríos Nunez and Nunez Yanez, 2016, Mello et.al., 2017).

In Ecuador there are examples of studies of some chains, such as milk producers, production chains and rural economic development, banana industry market structure analysis, production chain diagnosis of mariculture in Ecuador, cocoa productive chain and territorial agro-food chains, tensions and learning from the Ecuadorian Amazon dairy sector that focuses on the livestock sector (Suplicy 2015; Ríos, Benítez et al.,2016).

In spite of this, it is not a very much discussed and studied issue, therefore, the objective of this article is to diagnose the milk agro-alimentary chain in the Amazon region in Puyo, Pastaza to establish a sustainable development strategy.

## **2. Materials and methods**

The Supply Chain Strategic Collaborative Planning Model (MPCECS), applied to agro-food chains and the implementation process, contribute to the chains development in the Ecuadorian Amazon. It consists of three stages and 11 steps that integrate a tools group that facilitate the implementation of collaborative planning and control at a strategic level in agro food chains, with the study of 55 models and tools.

The MPCECS purpose was to determine the Collaborative Planning Level (NPC) in the food chain actors, in order to analyze the integration chain level, to design strategies types (interrelation Matrix between the NPC of the proposed strategies), the collaborative planning aim in the chains and finally to formulate a joint business plan for agro-food chains that focuses on competitiveness improving. The matrix allows the strategy approach, depending on the NPC in which the chain take place. The NPC is calculated using a checklist of 91 questions.

For the case studies development, the methodology proposed by the BestLog project of the European Commission for the study of reference cases was followed (Guerola Pérez, 2009). The

proposed methodology consists on the problem description, solution, challenges (lessons learned and success factors) and benefits (economic, environmental and social).

### 3. Results

The dairy agro-alimentary chain in Puyo city, located in the Pastaza province of the Ecuadorian Amazon region is made up of thirteen actors grouped into four links: suppliers, producers, sellers and consumers (figure 1).

