Paradigma económico | Año 13 Núm. 2 | julio-diciembre 2021 | ISSN: 2007-3062 | pp. 185-215

Territorial governance agreements for agri-food system's innovation. An approach from "Amaranth" in Mexico City

Laura Elena Martínez-Salvador[1]

Abstract

Collaborative process among stakeholders, through governance agreements, may foster innovation in a territory. These territorial governance agreements (TGAs) could be held between Productive Units (PUs) and stakeholders from scientific-technological (S&T), industrial-productive (P&I) and government-institutional (G&I) structures. Considering this, the main objective of this paper is to analyze the effects of the TGAs on the level of innovation of PUs in the agri-food system of amaranth in Mexico City. To do this, a mixed methodology was used based on case study, semi-structured interviews and a survey applied to each PU's owners. The information was analyzed using statistical methods and a qualitative analysis was performed considering each PU's type of innovations. It is concluded that if the level of TGAs within stakeholders increase, so does the innovation level in the PUs in the amaranth agri-food system.

Keywords: territorial governance agreements, innovation, agri-food system.
JEL Clasificacion: O31; O13.

* Investigadora Asociada en el Instituto de Investigaciones Sociales, Universidad Nacional Autónoma de México, México. Correo: laura.martinez@sociales.unam.mx..

RECEPCIÓN: 15/12/2020 ACEPTACIÓN: 01/03/2021

Resumen

Acuerdos de gobernanza territorial para la innovación de sistemas agroalimentarios. Un acercamiento desde el "Amaranto" en la Ciudad de México

La colaboración entre *stakeholders* (actores relevantes), a través de acuerdos de gobernanza, puede fomentar la innovación en un territorio. Estos acuerdos de gobernanza territorial (AGT) podrían celebrarse entre Unidades Productivas (UP) y actores de las estructuras científico-tecnológica (CyT), industrial-productiva (IyP) y gobierno-institucional (GyI). Teniendo esto en cuenta, el objetivo principal de este trabajo fue analizar los efectos de los AGT en el nivel de innovación de las UP en el sistema agroalimentario de amaranto en la Ciudad de México. En este sentido, se utilizó una metodología mixta basada en estudio de casos, la aplicación de entrevistas semi-estructuradas y encuestas a los dueños de las UP. La información se analizó mediante métodos estadísticos y se realizó un análisis cualitativo considerando el tipo de innovaciones de cada UP. Se concluye que, si aumenta el nivel de AGT entre stakeholders el nivel de innovación en las UP del sistema agroalimentario del amaranto también presenta un incremento.

Palabras clave: acuerdos de gobernanza territorial, innovación, sistema agroalimentario.
JEL Clasiffication: O31; O13.

Introduction

Agri-food systems, especially agro-industrial units or enterprises, require continuous innovations to meet food-market demands at both local and global level, and to address pressures and trade-offs resulting from macroeconomic impacts, multi-structural problems, and increasingly information asymmetries (Rama, 2017). These innovations must be supported by the articulation of different forms of governance (Contini *et al.,* 2020). Innovation, as the development of a new or significantly improved product, process, organizational process or marketing methods (OECD,2005), is a collaborative activity (Laursen and Salter,

2006) based on human relationships, negotiating schemes, coordinating efforts, articulation, and learning (De los Ríos *et al.,* 2011).

This perspective of innovation diverges from the linear model of innovation that has characterized hegemonic economic theories, which describes it as a one-way isolated process. Under this new interactive vision, innovation is built on collaboration between actors, exchange of technological, tacit, and explicit knowledge, and the existence of learning processes within organizations (Morgan, 1997).

Interactive models consider innovation as the product of linking activities within a production chain in the form of feedback circuits, which pursue common objectives. In these models, innovation is originated by the identification of commercial opportunities where the creation of knowledge and learning are given as part of the same process, and where collective actions and personal and institutional networks result in comprehensive developments of invention, innovation, and dissemination (Morales, 2004).

However, given the heterogeneity of the stakeholders (which are actors -or a group of individuals- that can affect or could be affected by the fulfillment of defined objectives, and whose participation is vital to achieve those goals [Fontaine *et al.,* 2006]) who carry out innovation activities, there is a need for a theoretical approach that integrates a variety of factors, from the level of innovation within the organizations up to the collective agreements built (or governance agreements in the territory), which could be formal or informal, among stakeholders of the system, to promote innovation for the sustainable management of territorial resources, This approach build upon the idea that the territories are those socio-cultural spaces built beyond geographical spatiality, where innovation is being germinated. In this sense, the objective of this research was to analyze the Territorial Governance Agreements (TGAs onwards), under a comparative perspective approach created between Productive Units (PUs) and stakeholders from scientific-technological (S&T), industrial-productive (P&I) and government-institutional (G&I) structures, along with the effects of these agreements onto the degree of innovation of selected PUs in the agri-food system of amaranth (Amaranthus hypochondriacs), which is a Mesoamerican native crop, mainly produced and transformed in Mexico City, with great importance in the territory.

