Colegio de Postgraduados

Strategic planning with a production chain approach to identify training needs in the agrifood sector

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ABSTRACT

Objective: to generate a strategic plan, with a production chain approach, that allows identifying the training needs in the agrifood sector in Quintana Roo.

Design/Methodology/Approach: the study was developed in three methodological stages 1) A workshop to explore the training needs through participatory action, in order to obtain a relational framework of those institutions in the sector in which the trainees interact, aiming to identify and prioritize the training needs in a double-entry matrix; 2) Design of the training program, using as input the needs identified in the exploratory workshop; 3) Implementation of the training, with an ex ante and ex post evaluation of each topic to verify that the training was effective.

Results: the main problems detected were marketing (28.8%), production (25.9%), supply of inputs and services (25.3%), transformation (12.2%), and consumption (7.1%). Likewise, a relational framework of 25 institutions that provide support to the different links identified in the production chain. The median of achievement (correct scores) before training was 8.92, and 10.81 afterwards.

Limitations/Implications of the study: the capacity of the course was limited by the available resources, both facilities and financial. However, it is important to implement a mixed modality to reach a greater number of people.

Findings/Conclusions: strategic planning with a production chain approach is a useful tool to focus ad hoc training needs, since 70.9% of professionals improved their skills on crops of interest.

Keywords: production chains, training, tropical fruits trees.

Citation: Uzcanga-Pérez, N. G., Maya-Martínez, A., Sánchez-Toledano, B. I., & Cano-González, A. de J. (2025). Strategic planning with a production chain approach to identify training needs in the agrifood sector. *Agro Productividad*. https://doi.org/10.32854/agrop.v18i1.3006

Academic Editor: Jorge Cadena Iñiguez
Associate Editor: Dra. Lucero del Mar Ruiz Posadas
Guest Editor: Daniel Alejandro Cadena Zamudio

Received: September 20, 2024.
Accepted: January 05, 2025.
Published on-line: February XX, 2025.

Agro Productividad, 18(1). January. 2025. pp: 155-162.

INTRODUCTION

The agricultural sector in Mexico faces some challenges to overcome, including low levels of productivity, limited access to consumer markets, an unfavorable background of plant and animal sanitary conditions, high risk of the activity, as well as insufficient financing. To face these problems, we propose to guarantee the insertion of scientific and technological research production as innovation processes to those prioritized production chains. To this end in the state of Quintana Roo, strategic planning with a production chain approach was implemented to identify training needs aimed at both traditional and alternative crops. For those traditional crops, coconut (*Cocos nucifera* L.) and citrus trees; as well as other crops with potential for industry and health benefits, that represent an

alternative for adverse agro-ecological zones, such as dragon fruit (*Hylocereus* spp.) and soursop (*Annona muricata* L.) (Esquivel y Araya, 2012; García y Quiroz, 2010).

In 2022, 41 984 hectares (ha) were established in the state of Quintana Roo with these crops, of which 2141 ha were coconut, 1813 ha of dragon fruit and 4657 hectares with citrus trees, 68.9% lemon, 30.2% orange, and 0.9% tangerine (SIAP, 2022). Although there are no official statistics on the cultivation of soursop, it is of interest both to public policy agencies and to local producers, because it has alleged health benefits and positive effects on glycosidic metabolism, and against cancer (Sosa *et al.*, 2022).

The assumption is that development of knowledge and skills, among those trainees contributing to the generation of value, in the chains of interest and the guiding axis of participatory action, both conform a useful methodology to understand the processes of formal and community teach & learning processes in order to improve social existing practices. Capacity development focuses on the solution of community problems with context analysis, processes evaluation, and categorization of priorities (Almaguer-Kalixto *et al.*, 2024). Thus, the aim of this study was to generate a strategic plan with a production chain approach that allows identifying the training needs in the agrifood sector in Quintana Roo (Mexico).

MATERIALS AND METHODS

To generate the strategic plan and to identify training needs, a descriptive, cross-sectional, and participatory study was implemented with a production chain approach. Which made it possible to identify the sequence of dependent and related activities, that is, the necessary 'links' to successfully bring a product to its destination, through the development of a training program that will allow this purpose to be achieved. To this end, it was considered that each link is the set of groups of actors in the production chain, which work in related economic activities (Padilla y Oddone, 2016).

