Social interactions and business portfolio among vegetable producers in central Mexico

Heredia-Sánchez, Ma. Guadalupe[1]; Martínez-Castañeda, Francisco E.[1*]; Ruiz-Torres, Mónica E.[1]; González-Hernández, Vianey[1]; Nuñez-Espinoza, Juan F.[2]; Thomé-Ortíz, Humberto[1]

[1] Universidad Autónoma del Estado de México. Instituto de Ciencias Agropecuarias y Rurales. Instituto Leterario #100, colonia Centro, Toluca, Estado de México. C.P. 50000.
[2] Colegio de Postgraduados. Desarrollo Rural. Campus Montecillos, km 36.5, Carretera México-Texcoco, Texcoco, Estado de México. C.P. 56264.
* Correspondence: femartinezc@uaemex.mx

ABSTRACT
Objective: To analyze the social interactions and business portfolio of vegetable producers in central Mexico.
Design/methodology/approach: Work was conducted with 16 small-scale vegetable producers. Semi-structured questionnaires and periodic monitoring were used in the field to collect data. A Social Network analysis was carried out to understand the social interactions between producers, and the Boston Consulting Group (BCG) and Ansoff matrix was used for the business portfolio.
Results: The study found that the products with potential in the market were lettuce and nopal. Broccoli and squash represent low sales and low utility. Producers with a higher degree of centrality grow lettuce, broccoli and squash, so we suggested developing strategies for introducing nopal.
Limitations on study/implications: It was necessary to develop into market and consumers analysis.

Keywords: Social Network analysis, Boston Consulting Group and Ansoff matrix.

Citation: Heredia-Sánchez, Ma. G., Martínez-Castañeda, F. E., Ruiz-Torres, M. E., González-Hernández, V., Nuñez-Espinoza, J. F., Thomé-Ortíz, H. (2023). Social interactions and business portfolio among vegetable producers in central Mexico. *Agro Productividad*. https://doi.org/10.32854/agrop.v15i4.2394

Academic Editors: Jorge Cadena Iñiguez and Libia Iris Trejo Téllez

Received: October 07, 2022.
Accepted: March 12, 2023.
Published on-line: June 09, 2023.

Agro Productividad, 16(3). March. 2023. pp: 167-178.

INTRODUCTION

Mexico produces a large variety of vegetables which, in addition to generating foods, also represent an important source of employment. These productive systems belong to small-scale agriculture, contributing to the agriculture and livestock production economy of the country with 54% of food production and 80% of hired and paid employment (SADER, 2022a).

According to SADER (2022a), small-scale agriculture includes farmers from 0.2 ha with irrigation to 5 ha rainfed, characterized using family labor, limited access to resources, and production directed to auto-consumption. Small-scale production is conceptualized as a "way of life", as well as generator of territorial development (Santos-Barrios *et al.*, 2017). It represents an opportunity to make local economies more dynamic, especially when specific policies are combined (Robles Berlanga, 2016).

Approximately 20% of Mexican families reside in rural zones (INEGI, 2020). Small-scale farmers in our country contribute 40% of the foods that we consume, contributing to the welfare and food sovereignty of the population. These production schemes allow creating the conditions to produce healthy foods that contribute to the diet and the family economy (SADER, 2022b).

In Estado de México, it is estimated that the surface planted with vegetables is 32,333.24 ha, representing 4.87% of the total national vegetable surface, of which 11,550.56 ha are cultivated under irrigation conditions and 20,782.68 ha are rainfed; this activity is developed in 70 municipalities of the state (SECAMPO, 2022). Horticulture is considered one of the most profitable activities, where 2,129 inhabitants are occupied and receive financial income (PDM 2022-2024).

The vegetables are used as food, in the cosmetics industry, in traditional medicine, and in the transformation industry (CEDRSSA, 2020), among others.

In the municipality of Xonacatlán, 58.57% of the territory has agricultural use, primarily for grain production, followed by perennial crops and to a lesser extent the cultivation of vegetables (PDM, 2019-2021). This activity is relatively recent and has taken place thanks to the collective work among vegetable producers, fostering a positive interaction between them and other actors involved in the productive activity (Gutiérrez, 2018).

The existing relationships between collectives are based on principles and historical experiences that can be the result of bonds of trust created during years or via kinship, geographical proximity, grocer's activities, technical assistance, and sales; these allow projecting development strategies to improve the socio-productive and economic activities in horticulturists (Rousseau *et al.*, 1998).