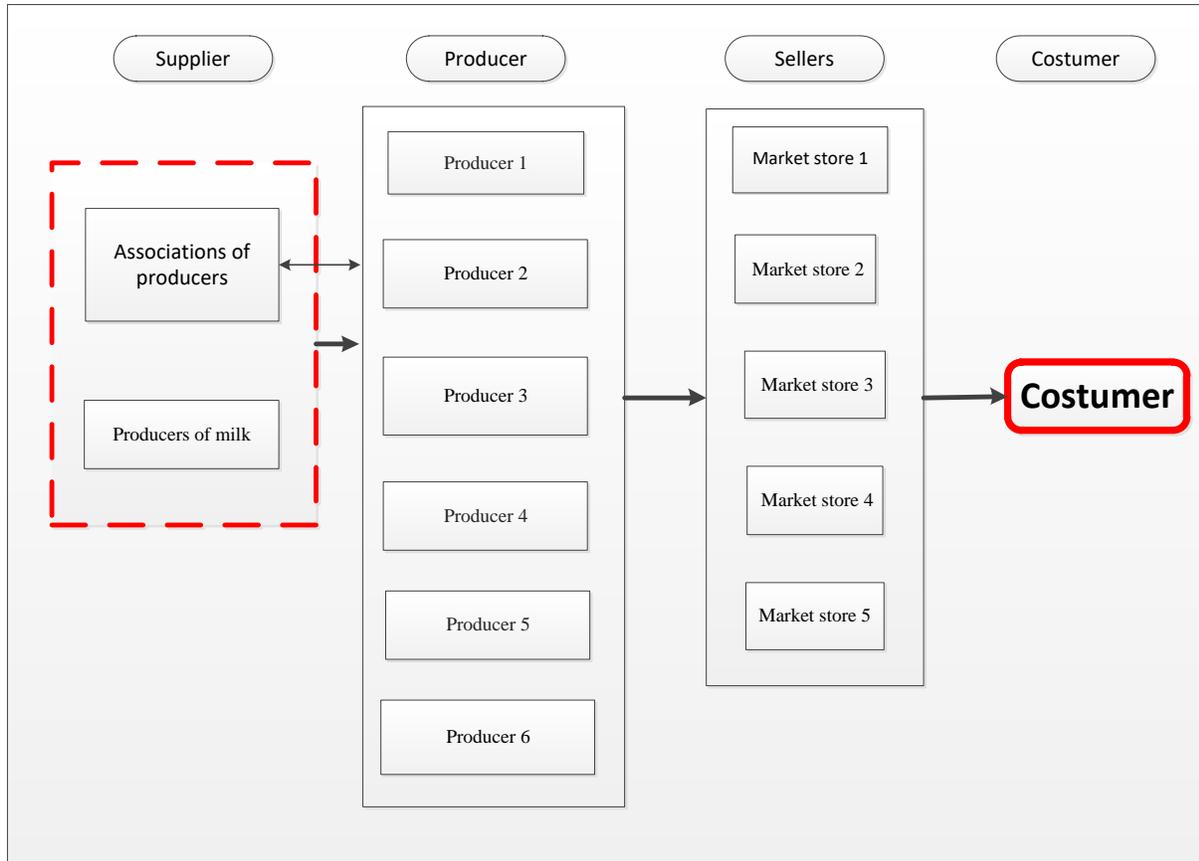
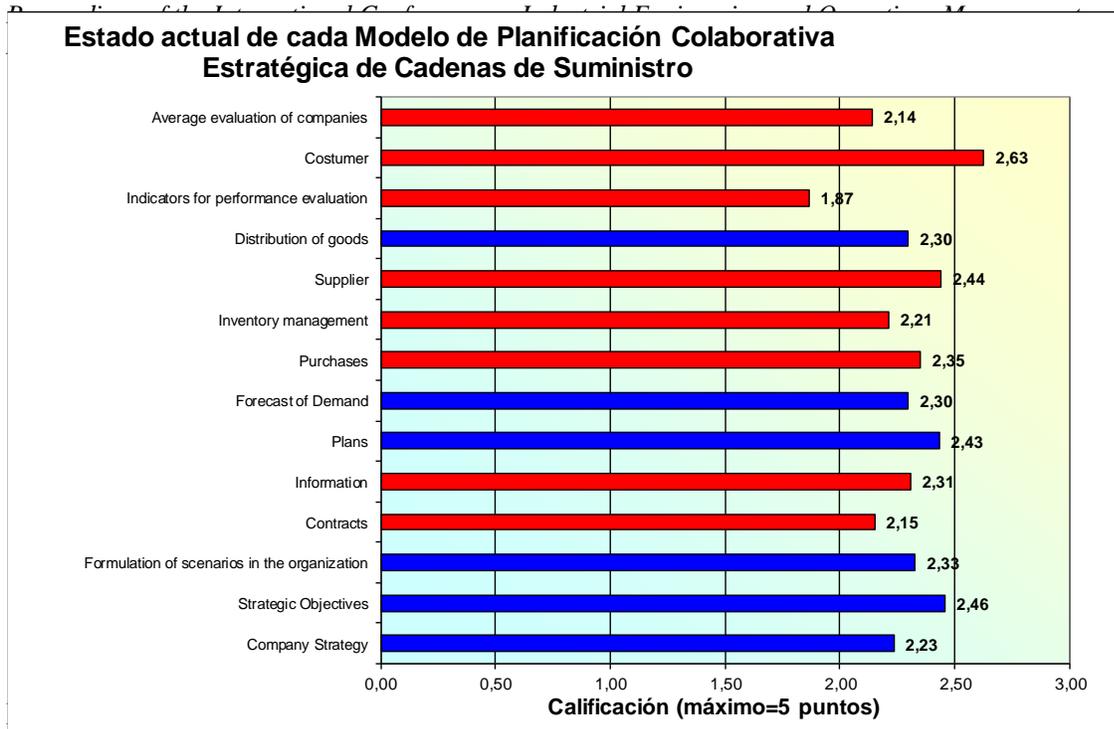


Figure 1. Map of the milk agro-food chain.