1. Theoretical background

1.1 Innovative environments. The role of the territory in innovation

Considering an interactive vision of innovation, an innovative environments might be described as "the set of relationships [and subjects] that integrate a local production system and an industrial culture [to generate] a localized dynamic process of collective learning" (Camagni, 2003: 40). These innovative environments become spaces that encourage geographical and sociocultural proximity of organizations and stakeholders, proximity that is based on the existence of a set of rules, value scales, trust bonds, patterns of shared behavior and feelings of identity and belonging to the territory, elements that condition the effectiveness of economic activities and innovation processes (Poméon and Fraire, 2011). This territorial proximity promotes building competencies and capacities that encourage the reduction of uncertainty, the creation of networks that support the credibility of organizations in the environment, and the coordination of collective actions and learning processes, which favors the existence of innovative processes (Camagni, 2003).

For Méndez (2006) the spatial agglomerations found around productive chains generate tactical technological knowledge which encourages collective learning processes increasing the rate of innovation and economic performance, especially since the links and arrangements between stakeholders create organizational sets and cooperation relationships under a territorial logic. Under this territorial logic, collaborative relationships are generated based on specific rules and community knowledge that fosters the learning process and territorializes innovation (Méndez, 2006). This learning process, and the consequent innovation, requires a wide range of negotiations and coordination arrangements between multiple stakeholders, which implies a series of governance processes in those spaces where territorial peculiarities converge.

1.2. Territorial governance arrangements and stakeholders for agri-food innovation

The new role of the territory on innovation implies that institutional arrangements, negotiation processes and social networks must be considered. In this sense, governance strongly emerges as a construct that drives territorial resources management, thus facilitating innovation

(Davoudi *et al.,* 2008) and allowing to reflect on the territorial nature and multi-actor dialogue that gives way to innovation (Salcido et al., 2016). This governance is built by the presence of new collective actors, who emerge under different societal contexts (Aguilar, 2006) in order to achieve public-private agreements focused on solving problems of common interest (Kooiman, 2003). Governance is based on co-management of the territorial planning decisions and the human connection towards natural resources (Valverde, 2016). Also, governance is traditionally observed as a set of normative principles, elements of social participation and collective decision-making to carry out the direction or coordination of society and it is a concept that, in the light of collectivity and territorial build-ups, has required a reconsideration in its definition (Rosales and Brenner, 2015; Zubriggen and Milanesi, 2008).

The contribution of the present paper relies upon the discernment of governance, especially territorial governance (Torre and Traversac, 2011) not only from its role in territorial resource management processes but also, by considering the socio-economic characteristics, local knowledge, and context of the stakeholders of a territory, and the role of these elements in the construction of formal and informal arrangements. In this sense, we propose that territorial governance needs to be understood as those collective agreements built, formally or informally, among stakeholders of a system, aimed to building capabilities, as well as the formation of institutions, and the coordination of socio-economic processes that allows the sustainable use of tangible and intangible territory resources.

Nonetheless, for territorial governance to exist there is a need for a geographic, organizational and institutional proximity between local agents as well as a spatial concentration of similar and specialized business (Sanz & Moragues, 2016). Also, for Davoudi and others (Davoudi *et al.,* 2008), territorial governance is a model of the organization of collective actions, based on principles of coordination, transparency, and trust (Nooteboom, 1999) among actors whose interests are oriented towards a common objective of territorial development.

So, this research´s perspective relays on understanding TGAs and all those links, formal and informal, based on the physical and sociocultural proximity between different stakeholders of a system.

Within the innovative territories, TGAs can articulate resources for learning processes, accumulation of technological capacities, and

can act as drivers of the level of innovation, through multi-stakeholder collaboration. The participating stakeholders on TGAs are part of different structures that could be described considering the original approach of the Relationship Triangle (Sabato and Botana, 2011) and from the evolutionary perspective of the Triple Helix (Etzkowitz and Leydesdorff, 2000). These stakeholders' structures are: (i) scientific-technological (S&T onwards), (ii) productive-industrial (P&I) and (iii) government-institutional (G&I) structure.

The S&T structure comprehends all organizations that belong to the education system, such as scientists, institutes, and research centers (Sabato and Botana, 2011). Organizations of the S&T structure are promoters and transformers of scientific and technological knowledge that can be materialized into innovations, to address demands of a market or a system.

Another structure that integrates stakeholders whose agreements are necessary for innovative development is the P&I, which integrates those organizations that demand technological knowledge. These organizations are transformers and makers of innovation (Sabato and Botana, 2011) and it comprehends all companies, industrial groups, chambers of commerce as well as non-governmental organizations or civil associations to support productive activities, suppliers of input materials, equipment, machinery or other technical services, consultancies or knowledge transfer agencies.