For its part, the Social Network analysis allows exploring the structure of relationships between individuals, groups and organizations, both inward and towards the context where they develop (Sanz, 2003). Thus, the Social Network analysis (SNA) was adopted as a methodological tool to study the productive structure of vegetables (group and individual) based on the existence of information flows (Velázquez and Aguilar, 2005).

Figueroa *et al.* (2012) evaluated and determined the organization and the value of trust in businesses and vegetable producers' networks. Pérez *et al.* (2017) evaluated the behavior of poultry production agglomerations, the various forms of relating, such as friendship, kinship, solidarity and culture; as well as the attributes generated around the 11 groups of women devoted to this activity. Santos-Barrios *et al.* (2021) assessed the socio-productive relationships of small-scale pork producers and their weight in the reproduction and continuity of the system.

Vegetable production in the municipality is primarily lettuce, nopal, broccoli, spinach, squash, and chives, among others. This portfolio of products fulfills two functions mainly: to satisfy family consumption and to generate complementary financial income.

The business portfolio is established as a basic input for the analysis, commercial positioning and strategy design (Villavicencio- Gutiérrez, 2018). The Boston Consulting Group (BCG) matrix allows deciding what is necessary to invest, maintain or abandon in the Strategic Business Units (SBUs) (Castellanos, 2015). The Ansoff matrix allows identifying new opportunities for growth regardless of the size or sector of the activity.

This matrix bases the business opportunities on the markets and the products (Kotler and Keller, 2012).

From this the importance of establishing the social relationships and the social structure of vegetable producers, as well as outlining commercial strategies based on their business portfolio to maintain their productive systems and, with this, to contribute to the territorial development of the zone.

MATERIALS AND METHODS

Study zone

The study was conducted in the localities of Santa María Zolotepec, Mimiapan, Col. Emiliano Zapata and Tejocotillos in the municipality of Xonacatlán, located in Valle de Toluca. The predominant economic activity in the municipality is the manufacture of stuffed toys. The predominant climate is temperate-subhumid, with mean annual temperature of 12.4 °C (Atlas de Riesgo Municipal, 2019), mean altitude of 3050 meters above sea level (INEGI, 2020). It borders north with the municipalities of Otzolotepec and Jilotzingo; east with Jilotzingo, Naucalpan de Juárez and Lerma; south with the municipality of Lerma; west with the municipality of Otzolotepec.

Vegetable production in Xonacatlán is a relatively new activity, started 10 years ago with the conformation of the Local Agency of Rural Producers (Agencia Local de Productores Rurales, ALPR) of Xonacatlán. Presently the municipality is known for the production of nopal, spinach, broccoli, chives, chard, lettuce, beet, cilantro, tomato, green tomato, epazote and cucumber.

In this zone, the production of vegetables is carried out in two cycles: 1) spring-summer, when the vegetables harvested are the ones sensitive to frosts, such as tomato, squash, cucumber, broccoli, chili pepper, tomato and nopal; and 2) fall-winter, with the harvest of those that tolerate lower temperatures, such as the case of broad-leaf vegetables like spinach, chard, lettuce, beet, radishes and chives. There are two types of facilities: 1) open-air, whose vegetable patches are characterized by surfaces that range from 500 m^2 to 2 hectares where seasonal vegetables are produced, rainfed irrigation is used, and mostly organic and natural fertilizers are used; and 2) greenhouse, productive units that range from 100 to 250 m^2 where covered facilities are used with controlled climates and vegetables of various cycles and broad leaf are used. There are mixed productive units (greenhouse and open-air).

Data collection

Semi-structured interviews were applied to all the members of the production units. The sample was 16 vegetable producers, which represent 57.1% of the total recorded in the current register of the municipality of Xonacatlán. From the 16 producers, 11 belong to a social group under the scheme of the Local Association of Rural Producers (ALPR), and the remaining 5 are independent producers. Four producers are open-air, seven greenhouse and five mixed systems.

The interviews gathered information related to the characteristics of the producer (age, locality, schooling, members of the family, recipients of social programs, migration,

additional activities to farming, income, and family expenses) and of the productive unit (crops planted, type of production, geographical proximity, surface, place of trade, suppliers, inputs, assistance institutions, training). Information was gathered on social relationships and trust among producers. The compilation of a list of cases (producers) and connections (bonds) was considered, according to Scott (2013).

