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Productive dynamics and sugarcane supply management in a competitive environment: a study of three sugar mills in Jalisco

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ABSTRACT

Objective. To identify the profile of producers and analyze sugarcane supply strategies in a zone shared by three sugar mills in Jalisco, to propose lines of intervention that strengthen the sustainability of supply in a competitive environment.

Design/Methodology/Approach. Surveys, interviews, and statistical records were analyzed to develop a typology of growers based on the dynamics of cultivated land and to characterize the acquisition and retention strategies of sugar mills. The Delphi and MICMAC methods were used to explore different scenarios and support the analysis. Differentiated strategic actions derived from the analysis are proposed.

Results. Four producer profiles were identified: social, stable, diversifying, and specialized. Sugar mills implement differentiated strategies; one is focused on general supplier retention, another prioritizes large-scale growers, and a third operates based on close service to the suppliers as a value proposition. Prospective scenarios agree that sustainable production intensification is the main strategic approach in the face of reduced sugarcane cultivation area, and competition from alternative crops. Within this framework, diversifying and specialized sugarcane growers show greater potential to enhance sectoral productivity due to their openness to innovation and positive response to incentives.

Limitations/implications of the study. The study was based on a convenience sample of 42 producers, which limits the possibility of extrapolating the results to the entire production base. Likewise, the low participation of industry representatives and restrictions on the disclosure of information limit the possibility of comparing supply strategies in depth. However, the findings offer valuable information for other regions facing similar sugarcane supply challenges.

Findings/Conclusions. Current strategies lack effective targeting, preventing them from focusing on the actual capabilities of the production base. A shift towards differentiated supplier targeting and retention models is proposed, based on intensification, the building of organizational and technical capacities, and on establishing lasting links with agribusinesses.

Keywords: typology of producers, supplier retention, production restructuring, sugarcane supply.

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INTRODUCTION

Sugarcane is one of the most important crops in Mexico, both for social impact and economic value. The sugar agro-industry generates 500 000 direct jobs and 2.4 million indirect jobs, involving producers, farm laborers, cane cutters, transporters, and mill workers in more than 269 municipalities across the country (Gómez-Merino *et al.*, 2021). Jalisco is the second-largest Mexican sugarcane-producing state and faces a changing agricultural landscape due to the shift towards more profitable crops such as berries, avocados, agave, and vegetables according to the Mexican Committee for the sustainable management of sugarcane (Comité Nacional para el Desarrollo Sustentable de la Caña de Azúcar-CONADESUCA, 2024) y el Gobierno del estado de Jalisco (2023).

In the sugarcane harvests between 2014-2024 it was noticed that the area dedicated to agave grew by 107%, while the area of sugarcane decreased by 3.53% according to CONADESUCA (2024) and Mexico's Agri-Food and Fisheries Information Service (Servicio de Información Agroalimentaria y Pesquera-SIAP, 2024). This shift has caused increasing pressure on the supply system for sugar mills, especially in regions where multiple agribusinesses compete for a shared production base. Changes in production dynamics have impacted traditional governance processes. Agricultural producers value now not only prices, but also efficiency in logistics and institutional proximity (Susilowati *et al.*, 2020; Ghezzi *et al.*, 2022).

Strategic decision-making in the region is limited by the lack of effective targeting of the base of sugarcane growers, the lag in technological adoption, the aging of growers, the lack of sugarcane varieties renewal, and a sugarcane registry that does not distinguish active producers. Furthermore, the fragmentation of land ownership and the pursuit of social benefits limit the accurate identification of the sugarcane supply system (FAO & BID, 2007; CONADESUCA, 2024). This prevents supplier recruitment and retention strategies to be adapted to the capabilities, motivations, or levels of technological use of the different profiles of producers.

Within this context, the objective of this study was to identify the profile of producers and analyze sugarcane supply strategies in a zone shared by three sugar mills in Jalisco, to propose lines of intervention that strengthen the sustainability of supply in a competitive environment.