On the other hand, the G&I structure envisages all those institutions that design and implement public policies aimed at the development of innovation, and whose mobilization of resources for this matter, are directly pointed at P&I through direct stimulus, innovation subsidies, tax condonations, and indirectly to the S&T through projects and innovation scholarships. This resource mobilization is carried out through administrative processes (Sabato and Botana, 1986).

The interrelationship between stakeholders of each structure (S&T, P&I and G&I) for the development of innovation depends extensively on the ability of these structures to use their knowledge, and incorporate it into their strategies, as well as to unify efforts and lead actions towards common goals. This linkage is a condition that, for it to be implemented, requires consideration of the cultural systems, values, attitudes, and beliefs that motivate the behavior of subjects (Sabato and Botana, 1986), which is possible through a territorial approach.

Therefore, TGAs, for the development of innovation, are grounded on the idea that PUs are the knowledge transformers and architects of innovation, greatly linked to the S&T and G&I structure.

(i) Between P&I - P&I. This inter-firm linkage can be considered more beneficial for innovation when presented between PUs with differentiated products or in different markets (Nootebom, 1999) where competition does not become a cooperation barrier. However, a TGA can generate collaboration at different levels to drive PUs innovation like through the purchase of input materials between stakeholders which are relevant for technological innovation (Roseboom, 2003); the purchase or temporary use of equipment or machinery owned by other companies. These activities can have a normal level of contribution to innovation. TGAs whose cooperation involves the synergy of resources, human capital, sensitive knowledge around processes, collaborative design of technology, and acquired risk-sharing, would involve a high level of contribution towards innovation.

(ii) Between the R&P-S&T. S&T organizations create frontier knowledge and play an important role in innovation systems through the transference of their expertise and technologies (Filippetti and Savona, 2017) towards P&I. Nonetheless, and despite the role that P&I-S&T linkages have to foster innovation (Perkmann *et al.,* 2013), the nature of agreements does define their effects on the level of PUs innovation. In this sense, a medium contribution to innovation comes when universities or research centers carry out activities that involve human resources development, such as student agreements for their professional development, fieldwork, thesis research, or technical reports. On the other hand, a high level of cooperation, where TGAs could have a high impact on the level of PUs innovation, is presented when unifying resources from both the S&T and PUs structures for supplies improvement, such as the design, development, or implementation of machinery and technological equipment for production systems. In the agri-food sector, this could mean the use of improving seeds, the design of a new irrigation equipment, the development of novel harvesting methods, the use of information technologies and agronomic management techniques and quality assurance systems, and the collaboration in specialized research for product transformation, such as bromatological studies for nutraceutical improvement.

(iii) Between P&I-G&I. Support from G&I structure towards innovation has been increasing in the last decades, especially concerning the use of public policy instruments such as government financial resources, direct and indirect financial instruments (tax incentive or tax-cuts) promotion programs and technology transference programs (PWC, 2020; Solleiro and González, 2002). In this scenario, strategies that may have a medium level of impact of TGAs on PUs innovation levels would involve receiving and exercising financial supports or stimuli, whether in the form of direct or indirect transfers; support for the acquisition of equipment; in-kind supports or technological training to improve productive process. However, although these actions may affect the innovative behavior of the PUs, the highest level of articulation is presented when resources from G&I structure are directed to the design of specialized equipment or machinery for production processes or transformation through a synergy with local stakeholders.

2. Contextual background

2.1. The case of the amaranth agri-food system in Mexico City

Amaranth (by its scientific name *Amaranthus hypochondriacus* L.) is an ancestral crop of Mesoamerican origin, whose first archaeobotanical registers can be located just over 4 thousand years ago (Martínez and Alvarado, 2019). Although little information exists regarding global amaranth production, it is possible to find extensive literature on the exceeding food properties of amaranth and its possibilities to tackle complex problems, such as malnutrition (Espitia *et al.,* 2010; Santiago *et al.,* 2014).

In Mexico amaranth can be found in at least 18 of the 32 federal entities; however, by 2018, most production came from the state of Puebla, followed by Tlaxcala, State of Mexico, and Mexico City, with a maximum of 5,125 tons in the case of Puebla, and a minimum of 152 tons for Mexico City (SAGARPA, 2020) therefore mayor production is concentrated in central Mexico.

Mexico City, one of the most densely populated cities in the country, concentrates the largest number of amaranth agro-industrial productive units, especially in the town hall of Xochimilco. In this town, those units have made the production, transformation, and marketing of amaranth

its main economic activity, which means that they invested efforts into rescuing the cultural, agronomic, and nutritional value of the seed, while adding up value into their food products. These amaranth agro-industrial units require an enormous amount of amaranth seed as it is a primary raw material. Therefore, Mexico City has become an anchor for the amaranth agri-food system in the country´s central region.