Data analysis: Social Network Analysis (SNA)

The existing structures between actors and their relationships were examined, where interactions were seen as a set of points and lines (Dettmer, 2019). For González and Basaldúa (2007), a network is the result of the relationship between human groups that have two or more people, with the purpose of helping themselves, doing business or conducting any activity with common interests. It should be said that the social networks are made up of: nodes (actors), bonds (social relationships/interactions) and flows (direction in which social relationships move).

The links visualized were: 1) Trust, when two actors know each other and share information; 2) Kinship, blood relationship or family bonds between producers; 3) Purchases, interaction that are produced by trade exchanges between counterparts; 4) Procurement, interactions between producers and suppliers of farming inputs; 5) Commercialization, relationships between the producer and those that purchase their products, including bartering; 6) Public institutions, interactions between vegetable producers and institutions.

The data were organized into symmetrical and asymmetrical matrices. The first are square and express a homologous relationship of bonds (Lugo Morín *et al.*, 2010). The second ones are articulated through public institutions. In each matrix, the "0" indicated the absence of relationship and the "1" presence of the relationship. To identify the producers (actors) within the SNA and to protect their identity, each was assigned a code using letters.

The level of participation was determined by two centrality measurements:

1) Degree of centrality (number of actors to which an actor is directly connected). It is expressed under the following formula (De la Rosa *et al.*, 2005).

$$d_i = \sum_{j \in V} A_{ij}, \forall_i \in V$$

Where: A_{ij} = Matrix that connects the nodes i and j; and d_i is the centrality (degree).

2) Degree of intermediation or betweenness (possibility of a node or actor to intermediate the communications between pairs). The formula (Álvarez and Aguilar, 2005) to calculate such a measurement is:

$$g_k = \sum_{i<k<j} \frac{g_{ikj}}{g_{ij}}, \forall_k \in V$$

Where: g_k=degree of intermediation; g_{ij}=number of geodesic distances from node i to node j; g_{ikj}=number of bonds between i and j and which go through k (de la Rosa *et al.*, 2005). The data were analyzed with UCINET version 6.7 for Windows (Borgatti *et al.*, 2002).

Boston Consulting Group Matrix

It was used to calculate the relative market quota and the market's annual growth rate from the business economic units (BEUs) as a criterion to make investment decisions (Kotler and Keller, 2012). It is made up of four quadrants: i) Star quadrant, product that tends to grow rapidly and has participation in the market; ii) Interrogative quadrant, representing the strategic business division, has low participation in the market, but has possibility of rapid growth; iii) Cow quadrant, strategic product in the market with low growth and high participation in the market; and iv) Dog quadrant, strategic product with low participation in the market and low growth rates. The life cycle of the product was considered to determine the strategies for each product, according to the following: 1) Interrogative=Introduction; 2) Star=Growth; 3) Cow=Maturity; and 4) Dog=Decrease.

Ansoff Matrix

The Ansoff Matrix allowed identifying growth opportunities regardless of the size or sector of activity, which in the case studied are of family type. The matrix was based on the business opportunities detected in the markets and the products. The market was a short-circuit commercialization street market. The products were lettuce, nopal, broccoli and squash.

The following was considered: i) whether greater market participation could be attained with the current products and markets (strategy for market entry); ii) whether new markets can be found or developed for the current products (strategy of market development); iii) the possibility of developing new products of interest for current markets (strategy of product development); and iv) whether there are opportunities to develop new products for new markets (diversification strategy) (Kotler and Keller, 2006).

RESULT AND DISCUSSION

The average age of producers is 46±11 years with secondary education and seven years of experience in vegetable production. Likewise, Santos Barrios *et al.* (2021) consider backyard pork breeding as a family economic activity, and vegetable production in Xonacatlán is similar to this concept. Each family production unit has on average five members. Of the families, 69% have extra income from non-agricultural employment; 50% of the families participate in social assistance programs (Table 1).

Of the orchards and greenhouses, 62% have masculine leadership and the remaining feminine. Despite the important role of rural women, decision making is still concentrated in men, which agrees with what was reported by Ruiz-Torres *et al.* (2017) in the case of dairy farms and with Bain *et al.* (2018) with regards to the involvement of women in milk production. Women's empowering and their inclusion in decision-making areas will

Table 1. Social programs which benefit vegetable producers.