MATERIALS AND METHODS

This research was conducted in Valles y Lagunas de Jalisco, a zone shared by the sugar mills of Tala, Ameca, and Bellavista. A mixed-methods approach both exploratory and explanatory was used. To characterize the profile of producers, a semi-structured survey was administered to 42 sugarcane growers selected through non-probability convenience sampling, taking advantage of the meeting and payment points common to producers in municipalities such as Ameca, Tala, Magdalena, Etzatlan, and Ahualulco de Mercado, Jalisco (México).

The instrument was structured in four sections: producer identification, size and management of the production unit, family structure, and access to technical assistance and financing. Both open-ended and closed-ended questions were designed, allowing for

the collection of qualitative and quantitative data that included variables such as current and previous sugarcane cultivation area, water regime, technical assistance, level of technology, age, motivations, and links with sugar mills. For the construction of profiles, the current cultivation area and the area dedicated to cultivation 10 years ago were selected as key variables. Then, data were analyzed using scatter plots in order to classifying four groups: social growers, stable growers, diversifying growers, and specialized growers. Each group was defined with a threshold of up to 3 hectares for both variables to ensure statistical consistency. Data were stored and categorized in Excel® and were processed using descriptive statistics. This segmentation was compared with the Producers Registry of CONADESUCA (2024) to identify discrepancies with the official data on production and administrative structure.

In a second stage, interviews were conducted with technical and management staff from sugar mills, as well as with representatives of sugarcane grower organizations, addressing aspects such as the perception of problems, recruitment efforts, incentives, technical monitoring, technology use, and links with growers. As a complement to the main analysis, a prospective analysis based on the Delphi method was implemented by consulting a panel of eight experts selected by convenience sampling, based on their knowledge and experience in decision-making within the sugarcane production system (Cabrera Palafox, 2022). The agreed-upon statements were analyzed using the Cross-Impact Matrix and Multiplication Applied to a Classification (MICMAC) methodology, which allowed for the visualization of influence and dependence relationships among variables (Godet, 2000; Arango & Cuevas, 2012).

With the results, three prospective scenarios were constructed: sustainable consolidation, competition and adaptation, and sugarcane recovery in the face of the crisis with agave increasing production. Finally, the production profiles were cross-referenced with some of the strategic factors found in the scenarios, to propose segmented and differentiated lines of intervention, based on the experiences observed both in the field and in specialized literature, in order to prioritize criteria of technical feasibility and operational capacity.

RESULTS AND DISCUSSION

Our main results are described based on the prospective scenarios created, and discussion is structured around the elements identified as strategic for strengthening the sustainability of the sugarcane supply system, in a competitive environment challenged by production restructuring in the production systems.

Typology of producers

The pressure exerted by seemingly more profitable alternative crops has led to heterogeneous behavior among sugarcane growers. To understand this, a typology was constructed based on the variation in sugarcane cultivation area between 2014 and 2024 (Figure 1).

This segmentation allowed the identification of differentiated profiles of producers in terms of their motivations and the scale on which those influence their relationships with agribusinesses, and their participation in the regional sugarcane production system. Four

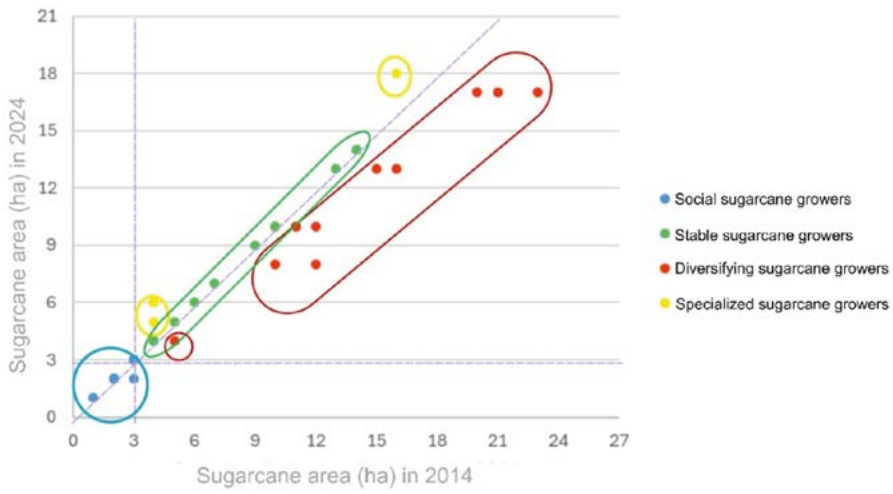

Figure 1. Producer profiles according to the behavior of the recent area dedicated to sugarcane cultivation (2024) compared to what was recorded as sugarcane cultivation in 2014.