The town hall of Xochimilco in Mexico City is considered as "[the] traditional [region] of amaranth production" (Ramírez *et al.,* 2010: 64) where the tradition, the tangible and intangible knowledge, and the know-how around amaranth- activities in this region have been inherited from parents and grandparents (Manzo and Ornelas, 2011). For Ramírez and collaborators (Ramírez *et al.,* 2010), the amaranth producers of Xochimilco have managed to preserve the cultivation of amaranth, and its genetic diversity, due to a vision of collective identity and common roots. The innovation around amaranth crop in the region has also taken place through a series of (organizational) innovations aimed at the rescue of natural areas and landscapes (Escalante, 2010) and environmental restoration. Product and process innovations can be materialized through the generation of new foods with high nutritional content and quality standards; and finally, marketing innovations using social media to improve sales numbers. Some of these innovations are been carried out in the 500 mini-workshop units localized in the town hall of Xochimilco (INEGI, 2019).

3. Materials and Methods

3.1. Study area

The study site is within the town hall of Xochimilco, in the south-east of Mexico City. Xochimilco has an area of 12,517 ha, from which 15.5% is destined for conservation soil while around 79.9% is cultivated (SEDEMA, 2016). The main reasons for selecting Xochimilco town hall as the study area for this research were: (i) in this town hall, a significant percentage of the local population is engaged in amaranth productive activities and some other agricultural process performed under traditional forms. Those activities are especially important for local culture and the economy of the territory. In fact, since 1987, Xochimilco was recognized as cultural heritage of humanity by the United Nations Education Organization, Science and Culture (UNESCO) (SEDEMA,

2016: 57); (ii) also, already stated, Xochimilco is the main amaranth's productive region in Mexico City and where most amaranth-added-valued activities take place, mainly because there is a (iii) high concentration of amaranth agro-industrial units that makes Xochimilco a local cluster of amaranth crop, having great relevance for the amaranth seed's closer producers states (Puebla, Tlaxcala, State of Mexico, Morelos and Hidalgo), that deliver a significant amount of their production towards Xochimilco agribusinesses. Besides, (iv) Xochimilco has a longline tradition a cultural relation to amaranth; for instance, in 2016 the Alegría (traditional sweet made out of nuts, amaranth, and honey bee) received the Intangible Heritage appointment given by the Ministry of Culture of Mexico City.

3.2. Data Collection and Sampling Methods

To analyze the existing TGA among amaranth PUs and stakeholders in the amaranth agri-food system, a case study methodology, under a comparative perspective analysis, was used, where various amaranth PUs were observed to identify their relationships, convergences, and discrepancies (Piovani and Krawczyk, 2017), which broaden the known information of that social phenomena and how social actors unify efforts to achieve objectives (Bartlett and Vavrus, 2017; Yin, 2009). This approach also helped to learn how TGAs influence the level of PUs innovation.

To gather specific information on single subjects, a semi-structured interviews and a survey was applied to the owners of seven amaranth's PUs. The interviewed and surveyed stakeholders are currently localized in Mexico City, and the selection of the PUs was made from a non-probabilistic snowball sampling. To be able to do that kind of sampling, the first contact was made with one of the most recognized amaranth organizations within the study area: the Sistema Producto Amaranto A.C (civil association Amaranth Productive System, APS onwards) in Mexico City.

3.3. Conceptual structure and methodology for estimation

For collecting information, a semi-structured interview and a semi-open survey was designed and applied to owners of each agri-food PU during 2018 and 2019.

The questions aimed to gather general information of the PUs innovative behavior in the last three years, which could have been developed in terms of the types of innovation (product, process, organization, and marketing). Other questions focused on identifying the unit's ability to create links, at different levels, and create formal and informal TGAs with other stakeholders in the amaranth agri-food system, to exchange knowledge and information, and whose articulations might have effects on the innovation level. This part analyzed the specific ways in which the agreements, if any, were presented between each classification of stakeholders.

The interviews were transcribed and information was thematically selected; also, the survey's results were systematized using MS Excel® program, so it was possible to the imbedded statistical methods to obtain correlation coefficient, multiple linear regression coefficient of determination, and a Chi-square test.

To prove that TGAs can influence the level of innovation of PUs, the starting point is the premise that the variable of interest (dependent variable) or 'innovation level (INNO_L onwards)' is a linear function of other independent (behavioral or independent) variables such as agreements with the P&I structure (LINK_PROD onwards), the S&T structure (LINK_SCIEN onwards); and the agreements with the G&I structure (LINK_GOV onwards).