Three methodological stages were defined: 1) a workshop to gather training needs; 2) development of an ad hoc training program to the identified needs; 3) implementation of the training program.

To collect the information, 1) two participatory workshops were held (October 24 and 25, 2023), with the attendance of 38 professionals specialized in the agricultural sector. The information collected was, on the one hand, to form a relational framework of the institutions that promote activities in the sector; and on the other hand, the demands or training needs for each of the links: suppliers of inputs, production, storage, transformation and marketing of each of the crops of interest: coconut, citrus trees, dragon fruit and soursop. This set of problems or training needs was prioritized, by link and by crop, through the use of a double-entry matrix; for this purpose, a tool designed in Excel® was used to facilitate the compilation and analysis of data.

2) Development of the training program. The identified and prioritized needs were used as input to design a training program, in which the needs were considered by link for each crop chain, trying to influence as far as possible, the sustainable development goal (SDG 4.7) on acquiring theoretical and practical knowledge to promote sustainable development (Naciones Unidas, 2018).

3) Implementation of the training program. The professionals in the sector who participated in the workshop on exploring needs, in addition to other actors in the agrifood sector were trained by implementing the program developed. An *ex ante* & *ex post* evaluation of each topic taught was implemented to verify that the training was effective. That is, if the achievement among the course attendees improved with the training. To this end, a structured questionnaire of closed questions was designed for each topic, a total of 45 issues that were applied before and after the training. For the statistical analysis of this dataset, Wilcoxon's non-parametric test was used to test the hypothesis of equality between two population medians for related samples (an error $p \leq 0.05$ was set) in SPSS© version 23.

RESULTS AND DISCUSSION

Workshop to gather research needs

There was active participation and dialogue among the attendees from eight Mexican agencies: Ministry of Agriculture– AGRICULTURA (37%), Secretariat of Agricultural, Rural and Fisheries Development in Quintana Roo– SEDARPE (29%), Plant Health Committee (11%), Secretariat of Economic Development– ECONOMÍA (5%), Agrifood and Fisheries Information Service– SIAP (5%), National Service of Health, Safety and Agrifood Quality– SENASICA (5%), the municipality (5%) and the city council (3%). In total, a relational framework of 25 institutions in which actors interact was identified, then classified according to their purposes in seven areas, which could also promote cooperation and collaboration between entities to empower rural inhabitants by contributing to SDG 17 (Naciones Unidas, 2018). (Table 1; Figure 1).

The essence of strategic planning is the identification of opportunities and threats that, together with other relevant data, provides the basis for decision-making (Palacios, 2020). In this study, it was identified that most of the problems were categorized as follows: marketing (28.8%), production (25.9%), supply of inputs and services (25.3%), transformation (12.2%), and consumption (7.1%) (Table 2 to Table 5). Marketing is one of the critical nodes in

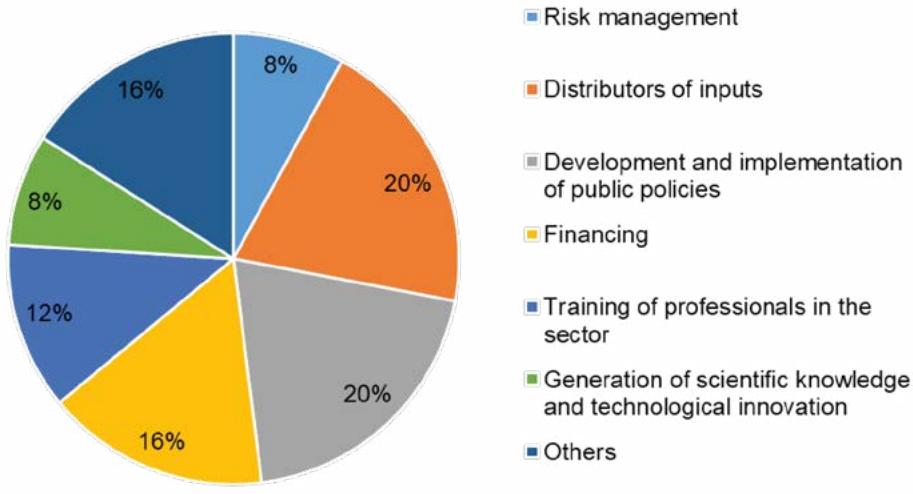

Figure 1. Classification of institutions according to their purposes.