profiles were distinguished. Social sugarcane growers: farmers with less than 3-hectares cultivation areas who have maintained these areas constant, prioritizing the social benefits associated with Mexico's National Registry of sugarcane growers —such as medical care provided by the government, pensions and subsidies—, over production profitability. They mostly come from families who continue the traditional sugarcane production, with low levels of technology, recording the lowest yields. Stable sugarcane growers: they grow sugarcane in medium-sized cultivation areas with no variation over the period evaluated. They are characterized by minimal technological adoption, risk aversion, and high dependence on third parties for agricultural labors. Their main motivation is the certainty of annual income derived from contracts with sugar mills.

The other two profiles described are Diversifying sugarcane growers: they are farmers that have reduced their sugarcane cultivation area to incorporate other crops, mainly agave. They are responsive to economic incentives, growing sugarcane as a backup crop. These growers maintain higher yields than the previous groups and are open to adopting new technologies. Finally, Specialized sugarcane growers: these large-scale farmers have increased their sugarcane cultivation areas in recent years. They are focused on improving yields, demonstrating greater investment capacity in cultivation and innovative agricultural practices. In addition, they are often influenced by younger generations and adhere to a more business-oriented approach in their operational models.

These differences influence how each producer profile relates to agribusinesses, also the types of incentives that are attractive for their recruitment and retention as suppliers by the sugar mills (Table 1).

Differentiated strategies of the sugar mills

Understanding how these profiles are configured allows us to assess the challenges that agribusinesses face in their relationships with the production base; also, the strategies implemented by each sugar mill to address these challenges. The sugar mills in the supply

Table 1. Producer profiles and their strategic links in the sugarcane supply system of the evaluated sugar mills.

Producer profile	Main motivation	Priorities of the producer	Tendency toward loyalty to a sugar mill
Social sugarcane growers	Social benefits	Stability and access to health services	High
Stable sugarcane growers	Financial stability and secure annual income	Timely payments and economic security	Medium (depending on payment punctuality and transparency)
Diversifying sugarcane growers	Maximization of household income through moderate diversification	Profitability	Low (they prefer productive and commercial flexibility)
Specialized sugarcane growers	Increase in future profitability through specialization	Long-term competitiveness and profitability	Low (younger producers constantly seeking better conditions)

zone evaluated have adopted different strategies in response to the competitive pressure generated by alternative crops. Although they operate in the same territory and under similar environmental conditions, each sugar mill addresses the supply challenge from a particular perspective (Figure 2).

Figure 2. Comparison analysis of actions implemented by sugar mills to ensure sugarcane supply.

Sugar Mill A perceives the problem as a long-term phenomenon linked to production restructuring, a lack of generational continuity, and the weakening of loyalty of sugarcane growers toward other production options. The loss of cultivation area represents the end of long-term relationships historically built with producers, jeopardizing operational continuity. In response, this agribusiness (Sugar Mill A) has opted to implement a strategy centered on a supplier retention program that prioritizes administrative simplification, the use of digital media for timely communication, and investments in improved technical assistance and mechanization. It also includes close-service projects for producers and satisfaction surveys; furthermore, it contemplates the application of tailored financial incentives, advanced technical assistance, and preferential service for producers who supply large volumes.

In contrast, Sugar Mill B addresses the problem from the perspective of operational stability and competitive advantage over the other two mills. This industry recognizes that, in a highly competitive environment, logistical efficiency and speed of collection are as crucial as price or individual incentives. Therefore, it prioritizes retaining large producers, who control the majority of the supply and represent lower logistical costs per ton. To achieve this, it has established incentives such as tonnage bonuses, in-advance payments based on committed volume, and preferential shifts for harvesting and hauling. Furthermore, it organizes social events to improve perceptions within the community, strengthening a sense of belonging to the agribusiness. The strategy includes harvesting at the optimal age as a quality policy to avoid losses in the KARBE indicator (Standard base recoverable sugar kilograms) that protects supplier income.