So, the previous conceptualization of the relationship among variables leads to the following equation, which is a vector of independent variables (Xn):

$$Yi= b1X1+ b2X2 + b3X3+\mu i \quad (1)$$

Where Yi, implies the innovation level as a summon of the four types of innovation in each PU. On the other hand, b1, b2, b3, are the parameters to be estimated with μ as a symbol of the error or residual of the linear regression model. It is important to note that the dependent variable (INNO_L) was obtained by adding up the individual observations corresponding to the level of innovation, for each type of traditional innovation (product, process, organizations, and marketing), carried out in each PU. Also, independent variables (LINK_PROD; LINK_SCIEN; LINK_GOV) were obtained from the survey applied to the PUs, adding

up individual observations on the agreement levels with each stakeholder, focusing on activities that could lead to innovation. These levels of agreement and innovation levels ranged from 0 to 3 values depen-

Table 1
Description of categories, values, and qualitative meaning, of both level of innovation and TGAs

Level of innovation	Value	Xt=ho+t*h1
No	0	No mutual knowledge existed
We are assessing to implement some innovation procedures but had not done it yet	1	recognition of part of the unit around the activities of the other actors, but no linkage had been established
The development of some type of innovation is in process	2	agreements had been created, formal and informal, to collaborate sporadically, albeit without compromising or exchanging resources
Yes	3	Resources, efforts, and knowledge had been constantly integrated to solve problems and achieve mutual objectives.

Source: Own elaboration based on author´s methodological approach.

ding on the deepening of the agreement and the intensity of the innovation level. This is summarized in Table 1.

Consequently, to understand the effect of independent variables in the level of innovation, statistical methods were used to analyze the results of surveys from a quantitative perspective. These statistical methods were: (i) determination of the correlation coefficient between variables, which helps to identify the relationship (linear association) between two variables, and the degree of linkage between those variables; (ii) multiple correlation coefficient; (iii) coefficient of determination (R2) of the regression; (iv) calculus of the value of the coefficients (b1, b2, b3); (v) definition of the best adjustment line; (vi) significance of regression or value 'F' statistic, which was tested at 95% reliability with an α: 0.05. It is important to notice that the value of the F parameter in a Variance Analysis is commonly used to reject the null hypothesis that regression is not significant. The results were obtained from performing a multiple linear logistic regression model. This method is relevant for assessing the effect of independent variables on the dependent variable, especially when both are discrete, as is the case of this research, whose

variables are presented as the summation of each category of agreement per stakeholder, and the same as the summation of the level of innovation for each type of innovation (product, process, organizations, marketing). The final statistical methods that were used, (vi) Chi-square test, is particularly significant in this research given the size of the sampled units (N=7), to prove if the null hypothesis is true (that is if variables are independent among each other's) considering high, medium, and low levels of innovation as (i-columns) and high, medium, low levels of linkage governance agreements (j-row).

4. Results

4.1. Statistical estimation and simple linear regression model

Table 2
Descriptive statistics of dependent and behavioral variables

	Mean	Min	Max	SD_1	Skewness	Kurtosis
INNO_L	6.57	3.00	11.00	2.76	-0.37	0.43
LINK_PROD	9.86	7.00	15.00	2.73	1.57	1.03
LINK_SCIEN	4.43	2.00	6.00	1.40	0.17	-1.08
LINK_GOV	2.57	2.00	3.00	0.53	-2.80	-0.37

Source: own elaboration based on model calculations. [1] SD= Standard Deviation

Considering the methodological steps mentioned above, the descriptive statistic corresponding to the data collected is presented in Table 2:
It is possible to identify in Table 3 whether the variable 'innovation level (INNO_L)' (displayed as a dependent variable) presents some

Table 3
Correlation between dependent and behavioral variables

	INNO_L	LINK_PROD	LINK_SCIEN	LINK_GOV
INNO_L	1.00	-	-	-
LINK_PROD	0.76	1.00	-	-
LINK_SCIEN	0.88	0.59	1.00	-
LINK_GOV	0.53	0.41	0.29	1.00

[1] Source: own elaboration based on model calculations.

level of correlation with the level of linkage for each classification of stakeholders in the system.

The results of Table 3 indicate that all independent variables, individually, have a positive moderate correlation with innovation, so that, when one of the variables increases, so does the dependent variable, as

Table 4
Statistical results (coefficients and regression)

(ii) Multiple correlation coefficient	0.95		
(iii) Determination of R2 coefficient	0.91		
Typical error			
1.19	0.88		
Number of observations	7		
Variables	(iv) Value of coefficients	Typical error	
LINK_PROD	0.30	0.23	
LINK_SCIEN	1.26	0.43	
LINK_GOV	1.18	1.00	
(vi) Variance analysis		Estimated value of F	Critical value of F
Regression significance		9.75	0.05

Source: authors calculations. Estimations were made considering a 95% confidence level, with an alpha error $\alpha = 0.05$ and a constant $\neq 0$.

direct positive correlation is expected to behave. On Table 4 the statistical results of the regression are displayed.

