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Evolution of the Agri-Food Chain Concept in the 21st Century: The Taro Case

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ABSTRACT

Objective: To conceptualize the agri-food chain and analyze its evolution during the 21st century: The taro case.

Design/Methodology/Scope: A systematic literature review of magazines specialized in agri-food chains, value chains, logistics and supply chains for qualitative support and a case study of the taro agri-food chain were performed.

Results: Currently, agri-food chains include supply processes of inputs and necessary equipment, production, transportation, distribution and marketing, among other services. The study of agri-food chains has an effect on globalization within a stricter macroeconomic environment. The increasing industrialization of goods generates an aggregate value and provides a competitive advantage to companies and agents that take part in the chain. The taro agri-food chains, however, shows inconveniences in production, distribution, and storage processes due to the disintegration of links.

Study Limitations/Implications: There is information about the taro agri-food chains.

Findings/Conclusions: The agri-food chain concept has had a continuous evolution. Its structure has the objective to benefit each chain link; this generates commitments to produce based on needs. Both integration and experience allow strengthening and appraising the importance of each link, thus contributing to the generation of better income. Also, their consolidation has made them more sensitive to climate change, nutrition, and sustainability.

Keywords: supply chain, consumer, processes, aggregate value

INTRODUCTION

Agri-food chains will comprise links that go from the obtainment of raw materials to the consumption of the product. Currently, products suffer a great degree of transformation; commercial activities are diverse and there is a greater number of middlepersons that add value to the final product, going from short to long chains (Albusi, 2011).

Agri-food chain are a value chain or chaining of processes that foster a series of relationships and actions to perform specific primary, secondary and tertiary activities within a given territorial space, although with an incidence beyond the territory. Porter (1985) defined the value chain as an instrument for creating value for the buyer or consumer and its configuration or organization is crucial for the attainment of competitive advantages for chain links. In the 1990s, the

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value chain would be defined as the "set of activities developed within a company for designing, producing, marketing, delivering and supporting their products" (Porter, 1999).

Taro (*Colocasia esculenta* L. Schott) is perennial plant with an edible corm that belongs to the Araceae family. The genus is *Colocasia* and it is originary from the Indian-Malayan region (Quero-García *et al*., 2010). As a crop, taro requires warm and humid climate, with temperatures oscillating between 25 and 30 °C (Vázquez, 2013). Also, it demands continuous or intensive rain or irrigation between 1800 a 2500 mm per year (Berlin & Berna, 2009). According to FOASTAT (2017), the five main countries of taro production are Nigeria, China, Cameroon, Ghana and Papua New Guinea. Mexico produces and trades taro at a national and international level, in particular with the United States of America and Canada. In 2016, the part of Mexican taro in the Canadian market was of 1112 t, and occupied the second place with 44.6% of the total imported amount. As for the US market, the part was lesser, in the sixth position, accounting for 3.3% of world exports. Its international sale corresponds to the demand by African-Caribbean and Asian communities in these countries (FAOSTATA, 2017). The objective of this study was to review the concepts of agri-food chain in order to know the dimensions of their evolution and trends applied to the taro agri-food chain.