On their part, Sugar Mill C interprets the supply problem as a strategic opportunity to differentiate from the competition through a close-service tailored approach. This sugar mill acknowledges its limited supplier base, so it prioritizes direct, trust-based relationships and personalized attention. This approach is attractive to producers who feel neglected or overlooked by other industries. Sugar Mill C strategy is geared towards attracting and consolidating new suppliers, especially those who value the availability of local offices, flexible terms, and streamlined processes. This agribusiness has simplified administration procedures, strengthening its territorial presence through service centers and comparative advertising campaigns with the aim of improving perception of producers.

Prospective scenarios

Based on prospective analysis, the influential, dependent, and environmental variables with the greatest impact on the regional sugarcane system were identified. Production, technical, economic and institutional factors were considered. Among the statements with the greatest differential impact that that outstand on influence from one scenario to another, we identified the value of KARBE as an indicator of sugarcane yield ratio, which is considered decisive for supplier loyalty toward an agribusiness and is associated with producer profitability. Also, crop diversification, as a strategy reflecting the producer tendency to diversify agricultural activity as a means of increasing family income; irrigation and constant renewal, which have a high influence on sustainable consolidation due to their close relationship with productivity; and simplification in administration procedures,

as part of the supplier retention strategy to improve the perception of producers to agribusinesses.

Despite representing different trajectories that may not be mutually exclusive, these three sugar mills agree that productive intensification is the main axis for maintaining the profitability and competitiveness of sugarcane cultivation. In order to show how the relationships among the statements from these agribusinesses are structured, a graph on the influence vs. dependence function was generated, as a map which served as the basis for constructing the prospective scenarios (Figure 3).

Based on the identified elements, three scenarios were constructed that project opportunities and decisions that could influence the regional course of the sugarcane production system in the coming years. In the "Sustainable consolidation scenario", sugarcane remains as the dominant option. Priority is given to supplier retention and technological adoption is promoted, green harvesting, and intensification practices compatible with a sustainable model. Intensification is a gradual process driven by the adoption of technological innovations, plant varieties renewal, and the efficient use of production resources.

The "Competition and adaptation scenario" describes the persistence of a high-pressure environment caused by production restructuring toward alternative crops. This forces agribusinesses to adapt their strategies, explore new incentives, and improve logistics efficiency. Intensification is key to reducing costs, increasing productivity per hectare, and retaining producers who prioritize efficiency and production competitiveness. Finally, the scenario for "Sugarcane recovery in the face of an agave crisis" suggests a partial or