Considering the value, in descending succession, of the coefficients of the variables, the equation of the best-adjusted regression is displayed as follows:

(v) $Y = 1.26\,LINK\_SCIEN + 1.18\,LINK\_GOV + 0.30\,LINK\_PROD$ (2)

The values of the coefficients indicate that, in the face of a change in one unit of each of the independent variables, the level of innovation would change 1.26 units when changes occur in LINK_SCIENCE variable, 1.18 for the LINK_GOV, and 0.30 for the LINK_PROD variables. Also, the (vii) Chi-square test resulted in a value of 9.80 (for a significance level of α: 0.05, a level of trust of 95%, and 4 degrees of freedom with a chi-square value from tables of 9.48). Therefore, it is possible to reject the null hypothesis (9.80>9.48), which means that variables are not independent of each other, so significant information is generated by the variables considered in this case. The empirical results and discussions on this matter are further detailed in the next section.

5. Discussion

5.1. Territorial governance agreements for innovation in amaranth agri-food system

The analysis of each of the PUs (Table 5) allows us to identify their particularities, and to understand the relationship that each one of them has between the TGAs and their level of innovation.

In the first place, PU1 is a small Cooperative Society that started operations in 2005, and is considered a family-based PU; this implies that it was formed only by family members, although it currently has 9 employees. This PU is considered dynamically productive due to the inclusion of new products in its production line, although its owner recognizes that it still requires great efforts to increase productivity, as well as financial support to reduce the risk for innovation. The TGA's with other stakeholders are of relevance for this PU, but it's still having some resistance to share information related to new products (*PU1 Owner. Personal communication, Mexico City, April 2019*).

PU2 is a Rural Production Society launched in 2004; it has more than 21 employees and operates with two industrial buildings. This PU was formed as a family business, but currently has stakeholders-partners. In recent years it has shown growth which has allowed them

to invest in machinery and equipment to expand production capacity, they have also managed to incorporate different organizational strategies into their productive dynamics. Also, PU2 participates in all of the amaranth chain value and has shown great collaborative activity in the territory (TGA's). It is also considered a pioneer PU in the amaranth transforming process in the region (*PU2 Owner. Personal communication, México City, April 2019*).

PU3, founded in 2006 with 7 employees, is an organization under the tax regime Person with Economic Activities (PEA). This company has shown great changes and TGA's transformations in the last decade when it joined the APS in 2005 to create commercial and productive alliances, and this PU recognizes that much of its productive growth and recent innovations are the result of close bonds with other stakeholders in the town. It is worthy to mention that the recent internal administrative changes of PU3 have affected its innovation capabilities; however, this unit shows a business model focused on sales mostly out of the territory, which has favored its sale's growth (*PU3 Owner. Personal communication, Mexico City, May 2019*).

PU4 is a cooperative society that was established in 2005 and has 17 employees to date. The PU has expanded its production capacity in recent years, which has to generate technological development and process improvements, although the owner of PU4 acknowledges that they are reluctant to incorporate new productive and organizational processes, therefore its level of innovation is limited. It is worth mentioning that PU4 is a company that joined and helped APS in its origins, so it has been an active participant in its evolution and has shown great ability to link with other stakeholders in the region such as universities or other producers (P*U4 Owner. Personal communication, México City, May 2019*).

On the other hand, PU5 is an organization founded by a female amaranth producer under the PEA tax regime. This unit was established in 2014, with a family base of 7 people. PU5 founders belonged to a larger Cooperative Society, but in 2013 the breakdown of personal relationships forced PU5 creation, which was boosted thanks to founder's TGA's already formed in the territory with other stakeholders. These internal changes have limited PU5's capacity for innovation; although these changes have been the generators of organizational innovation (*PU5 Owner. Personal communication, México City, May 2019*).

PU6 is a unit that started operations in 2012 and is closely linked to PU2. This PU has only three employees, all family members. PU6's production model has leaned towards specialization through the amaranth popping stage, which is why this unit has become the main popped amaranth's supplier for PU2. This has increased PU6's sales volume, but has limited its searching neither for innovation nor the real added value of amaranth; this specialization model is what has also limited PU6's TGA's (*PU6 Owner. Personal communication, Mexico City, June 2019*).