#### Checklist results of the Strategic Collaborative Planning Model in Supply Chain

In the agro-food chain actors checking, results of low levels in the performance variables evaluation, in the company's average evaluation, in the contracts, in the inventory management, in the company strategy, in the merchandise distribution, in the demand forecast, in information, in the organization circumstances formulation, in purchases, in plans, in suppliers, in strategic objectives and in customers, were obtained (figure 2).



The milk agro-alimentary chain in Pastaza presents a value of 2.14, which represents a low level. The greatest weakness variable was the performance evaluation. Within this variable, there were some deficiency items, such as the absence of methods to evaluate the actor's performance; the actors were not measured by quantifiable, reliable and safe indicators. The information collection of each actor for the rest one is low, there was no information exchange or evaluation, among actors.

In the agro-food chain actors check list, the results by companies indicated very poor conditions for: Market store 5; Market store 4; Market store 2 and Market store 3. With a low level were: Producer 2; Producer 1; Producer 6; Producer 5; Producer 3 and Market store 1.

As a result, for the particular study of each actor it is determined that the municipal markets presented a very low level, while Market store 1 had a high level, together with the two of the potential market stores. The rest of the actors are set at a low level. The actors that are in critical condition (very bad and low level) must work in the set of variables of the application model: collaborative refueling, collaborative demand, collaborative forecasting and collaborative performance.

### Stage of the integration level among actors

The milk agro-alimentary chain, Puyo, Ecuador has a low integration level, so it is located in the assignment-negotiation stage. Because of this result, strategies should be geared towards negotiation among actors (figure 4).

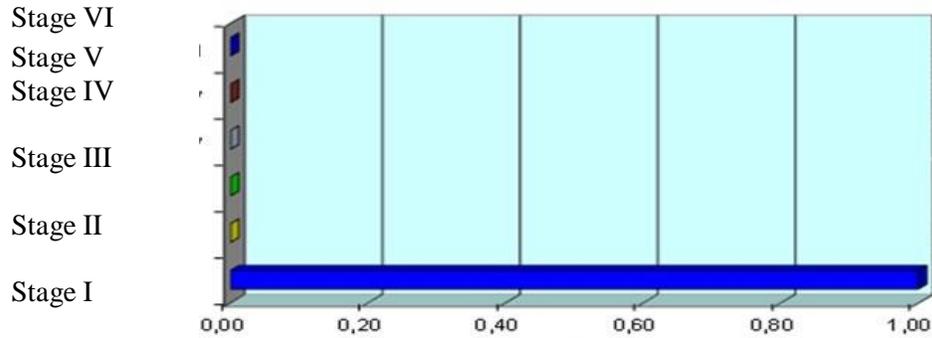


Figure 4. Qualification of each stage level of the supply chains strategic collaborative planning model.

### Strategies and aims

When the NPC is locating in the relationship matrix among integration levels and collaborative planning strategies, the chain is placed in level I.

Taking into account the strategies to be followed by the chain, they emphasis on focused discussion should be done on leadership cost, differentiation, approach in relationship to adversaries and relationship as adversaries.

The types of joint strategic objectives focus on enhancing customer satisfaction and result in:

- ✓ Market reach: increasing the market share by 40% of the total commodity.
- ✓ Competitiveness: To increase the logistics and industry resources efficiency by 20%.
- ✓ Service Level: To increase the variety through three new products, where the culture of the Ecuadorian Amazon is enhanced.