Table 1. Relational framework of the identified institutions supporting the production chains of interest.

Classification	Institutions	Acronyms
Risk management	Federal Commission for the Protection against Sanitary Risks	COFEPRIS
	National Insurance Institution	AGROASEMEX
Distributors of inputs	Agricultural Solutions	AGRISOL
	Agrochemicals "El Inge"	
	Agro veterinary "Huimanguillo"	
	"La Anita" from Chetumal	
	Agrochemicals from the Field	
Development and implementation of public policies	Ministry of Economy, National Institute of Social Economy	INAES
	Ministry of Rural Agricultural Development and Fisheries of the State	SEDARPE
Financing	Ministry of Agriculture and Rural Development (SADER) and Ministry of Welfare	SEBIEN
	Trusts Established in Relation to Agriculture	FIRA
	Risk Sharing Trust	FIRCO
	Mexican Popular Fund and SMG Fund S.C. DE A.P. DE R.L. DE C.V.	
Training of professionals in the sector	Technological Institute of the Mayan Zone	ITZM
	Felipe Carrillo Puerto Higher Technological Institute	TNMFCP
	Mayan Intercultural University of Quintana Roo	UIMQROO
Generation of scientific knowledge and technological innovation	National Institute of Forestry, Agricultural and Livestock Research	INIFAP
	Quintanarroense Council of Science and Technology	COQCYT
Others	Ministry of Economic Development	SEDE
	Federal Consumer Protection Agency	PROFECO
	Mexican Institute of Industrial Property	IMPI
	State Committee for Plant Health of Quintana Roo	CESAVEQROO

agriculture, therefore, the adoption of marketing strategies, the creation of new products, and the search for selling points are answers in a continuous improvement program of agricultural development (Mendoza *et al.*, 2019).

Development of the training program

Jiménez *et al.* (2020) stated that a strategy is the result of the sum of values, understanding of the importance of the parties involved, analysis of internal resources and competencies, the opportunities of the sector and the related industry. As well as a tool to achieve quality standards and improve performance, that also facilitates the implementation of tactical and

Table 2. Problems found on the Dragon fruit production chain.

Link	Problematic
Supplier of inputs and services	Lack of certified supplier of vegetative material (cuttings of white and red species), lack of technical assistance for the efficient application of inputs and crop management, lack of accessible financing, lack of services for soil analysis, no equipment and infrastructure to provide benefit.
Production	Lack of organization of producers to make consolidated purchases of inputs. Lack of availability of suppliers close to the production locations. Lack of knowledge of the nutritional needs, management and phytosanitary calendar of the crop. Lack of specialized technical assistance, low production volume and quality. Low production densities. Lack of product safety. Lack of updating of the technological package. Lack of training in pruning and fertilization.
Transformation	Lack of knowledge of the different options for transforming the product. Underutilization of the infrastructure for transformation. Lack of technical assistance in the production of by-products and derivatives (jams, liqueurs, dehydrated products). Lack of increasing the gastronomic offer of pitahaya.
Marketing	Lack of knowledge of market niches for processed products (with benefit). Lack of knowledge of official regulations for the processing, presentation, packaging and marketing of products. Lack of knowledge of the market, poor organization for marketing. Lack of knowledge of official guidelines for selecting the characteristics of the export product. Lack of a marketing strategy, advertising campaigns. Lack of designation of origin, low sales prices. Lack of formalization of purchase/sale trade. Underutilization of storage infrastructure. Lack of distribution channels and lack of public policies that encourage the marketing of products and derivatives.
Consumption	Lack of knowledge of consumer tastes and preferences, beneficial properties of the product, little availability of information on the benefits of consuming pitahaya and derivatives, insufficient information on the benefit of its consumption, few points of sale at fairs.

Table 3. Problems found on the Soursop production chain.