Table 5

Amaranth PUs innovation (product, process, organization and marketing innovation)

	Product innovation	Process innovation	Organizational innovation	Marketing innovation
U1	Incremental innovation (form modifications and ingredients addition).	-	Creation of a Cooperative's Union	Use of social media advertising
U2	New products with high nutrient value. (protein concentrates aimed to sport's market)	Magnetic traps to remove impurities. Process changes base on standardization manifests such as Official Mexican Standards	Member of Mexico's National Crusade against Hunger	Use of social media advertising. Guided tours and promotion strategies.
U3	Incremental innovation (changes in product ingredients and sizes).	-	Formal integration to the ASP	-
U4	Incremental innovations for the local market (size modifications and ingredients addition).	Improvement in administrative strategies (analysis of processes, flows and times) for the optimization of resources. These processes were learned in courses taken at the Postgraduate College.	-	Use of social media advertising
U5	Incremental innovations for the local market (modifications ingredients content to increase nutrient value).	-	Formal integration to the ASP	-
U6	Creation of products with low glycemic index, creation of a new line of products (aimed to Arab's food market).	-	-	International Strategic Alliances and use of social media advertising
U7	Incremental innovation (changes in product ingredients and sizes).	Registration on the local Tax Administration System	-	Use of social media advertising

Source: authors elaboration based on the designed and applied survey. Prod stands for product; Pros stands for process; Org: stands for organizational; Mkt: stands for marketing.

Lastly, PU7 is an organization conformed only by two amaranth producers under the PEA tax regime; it began operations in 2014 and has been linked to ASP for 4 years. Its owner recognizes that TGA's especially those built on with APS have created commercial alliances; which has been of true necessity because PU7 has been in the market for a very short time, which has also generated a limited level of innovation due to its learning curve. PU7 has benefited itself from TGA's, which has translated into the invitation to participate in socio-cultural and academic events organized by APS (*PU7 Owner. Personal communication, Mexico City, June 2019*).

Table 6
Overview of the PUs of the agri-food amaranth system in Mexico City

UNIT	TGAs with other stakeholders	Innovation Levels	Most relevant types of innovation	Innovation level tendencies within the last 3 years			
				PI	PrI	IO	MktI
PU1	14	7	Prod- Pros	↗	≠	↗	→
PU2	24	11	Prod- Pros- Org- Mkt	↗	↗	↗	↗
PU3	16	6	Prod - Org	↗	≠	↗	≠
PU4	19	9	Prod- Pros- Mkt	↗	↗	≠	↗
PU5	17	6	Prod- Org	↗	≠	↗	≠
PU6	11	3	Prod- Mkt	→	≠	≠	→
PU7	16	4	Prod- Pros- Mkt	→	→	≠	→

Source: authors elaboration based on the designed and applied survey. PI stands for Product innovation; PrI: Process Innovation; IO: Innovation within the organization and MktI: Marketing Innovation. Finally, the symbology stands for: ↗ increase, → Ongoing and ≠ No changes.

Also, as mentioned in Section 3 (Materials and methods), information on the case studies that were analyzed and compared, based on the designed interviews and survey, have been summarized in Table 6, which synthesized the results of the answers given by the PUs.

As it can be seen in Table 6, those PUs with higher levels of TGAs such as PU2 and PU4 showed an increasing trend in the level of innovation in the last 3 years, especially in product and process innovation. On the other hand, the PU with the lowest levels of TGAs, PU6, has also showed the lowest level of innovation and reflects a deficient trend in this area in the last 3 years. This confirms that the TGAs with different stakeholders could favor the development of innovations in the PUs. However, as it can be appreciated in the equation of the best-adjusted

multiple linear regression model presented (eq. 2), the TGAs do not have the same effect on the level of innovation. Given the fact that the effects of the TGAs with other stakeholders are different, it is necessary to analyze the nature of the TGAs themselves. Therefore, in the following sections, we would attempt to understand the impact of the TGAs within the innovation levels of the PUs, by type of innovations per structure and with each stakeholder.

5.2. Process innovation, TGAs and PUs

First, it is worthy to mention that process innovation within UP has been presented in 42% (3 out of 7) of cases. This process innovation is based on changes made to address quality regulations, mainly those established by the Ministry of Health (SS, Secretaría de Salud, by its acronym in Spanish), such as national standards and methods for determining the presence of salmonella and optimal yeast levels in food, or those related to the treatment of heat-trapped amaranth for processing. Other changes in production processes incorporate strategic and administrative planning knowledge to improve production times and optimize work efforts.

In these process innovations, it is possible to identify TGAs between PUs and stakeholders of the S&T structure such as the one formed between all PUs with the Colegio de Posgraduados (COLPOS, Graduated College) for the development of socio-economic research related to the production of amaranth and the development of workshops, courses and diplomas focused on the improvement of the social organization. Besides, the Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP, National Institute for Agricultural and Livestock Forestry Research) developed, in collaboration with these agro-industrial units, a guide to technology transferences and good practices in the production of amaranth. This included protocols around the proper management and control of plant diseases and harvesting techniques as well as amaranth threshing (Tavitas *et al.,* 2012). Also, the Universidad Autónoma Metropolitana (UAM, Metropolitan Autonomous University) designed and installed 'pilot' plots where innovations at the first stage of amaranth production were tested, such as the preparation of vermicompost and compost, accompanied by the weeding process for disease control of the amaranth plant. The implementation of a 'pilot unit' of amaranth production was carried with three

other surveyed agro-industry (P1-P3), allowing these same actors to learn from the innovations during the process. Also, units PU1 to PU3, and PU5 collaborated with the Universidad Autónoma de Chapingo (UACh, Chapingo Autonomous University) to design amaranth grain trapping machines.