Conceptualization of Agri-Food Chain

Several authors conceptualize the agri-food chain (CA) by referring to the term value chain (CV). Nevertheless, their meanings and scopes vary depending on the authors. For Guido & Mamani (2000), value chain (CV) is the existing relation between the purchase and sale of agricultural products between different actors or agents, which may include producers, distributors, consumers, industry, and input suppliers. Kaplinsky & Morris (2000) defined CV as a wide set of activities required to bring a product since its conception through the different phases of production, dispatch to end consumers and disposal of equipment and containers after the consumption in each phase. Iglesias (2002) defines CV as the vertical alliance or strategic network between an independent number of business organizations within the supply chain. In the first decade of 2000, CA was an articulation of different actors taking part in flows or movements of goods and services from the supply of inputs, production to the consumption; it takes into consideration the transformation and distribution of the product and provides a series of support services in each process step (Reinoso *et al*., 2007). By the end of that first decade of the 21st century, the agri-food chain was conceived from the socioeconomic reality viewpoint as a system that groups interrelated economic and social actors that have an articulated part in activities that add value to a good or service from their production to their arrival to consumers, including input and transformation, industrialization, transportation, logistics and other supporting services, such as financing (García *et al*., 2009). For Kaplinsky & Morris (2009), CV describes the total variety of activities required for conducting a good or service from its conception to the delivery to the consumer, disposition and final disposal through several intermediate production phases that need to be linked (and involve combinations of physical transformation and inputs of different producer services). Table 1 shows complementary definitions of agri-food chain and their historical evolution.

Includes interactions between agents to produce a good or service, from the raw material, industrial processes by production stages, processing, intermediation and marketing to satisfy a need.

Chain evolution analysis

In the 21st century, the agri-food chain has had several modifications due to new trends in the globalized world that induces companies to adopt changes in organization and integration forms in different environments. At the beginning of this century, chain processes were viewed vertically, and companies began to feel concern about having the correct placement in the global market. One of the main reasons for the implementation of the value chain in companies was the optimization of costs, reason why activities deemed to be essential were set up: production, distribution and marketing. Nevertheless, the objectives posed by companies were not attained, as the consumer became more demanding and with frequency, paying attention to health, environment and safety matters (Hernández & Villaseñor, 2014). In 2004, the focus of agri-food chains experienced a turn in agri-food chains in a wider sense; it considered all stages (production, industrialization, distribution and consumption): This refers both to products consumed fresh and those that include an industrial transformation process (Ballesteros & Ballesteros, 2004). It considered both the transformation and distribution of the product and the socioeconomic situation. In other words, the chain was

Table 1. Evolution of the Agri-Food Chain Concept in the 21st Century.

Reference	Concept / Definition
Kaplinsky and Morris (2000)	Wide variety of activities for transferring a product or service from its conception, through different production phases, to end consumers and final disposal after use.
Guido & Madani (2000)	Relation between the purchase and sale of (agricultural) goods between different actors or agents, which may include producers, distributors, consumers, industry and input suppliers.
Iglesias (2002)	Vertical alliance or strategic network between an independent number of business organizations within the supply chain.
Ballesteros & Ballesteros (2004)	All production, distribution and consumption stages that refer both to products consumed fresh and those that undergo an industrial transformation.
Reinoso *et al.*, (2007)	Articulation of different actors taking part in flows or movements of goods and services from the supply of inputs, going through the production, transformation and distribution of the product and provides a series of support services in each process step.
Kaplinsky and Morris (2009)	Variety of activities required to conduct a product or service from its conception to the delivery to the consumer, disposition and final disposal through several intermediate production phases.
García *et al.*, (2009)	System that groups interrelated economic and social actors that have an articulated participation in activities that add value to a good or service, from its production to its arrival to the consumer.
Bacigalupo, (2014)	Set of components (links) interrelated between themselves, with specific objectives and a context that conditions it.

Source: Self-modification.

already conceived as a system that grouped economic and social actors which integrates the logistic chain to attain a long-term yield. In this sense, actors that integrate the logistic chain are producers, agroindustry, and trade (Causado & Reatiga, 2013).

Logistics is a competitive force that has moved from the production to the distribution zone. Agricultural product sales include both the digital and physical parts of transactions, among which the relation with logistics in order to perform shipments and the distribution of products stands out. This is why those in charge of logistics should be prepared to lay down chains that respond to existing situations, but that may also change and adapt (Britta & Paul, 2001). Figure 1 shows the evolution of the agri-food chain in the 21st century.