Social program	Percentage of horticultors	Origin of the program
Scholar breakfast	12.5	State program
Strong families	12.5	State program
Youth builders	6.3	State program
Elder pension	6.3	State program
Pink card	12.5	State program

contribute to breaking barriers about their visibility in access to productive resources and the decision regarding these (De la O Campos, 2015; Kidder *et al*., 2014).

Social Network Analysis (SNA)

The social networks that are directly related to the production of vegetables are based on the trust built through kinship links, economic activity, type of production, proximity, and sale or barter of inputs. Two factors are added to these trust bonds: geographical proximity (neighbors), belonging to the same formal ALPR union. For Santos (2018), trust is understood as a social relationship that consists in the ability to open to others and represents the strength of the bonds.

The general network of vegetable producers in the municipality of Xonacatlán is concentrated in 30.48%, which indicates that the information is distributed through several central actors and far from behaving like a star network (Figure 1). For García Hernández (2013), the presence of several "star" actors benefits the direction and organization of activities given their experience and knowledge for the resolution of problems.

The actors Ga, Ro and L have, each, thirteen significant relationships within the network (Figure 1), which means that they connect with 86.66% of the actors in the network,

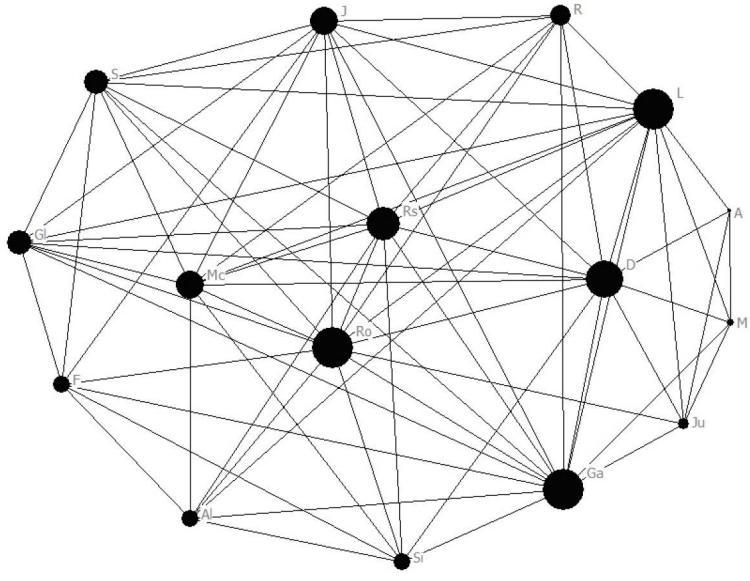

Figure 1. Horticulturist Degree.

produce in greenhouse and open-air, and trade their products in the street market and on the farm. D, Rs, J, Mc, S and Gl connect with more than 60% of the network. L and Ga have a greater capacity of connecting with those that do not connect with one another, given their degree of intermediation that represented 11.54% and 11.48%, respectively. The intermediation actors, in addition to giving information to socially distant actors, can capitalize the data that flow through them (Aguilar Gallegos *et al.*, 2016).

The information that is exchanged between producers has to do primarily with the productive activity. Relationships of kinship were observed (sister-sister, mother-son, father-son and uncle-niece) which influence the sub-networks created for the exchange of technical consulting (Figure 2). Ga and Ro, in addition to sharing kinship bonds, are the actors with highest degree of centrality, which is why they have been recognized as experts in the productive system. The nodes Ju, A, M and D are connected, in addition to kinship bonds (M and A), to the geographical proximity that productive systems have between them.

The type of programs and the relationships with actors are presented in Table 2 and Figure 3, respectively.

Three state institutions are the ones that have the highest number of connections with the producers (Figure 3). ICAMEX connects with 75%, SEDAGRO with 75%, and Ayuntamiento Municipal with 68%.

The social networks between institutions and producers agree with the hybrid networks described by Senesi *et al.* (2013), which allow connecting several actors by the same objective, sharing resources and improving the profitability of the business; however, the risk lies in the institutions restricting the development of each productive unit.

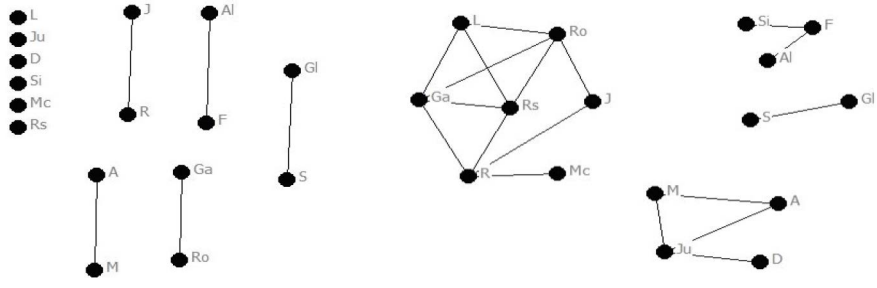

Figure 2. Kinship networks (left); technical consulting (right).