Link	Problematic
Supplier of inputs and services	Lack of certified silver and organic inputs, lack of a specialized soil and water laboratory, scarce financing services, lack of technical development of the irrigation system, lack of public policy oriented to cultivation, lack of equipment and inputs for its processing.
Production	Lack of specialized technical advice throughout the production process (pests and diseases, post-harvest, safety), lack of a local technological package.
Transformation	Lack of specialized equipment and inputs for processing, lack of traceability of the origin of the product.
Marketing	Lack of marketing channels, lack of training for distribution on the cold chain, lack of presentation in the market, lack of safety management and lack of promotion of products and derivatives.
Consumption	High product prices, lack of knowledge of the offer, limited commercial diversification, lack of consumer culture.

operational strategies to achieve goals (López & De la Garza, 2020). Likewise, considering that higher education is one of the main indicators to measure the level of development, by promoting efficiency and economic competitiveness (Urcid-Puga & Rojas, 2020), a training program was designed that addressed the following topics: strategy for production

Table 4. Problems found on the Coconut production chain.

Link	Problematic
Supplier of inputs and services	Lack of organization of producers for consolidated purchases, lack of certified walnut suppliers, lack of phytosanitary services.
Production	Lack of training on the technological package, lack of knowledge of the nutritional needs of the crop, lack of soil analysis to determine fertilization doses, lack of technical assistance and support for the comprehensive management of the crop, lack of knowledge of phytosanitary management, lack of own capital for investment, lack of accessible financing.
Transformation	Low availability of equipment and infrastructure to add value to production, lack of training for product transformation, lack of knowledge of official regulations for processing, presentation, packaging and marketing of products with benefit.
Marketing	Lack of knowledge of market niches for processed products (with benefit). Lack of knowledge of the market, lack of organization of producers for marketing. Lack of collection centers in the main production areas. Low production volume for agroindustry. Lack of a packing plant. Lack of marketing strategies for positioning products and identifying marketing channels. Lack of regulation for certification of authenticity of production by origin, culture, history and social impact, lack of a business plan for community companies. Lack of sales training.
Consumption	Lack of knowledge of consumer tastes and preferences.

Table 5. Problems found on the Citrus trees (lemon, orange, and tangerine) production chain.

Link	Problematic
Supplier of inputs and services	Lack of availability of certified seedlings and nurseries. Lack of certified mother gardens with buds and stalks, lack of soil, water, plant and phytosanitary laboratory services. Lack of financing services, shortage of phytosanitary specialists for national and international mobility certification as well as specialists for obtaining derived products. Insufficient supply of specialized inputs, technical services and irrigation systems, high cost of freight for inputs.
Production	Lack of updating of the technological package. Lack of knowledge of the appropriate doses of fertilization, low crop density because of diseases, efficient phytosanitary management (pruning and management calendar). Shortage of irrigation infrastructure. Lack of training in the integral management of the crop. Low availability of labor. Lack of organization of producers. Lack of knowledge of the processes for production certification. Lack of knowledge of the procedure for well authorization. Lack of knowledge of the advantages of high-density production. Lack of regulation of certified plants.
Transformation	Lack of agro-industry. Shortage of machinery to process and transform production. Lack of benefit to production (juices, liquors, oils, extracts, preserves, cosmetics, etc.). Absence of micro-enterprises to obtain products and derivatives. Lack of training for the transformation of raw materials. Lack of knowledge of good practices for obtaining products. Lack of knowledge of regulations on processes for agro-industry and lack of financing for benefit of production.
Marketing	Lack of collection centers in the main producing areas. Lack of packing plants for the national and international markets. Lack of a distinctive seal or registered trademark that reflects the identity of the product. Lack of knowledge about the traceability of production. Lack of knowledge of the market for products and derivatives. Lack of marketing strategies for positioning, promotion, entry into niches and new markets. Lack of post-harvest transportation. Lack of public policies that encourage the consumption of local products. Lack of selection, waxing and packaging of the product. Lack of guaranteed prices. Lack of organization of producers for marketing. Lack of logistics for product transportation.
Consumption	High variability in purchase price, low product quality for local consumption, poor promotion of acceptance of derived products.

planning towards agricultural sustainability, value-added strategies and transformation of production.

Implementation of the training program

The training course was held from February 26 to 28, 2024, with the participation of 134 professionals from the sector. The median achievement before the course was 8.92 correct scores, and 10.81 afterwards. Of the trainees, 70.90% increased their achievement score after the training, 12.69% of the cases remained at the same score, and 16.42% decreased their score. The statistic value was significant ($Z=-7.246$; with a p-value=0.0005); therefore, it was concluded that there was a significant difference in the median achievement after training.