In Phase 1, vertical chain, production and distribution were made for the regional and national marketing only In Phase 2, global market, the international marketing of products such as raw materials began. In Phase 3, industrial chain, the transformation of raw material into processed products was introduced. In Phase 4, the system, interrelated economic and social actors that participate in the addition of value were grouped together. In Phase 5, logistics, the product's time and life regulates the distribution thereof.

The concept of agri-food chain has had major changes within a short timeframe; it seeks to cover needs of consumers and shows a new focus. Thus "agri-food supply chains" (CSA) integrated by organization networks that work together to attain quality and opportunity come into existence. Nevertheless, the CSA concept has not been consolidated in practice to the point of reaching sustainable supply chains (FAO, 2015). In the food industry, supply chains are complex systems undergoing a constant change that involve several participants, both internal and external (Figure 2).

Agri-food chain planning requires designing management models that attain the wide identification of territory dynamics; it considers aspects such as production unit size, primary production conditions, technology, market demand, financial capacity and management practices that allow handling a wider group of variables (Vianchá, 2014).

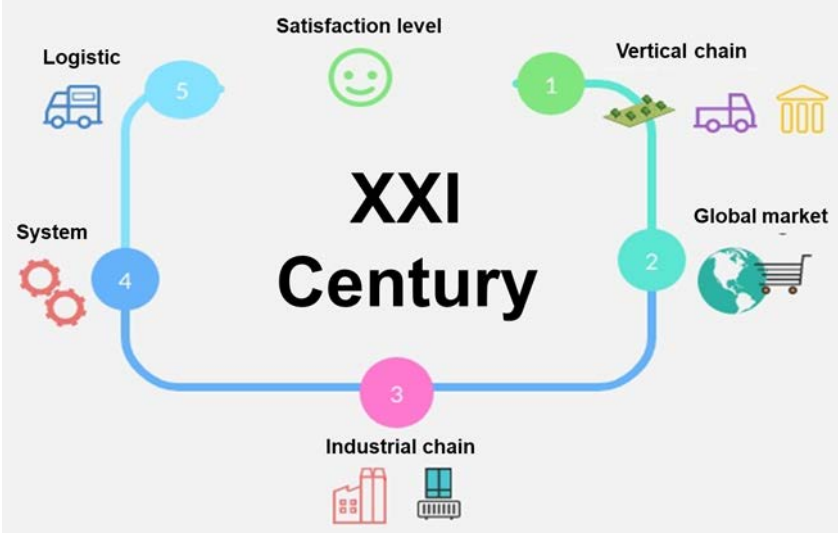

Figure 1. Agri-Food Chain Evolution Mind Map. Source: Self-modification.