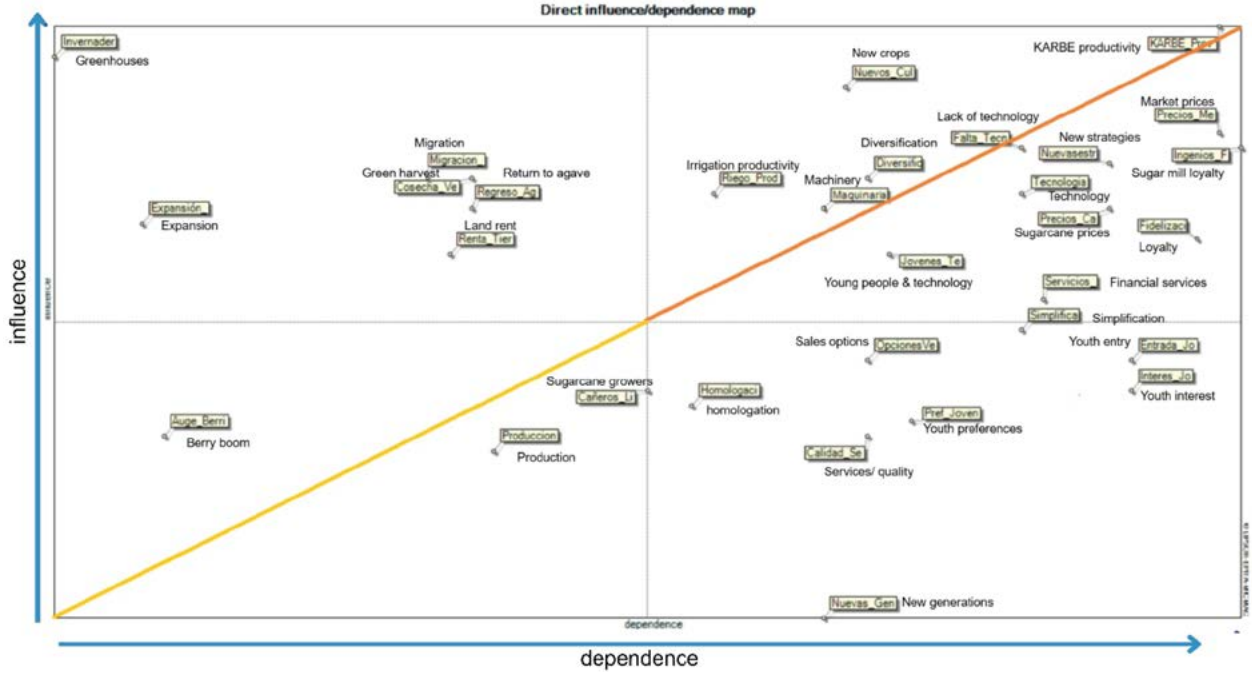

Figure 3. Map of influence *vs.* dependence of the identified statements for the future of sugarcane production and supply management.

total return of cultivation area to sugarcane due to the decline in agave profitability. This reincorporation requires favorable profitability conditions and support, through intensive technical management, sugarcane varieties renewal, and logistics efficiency. Intensification is the means to ensure a return as part of a new production stage with improved conditions.

Although each scenario responds to different contexts, they all require key conditions for restructuring or continuation in sugarcane cultivation, showing how to give direction to the role of intensification (Table 2).

While an extensive expansion could be considered an option to ensure supply, according to the Institute of Statistical and Geographic Information in Jalisco (IIEG Jalisco, 2018), this region already has virtually all agricultural lands occupied by crops such as sugarcane, agave, maize, chili peppers, among others. Therefore, adding new hectares of sugarcane would require conversion processes from other agricultural uses. Additionally, another factor limiting the expansion of the cultivated area is water availability, as the crop requires approximately 1500 mm of annual rainfall for optimal development (CONADESUCA, 2015). However, the average annual rainfall is around 930 mm, making supplemental irrigation essential (IIEG Jalisco, 2023).

Conditions for productive intensification

The main approach to intensification is based on the analysis of various arguments; former Mexico's Secretariat of Agriculture and Rural Development-SADER (2023) mentioned that the average sugarcane yield of the state of Jalisco was around 84 Mg ha^{-1} in 2023. However, CONADESUCA (2016) stated that the varieties most commonly used in Mexico (CP72-2086 and Mex 69-290) can achieve a potential average yield of 115 and 200 Mg ha^{-1}, provided that the agronomic management is optimal. This means there is room to improve productivity through the adoption of technological innovations, technical support, and new agricultural practices, such as plant renewal, precision agriculture, irrigation modernization, among others. There are also conditions that compromise the full utilization of productive potential. García-Preciado *et al.* (2017) indicated that in Jalisco, approximately 50% of the sugarcane acreage depends on two varieties that have been used for more than 30 years. The reduced genetic diversity and a low rate of seedling renewal

Table 2. Prospective scenarios of the sugarcane production system; environment, productive response and the role of intensification.

Scenario	Main environmental driver	Producer behavior	Role of intensification
Sustainable consolidation	Coordination and support from actors within the sugarcane system	Gradual intensification and long-term permanence in sugarcane cultivation	As part of a planned and gradual strategy
Competition and adaptation	Competitive pressure from alternative crops	Partial production restructuring toward alternative crops	Becomes necessary to maintain profitability and competitiveness
Recovery following the agave crisis	Decline in the profitability of agave cultivation	Partial or total return to sugarcane	Key to capitalizing on returning producers and attracting new ones

have led to a decrease in sugarcane yield and quality. Vegetative material used for seedling renewal mostly comes from commercial crops without formal certification protocols or systematic use of seedbeds (Aquino *et al.*, 2021; Reyes-Hernández *et al.*, 2022).