Table 2. Institutions and programs.

Institutions	Program
SADER	Fertilizers and catastrophic insurance
ICAMEX	Technical assistance and training.
SEDAGRO	Technical assistance, agricultural inputs, infrastructure, and machinery
City Hall	Business licenses Rural infrastructure
Local Delegation	Local workshops and exhibitions
Private institutions	Agricultural machinery, materials, and inputs

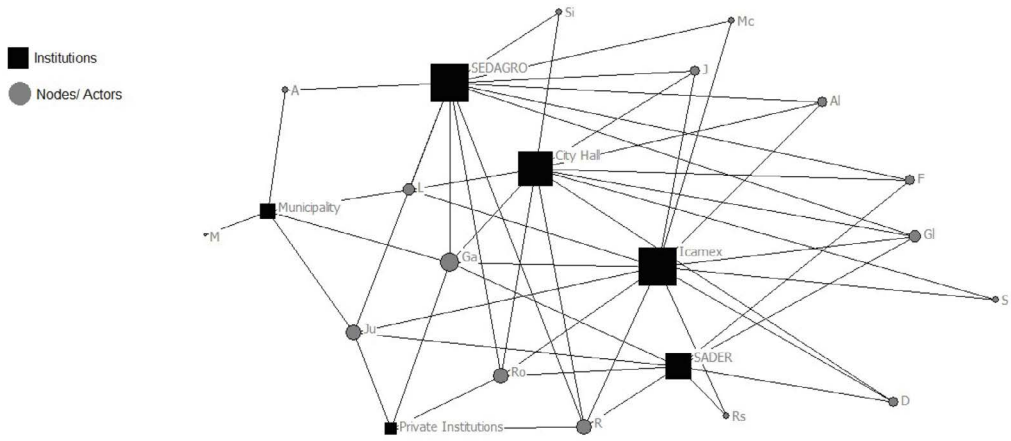

Figure 3. Degree between horticulturists and public institutions.

Boston Consulting Group Matrix

The results from the BCG matrix show that the BEU is located in the interrogative and dog quadrants (Figure 4).

Market growth in the nopal and lettuce BEUs are above average. To approach a star product, the companies must invest significantly in them, since they have a high potential (Moose and Reeves, 2022). The broccoli and squash BEUs are below the average in the dog quadrant, have low participation and low growth, and are essentially useless and should be paid off; it is unlikely that their current position will generate profit (Moose and