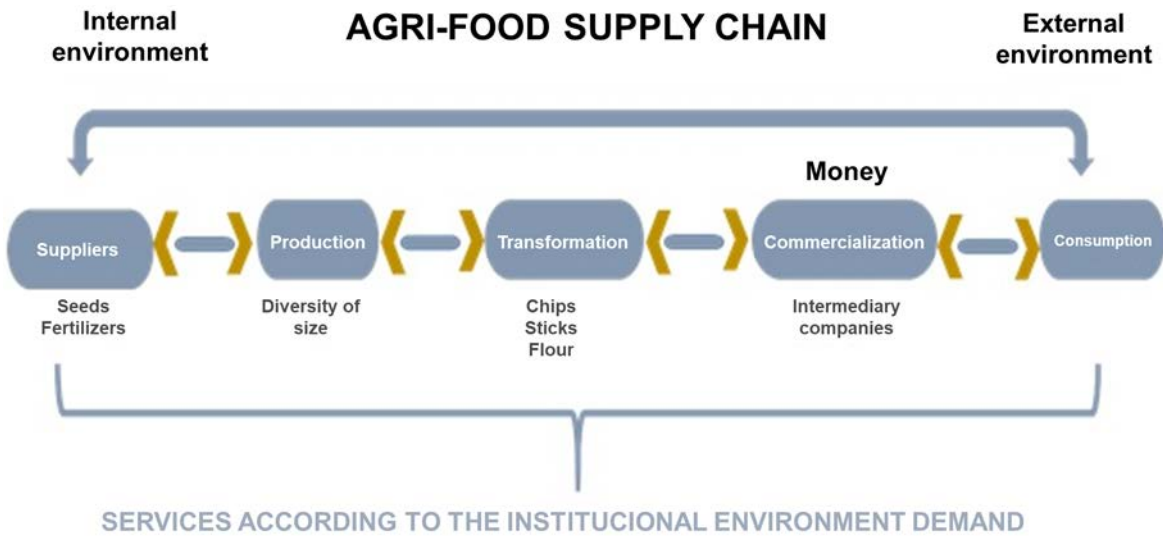

Figure 2. General scheme for an Agri-food Supply Chain. Source: Self-modification.

Agri-food chain of taro

Taro (*Colocasia esculenta* L. Schott, Araceae) is a perennial plant, if not harvested, that is native from Southeast Asia. It is a herbaceous, succulent plant, with no light stem. Leaves come directly from a primary underground corm which is more or less vertical. From here, secondary lateral and horizontal edible corms are formed (Moltaldo, 1991).

Mexico is a major taro exporter. However, there is no record of supply chains for this product (Vianchá, 2014). Currently, there are inconveniences in production, distribution and storage processes in the taro supply chain. Until 2016, there were no records of integration of any supply chain.

The main taro production areas in Mexico have no evidence whatsoever of any supply chain mapping, which causes deficiencies in production, preservation, transformation, marketing and consumption activities, requirements on raw material, labor and inputs, distribution paths, product marketing and customer satisfaction (Parra *et al*., 2017). Berlin & Berna (2009) performed a taro value chain analysis in Rio Grande, Matagalpa, Nicaragua, in order to identify the main problems of the taro value chain. They identified four main problems. 1) deficient taro handling; 2) deficient post-harvest handling; 3) weak organization of producers in the cooperative business 4) scarce marketing channels. Parra *et al*., (2017) performed a taro supply chain analysis in the main producer states of Mexico (Oaxaca, Veracruz and Tabasco); they reported a diagram of agents that intervene in a taro value chain (Figure 3). Currently, there are inconveniences in production, distribution and storage