### 4. Discussion

As a result of the identified weaknesses and the milk agro-food chain low state of in Puyo, Pastaza, Ecuador, together with the feeble integration among the actors, several improvements in order to reduce these gaps were necessary. Among these improvements could be mentioned:

- ✓ To define essentially the milk agro-food chain policies among all actors that make up the different links,
- ✓ To establish specific contracts and frameworks among all actors,
- ✓ To design an information system that enables the interrelation of the information among chain actors (suppliers-clients),
- ✓ To estimate the demand for dairy products in the Ecuadorian Amazon,
- ✓ To design products with the inclusion of Amazonian fruits and plants for increasing added value,
- ✓ To calculate the productive capacity in order to determine the chain limiting bottleneck,
- ✓ To use whey in processed products giving added value, stipulating the interrelation mechanisms among actors,
- ✓ To choose the chain focal actor for the performance financial analysis to each actor in the chain to reinvest capital,
- ✓ To analyze purchases and the supplier's evaluation,
- ✓ To diagnose the livestock system of the Ecuadorian Amazon cattlemen,
- ✓ To design alternative foods for animal nutrition based on the Amazon products and,
- ✓ To Train the staff based on the skills needed for agro-food chain management (table 1).

Table 1. Research proposals to promote the milk agro food chain sustainable development in the Ecuadorian Amazon conditions.

<b>Problems</b>	<b>¿What to research?</b>
Dairy production low levels in the Ecuadorian Amazon.	To develop research projects in the agricultural sector to increase the milk production levels in a sustainable environment.
Insufficient coordination among the actors that make up the chain.	To increase the training courses, offered in the universities of the territory.
Low training of the human potential belonging to the chain actors.	To identify and to work in the network coordination key processes that ensure the final products competitiveness and services selected.
Little incidence of the territory universities with scientific investigation projects.	To form a central institution or leading entity (company or focal entity) that exercises the management of the elements that ensure the integrated and value network competitive operation.
The key processes network that ensure selected final products competitiveness and services are not identified or coordinated.	To enable the focal entity to manage the knowledge model administration, the innovation management and the administration and monitoring of the value network to the end customer.
There is no a central institution or leading entity (company or focal entity) that exercises the elements management that ensure the value network integrated and competitive operation.	To integrate a collaborative participation of all value network processes in that focal entity.
The focal entity does not lead the knowledge model administration, the innovation management and the monitoring administration of the value network to the final customer.	To develop specialization courses for the chain processes executors.
There is no collaborative participation of all value network processes in that focal entity.	Flexibility of the elements related to the value network conformation.
There is a low processors specialization in the chain.	To develop an assurance plan through competitive performance indicators for the final consumer, such as service level, quality, costs, product availability and others.
Preexists a low flexibility in the value network conformation.	To integrate the treatment to waste, packaging and products discarded by the customer generating added value.
Competitive performance indicators are not assured for the end consumer, such as service level, quality, costs, product availability, and others.	To apply strategy or positive value network extension model in the environment and also integrate the value network in an innovation process.
In the value network there is a weak waste treatment integration, packaging and products discarded by the customer generating added value and a positive impact on the environment.	To work on the creation of an extension network strategy or model.
Innovation processes are not integrated into the value network.	
There is a lack of alliances with logistic operators that reach the value network target markets.	
No strategy or extension model of the value network is applied.	

#### **4. Conclusions**

Referential scientific literature development shows the agro-food chains relevance for Ecuador and contributes to the adoption of worldwide practices suitable in the context of the Ecuadorian Amazon; these elements are necessary for the productive matrix change in the country. The

research is based on the supply chain collaborative planning model strategic directed to Puyo milk agro-food chain. The chain horizontal diagnosis is made through the evaluation of the integration level among the actors of the agro-food chain collaborative planning strategic model.

The Puyo milk chain has four links: livestock farmers that produced 1100 liters of milk per day, six milk industries, four sellers today, two potential sellers and several regulators entities. The milk agro-alimentary chain state in Pastaza is 2.24, which represents a low value and the greater weakness variable is the chain configuration. The collaborative planning level (integration) is 2.14, it is low and the most deficient variable is the actor's performance evaluation. Both results show that the chain under study is underdeveloped. In the study chain the group of actors that present major weaknesses is the cattle sector and the markets (sellers).

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