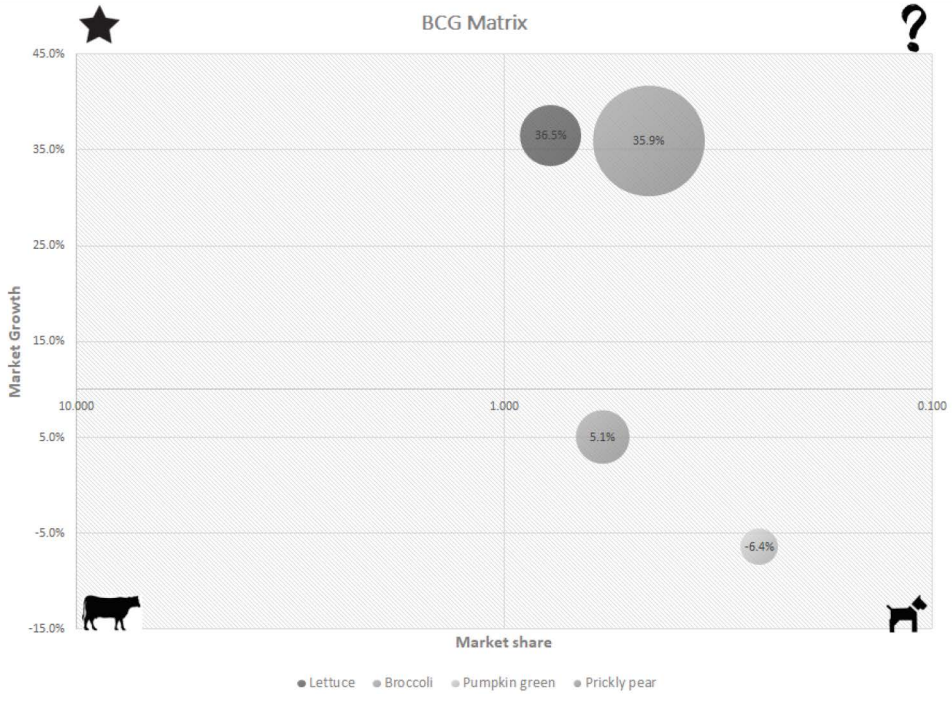

Figure 4. BCG Matrix

Reeves, 2022). Because of their cultural importance and since they are growing, strategies to reposition them are proposed.

When it comes to the relative market share (Table 3), lettuce (.78) is the product closest to 1.0. The relative market share represents the market participation of a company in relation to its largest competitor; if it is higher than 1.0 it surpasses the leader, and under 0.5 it is twice smaller than the leader (Kotler and Keller, 2012).

Nopal (.46) is twice smaller, compared to the leader producer, Otumba (SIACON, 2022). The nopal BEU represented the product with highest proportion in sales volume $454,000.00 in the year 2021. The broccoli BEU (.59) is twice smaller, compared to the production from the leader, Valle de Chalco (SIACON, 2022).

To become star products, the BEUs should concentrate the development of entrepreneurial abilities that allow them to improve their competitive position. The strategy of differentiation and positioning of a company ought to change as the product, the market and the competitors change throughout the product's life cycle (PLC) (Kotler and Keller, 2012).

The lettuce and nopal BEUs are in the introduction stage, their sales and benefits are low, and their main distribution mode is a short trade circuit through the market of local products in Xonacatlán; however, these BEUs are increasing their participation in the market. They require commercial technical investment and communication, as well as applying expansion strategies.

The broccoli and squash BEUs are inside the dog quadrant which indicates that the products are decreasing, there is low sale and a decrease in the utilities; however, they are products with cultural importance and value.

Ansoff Matrix

From the four options set out, it is suggested to focus on the market entry and market development strategies that imply a lower risk.

Table 3. Relative market share.

Product	Market share
Lettuce	0.78
Broccoli	0.59
Pumpkin	0.25
Nopal	0.46

Table 4. Xonacatlán BEU Ansoff Matrix.

	Current products	New products
Current markets	Market uptake - Market share increase	Product development - New products in the same market (chives, Swiss chard)
New markets	Market development - Expand the market for the current UEN, (geographical expansion, define the market segment, capture of new segments)	Diversification - Vertical integration (forward, backward)

Marketing strategies in declining phase. In this phase, the following is proposed:

- Product strategy: emphasizing the added value of family production, considering their cultural and nutritional value, underlying their benefits (type of agriculture and form of farming).
- Price strategy: maintaining prices in agreement to the market.
- Distribution strategy: the Xonacatlán street market represents an opportunity to position these products.
- Advertising strategy: retaining loyal clients, emphasizing nutritional and cultural advantages of the products.

CONCLUSIONS

Lettuce and nopal are products with market potential; broccoli and squash represent low sales and low utility. The producers with highest centrality (L, Ro and Ga) cultivate lettuce, broccoli and squash, which is why the importance of broccoli and squash should be reassessed. Nopal is a product with great market potential, so it is suggested to seek strategies for its introduction through pre-existing interactions in the general network, placing interest on the three producers of social relevance (L, Ro and Ga).

ACKNOWLEDGEMENTS

The authors wish to thank *Consejo Nacional de Ciencia y Tecnología* in Mexico (Conacyt) for scholarship number 1054725 given to Heredia Sánchez. And vegetable producers of central Mexico.

REFERENCES

Aguilar-Gallegos N., Martínez-González E. G., Aguilar-Ávila J., Santoyo-Cortés H., Muñoz-Rodríguez M. y García-Sánchez E. I. (2016). Análisis de redes para catalizar la innovación agrícola: de los vínculos directos a la integración y radialidad. *Estudios Gerenciales, 32* (140), 197-207. https://doi.org/10.1016/j.estger.2016.06.006

Atlas de Riesgos Xonacatlán actualización 2019-2021. Coordinación General de Protección Civil del Estado de México, Ayuntamiento de Xonacatlán. Recuperado el 1 de septiembre de 2022, de https://xonacatlan.gob.mx/contenidos/xonacatlan/docs/Atlas_Xonacatlan_2019_042_pdf_2020_2_6_093727_pdf_2020_5_19_114806.pdf

Bain, C., Ransom, E., Halimatusa´diyah, I. (2018). `Weak winners´ of Women's empowerment: The gender effects of dairy livestock assets on time poverty in Uganda. *Journal of Rural Studies*, 61, 100-109. https://doi.org/10.1016/j.jrurstud.2018.03.004

Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. *Ucinet 6 for Windows: Software for Social Network Analysis*. Harvard, MA: Analytic Technologie.