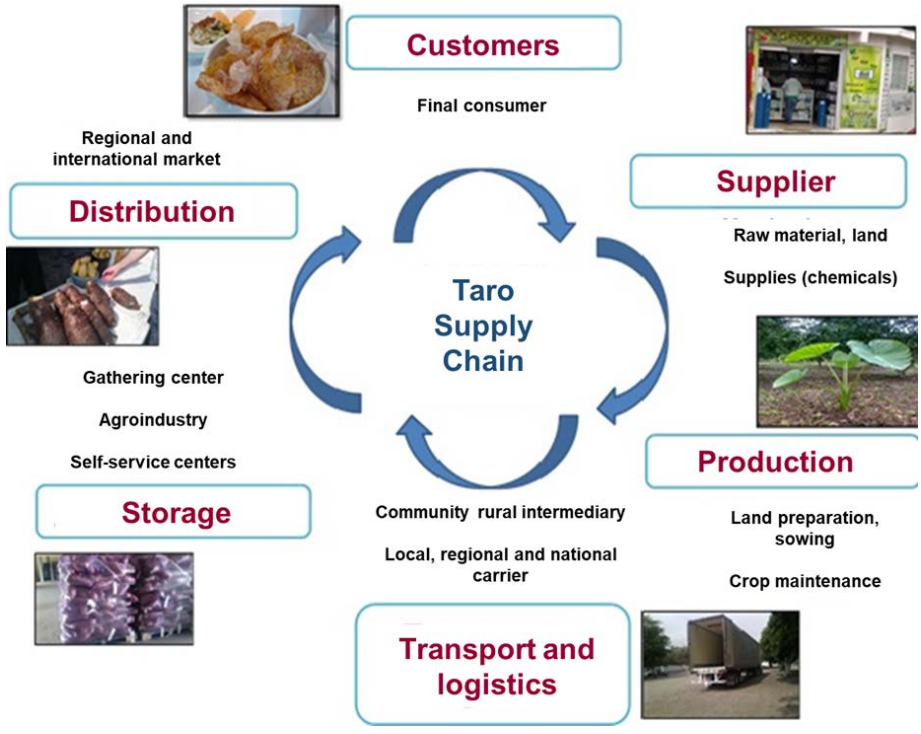

Figure 3. Agents that intervene in the Taro Supply Chain in Veracruz. Source: Self preparation.

processes in the taro supply chain (CS) in Mexico. Agents intervening in the taro CS are not integrated; *i.e.* they work individually, with little efficiency and do not attain the desired capacity (Parra, 2019).

More than 80% of taro production in Mexico is destined to export. Therefore, a logistic control that allows meeting the customer's needs with respect to product volume, quality and characteristics is necessary. Ballou (2004) mentioned the importance in the logistics of the supply chain; this set of functional activities (inventory control transportation, among others) are replicated along the flow channel; with this, the raw material becomes finished products and value is added for the consumer.

The taro agri-food chain is integrated by five links: 1) suppliers, 2) producers, 3) distribution, 4) transformation and 5) marketing. It shows competitive advantages upon being integrated. It streamlines production processes, reduces raw material and product loss, generates aggregate value to attain economic and social development. In recent years, the consolidation of the agri-food chain has been sensitized by three significant foci: climate change, nutrition and sustainability (Figure 4). Value chains strengthen the growth of small and medium companies like in the case of taro. Big companies gain two benefits: 1) a greater organization level that allows obtaining inputs at lower prices 2) a greater aggregate value generated in each productive stage the product goes through is gained. An agri-food chain, seen as a study and political formulation unit, is transcendental to understand and appraise agriculture's contribution to the country's economy. Also, wherever there is good performance and adequate articulation among different agri-food chain links, the competitiveness of the agricultural sector and the country's economy increase.

CONCLUSIONS

The agri-food chain concept has had a continuous evolution. The addition of products and services has increased in order to meet the customers' needs and demands. This grants a competitive advantage to companies and agents that integrate the value chain. Agri-food chains have become a relevant subject for companies, organizations and food-processing institutions. Also, they are an instrument that fosters rural development and contributes to the revitalization of competitive and sustainable economic activities that allow increasing their wellbeing level. Finally, the agri-food chain seeks to meet the consumer's needs, generate competitive advantage in companies and agents integrating the value chain.

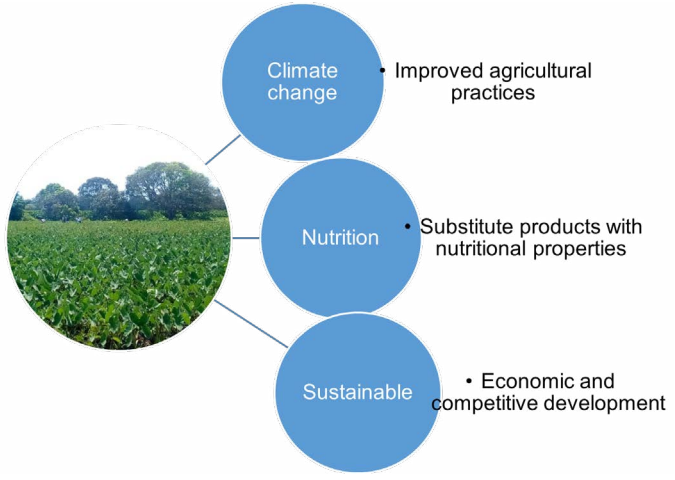

Figure 4. Current Taro Agri-Food Chain Foci in Veracruz, Mexico. Source: Self-modification.

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