In the agriculture sector, training is necessary to acquire updated knowledge and to replace obsolete or harmful techniques for the environment; to supply food to the population in quantity and quality; to venture into new markets and to preserve natural resources for future generations (Valencia-Benítez *et al*., 2023).

CONCLUSIONS

Strategic planning with a production chain approach resulted in a useful tool to increase the knowledge of 70.90% of the participants, thus contributing to the strengthening of capacities on crops of interest for the agricultural and economic development of the state of Quintana Roo (Mexico).

ACKNOWLEDGEMENTS

To the Secretariat of Agriculture and Rural Development in the state, for the funds to the Project "Multiplication of bean seed, soybeans, tropical fruit trees and sugar cane in Quintana Roo".

REFERENCES

Almaguer-Kalixto, P.; Hernández, A.; Escriche, P. (2024). Investigación de acción participativa y laboratorios de innovación social en el ámbito rural: retos y oportunidades. *Revista Prisma Social. 44* (s/n). 195-218.

Esquivel, P.; Araya, Y. (2012). Características del fruto de la pitahaya (*Hylocereus* sp.) y su potencial de uso en la industria alimentaria. *Revista Venezolana de Ciencia y Tecnología de Alimentos. 3*(1). 113-129. http://www.rvcta.org.

García, M.; Quirós, O. (2010). Análisis del comportamiento de mercado de la pitahaya (*Hylocereus undatus*) en Costa Rica. *Tecnología en Marcha. 23*(2). 14-24. https://dialnet.unirioja.es/servlet/articulo?codigo=4835523.

Jiménez, C.; Vasco, C.; Lara, P.; Cárdenas, F. (2020). Planeación estratégica en la responsabilidad social. *RECIMUNDO. 4*(2). 116-126. https://doi.org/10.26820/recimundo/4.(2).mayo.2020.116-126

López, J.; De la Garza, M. (2020). La creación de valor a través de la planeación estratégica en microempresas emprendedoras. *Contaduría y Administración. 65*(3).1-23. https://doi.org/10.22201/fca.24488410e.2020.2312

Mendoza, H., Loor, Á., Vilema, F. (2019). El arroz y su importancia en los emprendimientos rurales de la agroindustria como mecanismo de desarrollo local de samborondón. *Revista universidad y sociedad, 11*(1), 324-330. http://rus.ucf.edu.cu/index.php/rus.

Naciones Unidas. (2018). La Agenda 2030 y los Objetivos del Desarrollo Sostenible Una Oportunidad para América Latina y el Caribe. (LC/G.2681-P/Rev.3). www.un.org/sustainabledevelopment/es

Padilla, R.; Oddone, N. (2016). Manual para el fortalecimiento de cadenas de valor. 1ª ed.; CEPAL-FIDA: México, D.F., 2016; págs. 144. https://hdl.handle.net/11362/40662.

Palacios, M. (2020). Planeación estratégica, instrumento funcional al interior de las organizaciones. *Revista Nacional de Administración. 11*(2). 57-68. https://doi.org/10.22458/rna.v11i2.2756

SIAP (Servicio de Información Agroalimentaria y Pesquera). (2022). Estadísticas de producción agrícola. Gobierno de México. http://infosiap.siap.gob.mx/gobmx/datosAbiertos.php

Sosa, I.; Pareja, J.; Mugarte, A.; Chel, L.; Betancur, D. (2022). Propiedades, beneficios y efectos de la guanábana (*Annona muricata* L.) sobre la glucemia y el cáncer. *Revista Colombiana de Investigaciones Agroindustriales. 9*(2). 86-101. https://doi.org/10.23850/24220582.4976

Urcid-Puga, R.; Rojas, J. (2020). Modelo sinérgico entre planeación estratégica, valor compartido y flexibilidad curricular. *Revista Electrónica Educare. 24*(3).1409-4258. https://doi.org/10.15359/ree.24-3.19

Valencia-Benítez, J., Carmenates-Barrios, O. (2023). Validación de un instrumento para su implementación en el proceso de capacitación comunitaria. *Revista Metropolitana de Ciencias Aplicadas, 6*(3). 161-170. https://doi.org/10.62452/6astat31