In addition to agronomic and genetic improvements, it is important to consider that increased production requires addressing operational aspects related to the efficient logistics of cutting and transport to the mill. Efficiency during harvesting directly influences yield both in field and sugar mill (Palacios-Vélez *et al.*, 2011). Proper scheduling of cutting operations and effective transport management reduce downtime between harvesting and arrival at the mill, thus preventing losses of freshness that negatively impact industrial yield. Those authors also suggest incorporating information systems to monitor and coordinate the harvest in real time, achieving more efficient logistics and precise operational decisions.

While increased production is the common thread running through the possible scenarios and strategies to be implemented, their success depends largely on the ability to adapt to the diverse realities of the producer profiles conforming the supply system. Due to there are marked differences in levels of technology, technical capabilities, motivations, and even organizational structures. For intensification to effectively contribute to the competitiveness and sustainability of sugarcane crop, it should be implemented through differentiated intervention schemes tailored to each type of producer.

Possible strategic interventions differentiated by profile

Small-scale sugarcane farmers (Social growers) can benefit from the application of basic technologies, as it was demonstrated with a model applied to small and medium-sized sugarcane farms, where yields were improved through soil conservation practices, localized fertilization, and green harvesting (Castelán-Estrada *et al.*, 2016). This model includes support and practical training to foster the building of improved agronomic skills. Functional associations can also be incorporated, including the collective purchase of inputs at preferential prices, the management of demonstration plots to replicate practices under similar conditions, and the shared use of machinery, thereby improving territorial integration and individual productivity.

For Stable sugarcane growers operating under traditional methods and exhibiting low technological adoption, yields can be improved through practical, easy-to-implement, and low-cost solutions; such as improving soil structure and nutrient absorption through the incorporation of organic matter; proper waste management, or the localized application of phosphate fertilizers (SAGARPA, 2009; IICA, 2019).

In a subsequent report, SAGARPA (2009) also suggested that producers with these characteristics be served through agricultural extensionists with modular technical support, the use of technical assistance teams, and agreements with sugar mills. This would provide support in improving practices that could increase yields without creating greater challenges. On their part, Fideicomisos Instituidos en Relacion con la Agricultura-FIRA (2009) proposed a land consolidation plan that would group nearby plots belonging to different owners to reduce operation costs for services such as mechanization.

The Diversifying sugarcane growers present an intermediate profile in terms of technological use and openness to innovation. Therefore, it is recommended to implement

technology transfer mechanisms and technical support without compromising its profitability. According to Mejía *et al.* (2010) and Castelán-Estrada *et al.* (2016), training, monitoring economic results, and establishing demonstration plots, that allow visualization of the benefits of improving productive efficiency from the supplier perspective, are usually appropriate for this profile. FIRA (2009) and SAGARPA (2007) added that the incorporation of digital crop monitoring platforms, the scheduling of harvests, or the management of inputs; along with consolidated purchases of inputs and machinery, improved logistics, and varietal renewal, all contribute to reducing costs per hectare, which positively impacts profitability.

Specialized sugarcane growers represent a strategic profile for the sector due to their more business-oriented approach, higher yields, and openness to models with more advanced technology. IICA (2019) indicated that the implementation of technological packages with technical assistance improves the quality, volume, and regularity of sugarcane supply. Since this group shows favorable characteristics, their access to financing is facilitated, to develop business models and participate in the production of biofuels or fertilizers. Furthermore, they can play a key role in technology transfer processes to the other producer profiles through peer-learning and demonstration plots (SAGARPA, 2009).

Another factor to consider for the proper implementation of intervention strategies and the formulation of initiatives is to rely on a production base that reflects the actual structure of those involved in the supply system. One of the main challenges is recognizing areas for current improvement and assessing the need to supplement or build a database to focus services according to production capacities. Currently, the available registry is associated with the Governmental program "Produccion para el Bienestar" and the Mexican Social Security Institute (IMSS) that execute administrative functions, such as distributing subsidies and providing medical care, but do not allow for the identification of active sugarcane producers. According to this data, 94% of producers have a maximum of 5 hectares in sugarcane production, and only 4.42% belong to the Diversifying and Specialized groups, who are the ones with the greatest potential to improve the supply system. This record does not correspond to the reality observed in the field, but this discrepancy is explained by the fragmentation of agricultural lands to maximize access to government support.