CEDRSSA (2020). *Análisis de la producción y consumo de hortalizas. Centro de estudios para el desarrollo Rural Sustentable y la Soberanía Alimentaria*, Palacio legislativo de San Lázaro. Recuperado el 1 de septiembre de 2022, de http://www.cedrssa.gob.mx/files/b/13/88Análisis_producción_consumo_hortalizas.pdf

De la O Campos, A. P. (2015). Empowering rural women through social protection. *Rural Transformations-Technical Papers*, Series #2, Roma: FAO. Recuperado el 14 de septiembre de 2022, de https://slidelegend.com/empowering-rural-women-through-social-protection-towards-_59beaa511723dd77e8012bd1.html

Dettmer González, J. (2019). Análisis de Redes Sociales (ARS): Estado del arte del caso mexicano. *Espacio Abierto*, *28* (3): 5-24. Recuperado el 13 de septiembre 2022, de https://www.redalyc.org/journal/122/12264369001/html/

Figueroa-Rodríguez, K. A., Figueroa-Sandoval, B., Borja-Bravo, M., Carrillo-Hidalgo, O. M., Hernández-Rosas, F. y Tobón-Olguín, L. E. (2012). Confianza y redes sociales en productores de hortalizas en San Luis potosí, México. *Agricultura, Sociedad y Desarrollo, 9* (4):441–453.

García Hernández, A. (2013). Las redes de colaboración científica y su efecto en la productividad. Un análisis bibliométrico. *Investigación Bibliotecológica: Archivonomía, Bibliotecología e Información, 27* (59): 159-175. https://doi.org/10.1016/S0187-358X(13)72535-8

González C. y Basaldúa M. (2007). La formación de redes sociales en el estudio de actores y familias. Perspectivas de estudio en historia y antropología. REDES. *Revista hispana para el análisis de redes sociales, 12* (8): 1-27. https://doi.org/10.5565/rev/redes.104

Gutiérrez, J. (2018). Productores de Xonacatlán arraigan el cultivo de hortalizas tras casi 10 años. *Diario Evolución*. Recuperado el 13 de septiembre de 2022, de https://www.diarioevolucion.com.mx/productores-de-xonacatlan-arraigan-el-cultivo-de-hortalizas-tras-casi-10-anos/

INEGI. (2020). *Censo de Población y vivienda*. Instituto Nacional de Estadística, Geografía e Informática (INEGI). Recuperado el 8 de septiembre de 2022, de https://www.inegi.org.mx/programas/ccpv/2020/

Kidder, T., Bright, D. y Green, C. (2014). Meaningful action: effective approaches to women's economic empowerment in agriculture. *Oxfam Background Report*. Recuperado el 14 de septiebre de 2022, de https://ciaotest.cc.columbia.edu/wps/oxfam/0033629/f_0033629_27406.pdf

Kotler, P. y Keller, K. (2012). *Dirección de marketing*. 14ª ed. México: Pearson Education, Inc. Prentice Hall.

Lugo Morín, D. R. (2011). Análisis de redes sociales en el mundo rural: guía inicial. *Revista de Estudios Sociales. 1* (38): 129-142. Recuperado el 14 de septiembre de 2022, de http://www.scielo.org.co/pdf/res/n38/n38a10.pdf

Moose, S., y Reeves, M. (2022). *Boston Consulting Group*. Recuperado el 14 de septiembre de 2022, de https://www.bcg.com/about/overview/our-history/growth-share-matrix

PDM 2019-2021. *Plan de Desarrollo Municipal H. Ayuntamiento de Xonacatlán*, Estado de México. Recuperado el 10 de septiembre de 2022, de https://www.xonacatlan.gob.mx/contenidos/xonacatlan/docs/237_3plan-de-desarrollo-municipal-administracion-2019-2021_22513110050.pdf

Pérez-Hernández, l., M., Núnez-Espinoza, J. F. y Figueroa-Sandoval, B. (2017). Redes sociales y mujeres organizadas para la producción de ovinos en Salinas, San Luis Potosí. *Agricultura, Sociedad y Desarrollo, 14* (3):325-345.