Therefore, the initiative of the agro-industries is required to generate real records that allow the identification of true producer profiles, thus providing timely service, as a necessary condition to achieve a competitive and efficient sugarcane supply system.

CONCLUSIONS

This study confirmed that the sustainability of the sugarcane supply system in a highly competitive region will depend on how relationships with producers are established. Each producer profile expressed distinct motivations, scales, levels of loyalty, and technical capabilities. This diversity demonstrated that formulating universal acquisition and retention strategies is ineffective, because the real needs of each producer profile are not addressed.

Producers who respond mainly to social benefits were identified, but there are also profiles with higher productive potential, such as diversifying and specialized sugarcane growers. However, there are currently no indicators for the accurate evaluation of the results and impacts of the strategies. This contributes to the supply problems and weakens traditional governance.

The most immediate goal should be complementing and updating the National Registry of sugarcane growers to identify active producers, which allow creating tailored value propositions. In addition, the adoption of innovations is required, such as a complete and updated geo-referenced database of lands dedicated to sugarcane cultivation, in order to support an efficient supplier recruitment and retention of the younger producers who have the ability to revitalize the sector.

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REFERENCES

Aquino Mercado, P. R., Peralta Jiménez, J., Valdez Castro, J. C., & Salvador Juárez, I. (2021). Determinantes de la productividad de caña de azúcar. Sistema de Información para la Integración del Balance Azucarero (SIIBA).

Arango Morales, X. A., & Cuevas Pérez, V. A. (2012). Método de análisis estructural: matriz de impactos cruzados multiplicación aplicada a una clasificación (MICMAC). Tesis doctoral. Universidad Autónoma de Nuevo León.

Cabrera Palafox, H. (2022). Elaboración de un instrumento de investigación con el método Delphi. Analizando el estrés y malestar en docentes universitarios. *IE Revista de Investigación Educativa de La REDIECH*, 13, e1364. https://doi.org/10.33010/ie_rie_rediech.v13i0.1364

Castelán-Estrada, M., Salgado-García, S., Ortiz-Laurel, H., & Juárez-López, J. F. (2016). Transferencia del modelo de alta rentabilidad para la transformación integral del campo cañero en México. *Agro Productividad*, 9, 14-17.

CONADESUCA. (2024). Padrón de productores de la zona de abasto Región valles. Histórico de informes: 11° Informe estadístico del sector agroindustrial caña de azúcar en México (zafras 2013-2014/2023-2024). Variedades con mejores rendimientos de las zonas cañeras en México. Ficha técnica del cultivo de la caña de azúcar.

CONADESUCA. (2016). Variedades con mejores rendimientos de las zonas cañeras en México (pp. 1–7). https://www.gob.mx/cms/uploads/attachment/file/114367/Nota_Informativa_Febrero_2016_Variedades_con_Mejores_Rendimientos_de_las_Zonas_Ca_eras_en_M_xico.pdf#:~:text=2010,mx

CONADESUCA. (2015). Ficha técnica del cultivo de la caña de azúcar. SAGARPA.https://www.gob.mx/cms/uploads/attachment/file/141823/Ficha_T_cnica_Ca_a_de_Az_car.pdf

FAO & BID. (2007). Restricciones y oportunidades. In: F. Soto Baquero, M. Rodríguez Fazzone, & C. Falconi (eds.) Políticas para la agricultura familiar. Organización de las Naciones Unidas para la Alimentación y la Agricultura y Banco Interamericano de Desarrollo (pp. 16-18).

FIRA-Fideicomisos Instituidos en Relación con la Agricultura. (2009). Competitividad de la industria del azúcar en México.

García-Preciado, J. C., Álvarez-Cilva, M., Guzmán-Martínez, M., Cervantes-Preciado, J. F., & Bermúdez-Guzmán, M. J. (2017). Evaluación de variables de calidad en híbridos de *Saccharum* spp. en diferentes ambientes agroecológicos de Jalisco, México. *Agroproductividad, 10*(11), 105-106.