Robles Berlanga, H. (2016). La pequeña agricultura campesina y familiar: construyendo una propuesta desde la sociedad. EntreDiversidades. *Revista de Ciencias Sociales y Humanidades*, 7: 46-83. Recuperado el 13 de septiembre de 2022, de https://www.redalyc.org/pdf/4559/455949153003.pdf

Rousseau, D., Stkin, S. y Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. *Academy of Management Review*, *23* (3):393-404.

Ruiz-Torres, M.E., Moctezuma-Pérez., S., Arriaga-Jordán, C.M. and Martíinez-Castañeda, F.E. (2017). Espacios productivos y roles domésticos en granjas de leche en pequeña escala en México. *Agricultura, Sociedad y Desarrollo. 14* (3): 367–381. Recuperado el 14 de septiembre de 2022, de https://www.scielo.org.mx/pdf/asd/v14n3/1870-5472-asd-14-03-00367-en.pdf

SADER (2022a). *Secretaria de Agricultura y Desarrollo Rural*. Recuperado el 13 de Septiembre de 2022, de: https://www.gob.mx/agricultura/articulos/productores-de-pequena-escala-son-los-que-nos-dan-de-comer?idiom=es#:~:text=Los%20principales%20cultivos%20en%20los,%3A%20ma%C3%ADz%2C%20frijol%20y%20calabaza

SADER (2022b). *Secretaria de Agricultura y Desarrollo Rural*. Recuperado el 13 de septiembre de 2022, de https://www.gob.mx/senasica/articulos/pequenos-productores-sosten-de-nuestra-agricultura

Santos Anaya, M. (2018). Más allá del dinero: redes familiares, amicales e institucionales y su relación con las trayectorias educativas postsecundarias de jóvenes peruanos. *Revista Hispana para el Análisis de Redes Sociales, 28* (2): 166-187. https://doi.org/10.5565/rev/redes.799

Santos-Barrios L., Nuñez-Espinoza, J.F., Ruiz-Torres M.E., Clava-Hernámdez T., Martínez-García C.G. y Martínez-Castañeda F.E. (2021). Strategies and socio-productive relationships in pig backyard production. *Agroproductividad, 14* (12), 29-40. https://doi.org/10.32854/agrop.v14i12.1990

Sanz L. (2003) Análisis de Redes Sociales: o como representar las estructuras sociales subyacentes. *Apuntes de Ciencia y Tecnología*. Recuperado el 8 de septiembre de 2022, de https://digital.csic.es/bitstream/10261/1569/1/analisis_redes_sociales.pdf

Scott, J. (2013). *Social Network Analysis*. Third Edition. London, UK: SAGE.

SIACON (2022). *Sistema de información agropecuaria*. SADER. Recuperado el 13 de septiembre de 2022, de https://www.gob.mx/siap/documentos/siacon-ng-161430

SECAMPO (2022). Análisis de Tendencia de la Producción de los principales productos Agrícolas, Florícolas, y Pecuarios en el Estado de México. *Secretaría del Campo*, Gobierno del Estado de México. Recuperado el 8 de septiembre de 2022, de https://secampo.edomex.gob.mx/sites/secampo.edomex.gob.mx/files/files/Produccion_Campo/Tend_Prod_A_F_P2022.pdf

Senesi S., Rivas, C. F. y Palau H. (2013). Networks in Argentine agriculture: a multiple case study approach. *Revista de Administração, 48* (2): 281-294. https://doi.org/10.5700/rausp1088

Velázquez, O. A. y Aguilar, N. (2005). *Manual Introductorio al Análisis de Redes Sociales, ejemplos prácticos con UCINET 6.85 y NETDRAW 1.48*. https://www.researchgate.net/publication/264311672_Manual_introductorio_al_analisis_de_redes_sociales_Medidas_de_centralid

Villavicencio-Gutiérrez, M. R.v Martínez-Castañeda, F. E. y Martínez-Campos, A. R. (2018). Financial evaluation of Maguey pulquero products portfolio in Mexico's central highlands. *JAEID, 112* (2):361-379. https://oaj.fupress.net/index.php/jaeid/article/view/11173