Ghezzi, P., Stein, E., Ordoñez, R., & Cornick, J. (2022). Una puerta a las cadenas agroalimentarias globales para los pequeños productores. In Competir en la agroindustria. Estrategias empresariales y políticas públicas para los desafíos del siglo XXI. Banco Interamericano de Desarrollo. 283 p.

Gobierno del Estado de Jalisco. (2023). Agenda regional Lagunas (pp. 15-22). https://plan.jalisco.gob.mx/wp-content/uploads/2023/06/11-Lagunas-Agenda-Regional_final-V3.pdf

Godet, M. (2000). El arte de escenarios y planificación estratégica: Herramientas y trampas. Marcombo.

Gómez-Merino, F. C., Trejo-Téllez, I. L., & Aguilar-Rivera, N. (2021). Agregación de valor y diversificación de la agroindustria de la caña de azúcar en México: Opciones y desafíos. *ATAM, 34*(2), 6-10.

IICA-Instituto Interamericano de Cooperación para la Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación. (2019). Agenda de innovación intersectorial para el desarrollo agroindustrial de la caña de azúcar para Oaxaca, San Luis Potosí y Veracruz. Sustainability (Switzerland) 11(1): 1-14.

IIEG Jalisco-Instituto de Información Estadística y Geográfica de Jalisco. (2018). Diagnóstico de la región Valles (pp. 44-46). https://iieg.gob.mx/contenido/Municipios/10_valles_diagnostico.pdf#:~:text=El principal producto del sector,9

IIEG Jalisco-Instituto de Información Estadística y Geográfica de Jalisco. (2023). Diagnóstico de la Región Valles (p. 51).

Mejía S., E., Rivera A., J. C., Oviedo N., E., Debernardi D. V., H., & Tiscareño L., M. (2010). Estudio de caracterización de zonas potenciales de mecanización en las zonas de abasto cañeras. Colegio de Postgraduados, SAGARPA.

Palacios-Vélez, O. L., Mejía-Sáenz, E., Piñón-Sosa, L., & Sánchez-Hernández, H. (2011). La frescura de la caña de azúcar: Un caso de estudio en tres ingenios de México. *Agrociencia 45*(7), 831-847.

Reyes-Hernández, J., Coronado-Blanco, J. M., Bosque, L. Á. R., Khalaim, A. I., Estrada-Drouaillet, B., Torres-Acosta, R. I., & Reséndiz-Ramírez, Z. (2024). Efecto del estrés hídrico en el barrenador (*Eoreuma loftini* Dyar) y la caña de azúcar (*Saccharum officinarum* L.). *Acta Agrícola y Pecuaria 10*(1), e0101005.

SADER-Secretaría de Agricultura y Desarrollo Rural. (2023). SADER Jalisco refuerza acciones para la cosecha de caña en verde (Junio 1°). https://sader.jalisco.gob.mx/prensa/noticias/sader-jalisco-refuerza-acciones-para-la-cosecha-d

SAGARPA– Secretaría de Agricultura, Ganadería, Recursos naturales, Pesca y Alimentación. (2009). Histórico de informes. Programa Nacional de la Agroindustria de la Caña de Azúcar. Desarrollo de un modelo integral de sistema de información geográfica y edáfica como fundamento de la agricultura de precisión en la caña azúcar. Proyecto nacional de alta rentabilidad para el reordenamiento y transformación del campo cañero mexicano.

SAGARPA. (2007). Programa Nacional de la Agroindustria de la Caña de Azúcar.http://www.conadesuca.gob.mx/eficienciaproductiva/PRONAC.pdf

SIAP-Servicio de Información Agroalimentaria y Pesquera. (2024). Superficie sembrada con agave 2018-2023. http://nube.agricultura.gob.mx/avance_agricola/

Susilowati, K. D. S., Rachmi, A., & Riwajanti, N. I. (2020). Creating a sustainable supply of sugarcane through contract farming partnership (A case study at sugar factory "Kebon Agung", Malang-Indonesia). *International Journal of Supply Chain Management 9*(3), 117-128.