TGAs between the PUs with the G&I structure has been of particular importance. In 86% of cases surveyed, the resources requested by the PUs have been used for investment in machinery and production or plant equipment. These TGAs have been between PU3 and the Comisión Nacional de Zonas Áridas (CONAZA, National Commission of Arid Zones) through a national program aimed to support small producers for the development of arid zones (Programa de Apoyo a Pequeños Productores para el Desarrollo de las Zonas Áridas), especially for the acquisition of threshing machines for production processes.

In the same sense, it is important to mention that, through the APS social association, as an intermediary, all agro-industrial PUs generated formal TGAs with the Secretaría de Desarrollo Rural y Equidad para las Comunidades (SEDEREC, Secretariat of Rural Development and Equity for Communities), these agreements aimed at the development of machinery and technological equipment, as well as for the refurbishment of production plants and the purchase of supplies for primary production. Other necessary TGAs were also achieved between PU1 and PU2 and the Servicio Nacional de Inspección y Certificación de Semillas (SNICS, National Seed Inspection, and Certification Service) for the registration of native amaranth varieties.

Between actors in the P&I structure with PUs, TGAs it is important to mention that all PUs surveyed, retain a sense of identity and common roots that greatly influences their productive decisions, especially during the partnership with other actors in the same area (P&I). This has some dichotomic results; on one hand, it lowers transaction costs as confidence increases, but at the same time creates barriers to the entry of new non-local actors (Nooteboom, 2000), which could halt exogenous innovation processes. But for local actors who manage to establish TGAs, formal and informal, these agreements materialize into the exchange of ideas, the resolution of common conflicts. Nonetheless, most of these linkages revolve around the flow of raw materials between producers and transformers, and it is common to see collaborative efforts to meet market demands. In terms of activities to drive

process innovation, it is important to emphasize that the acquisition, improvement, or adaptation of machinery and equipment, is carried out by all PUs, although only 57% (4 out of 7) of these PUs have relied on local suppliers, or others PUs, for the design or development of specialized equipment for the amaranth industrialization process. This is due to the high level of distrust, disinterest, and non-collaborative competition dynamics existing between PUs within the agri-food system.

5.3. Product innovation, TGAs, and PUs

Regarding product innovation, the survey results showed that PU product innovations materialize in different practices, such as: (i) productive diversification: the creation of new products based on amaranth, modifying size and shape, flavor, ingredients; (ii) incorporation of products with low glycemic indexes, to target the diabetics' market; (iii) creation of products of high nutritional value such as protein concentrates, concentrated flours, designed for athletes, seniors, and children; (iv) obtaining amaranth protein concentrate with protein levels greater than 30%.

In this matter, the introduction of new products over the past three years has been carried out in only 57% (4 out of 7) of PUs; a remaining 28% (2 out of 7) of the agro-industrial PUs are in the process of implementing or planning the incorporation of new products into their production strategies. Besides, industrial property protection practices are not significantly present in the PUs, as only 50% (2 of the 4 that have incorporated new products) registered their new products, brands or have used any form of institutional protection into their novelties through trademarks.

In this sense, for product innovations, TGAs with the S&T structure materialized in the collaboration that PU1, PU2, and PU3 developed with the Instituto Nacional de Ciencias Médicas Salvador Zubirán (INCMNSZ, National Institute of Medical Sciences and Nutrition) to identify the nutritional content of amaranth and the performance of bromatological studies, which is the first step to know the nutritional contributions of amaranth food and, a step needed, to be able to develop food improvements. Also, collaboration with INCMNSZ also contributed to producing higher nutritional content foods, such as protein flours, pasta, or snacks, all based on amaranth flour and maize.

In this same product innovation matter, TGAs between G&I and PUs (all of them) have had a broad impact on the level innovation;

results showed that for 83% of the PUs, the resources requested for productive activities have resulted in changes and improvements in packaging, which also led to an increase product quality.

On the other hand, TGAs between the PUs and stakeholders of the P&I structure was formalized when collective marks were achieved. The registration of this kind of institutional protections is an important activity in the development of agri-food products, although this has been done by only one of the interviewed units (PU1). It obtained the collective mark, through formal TGAs with the APS, along with the Central de Organizaciones Campesinas y Populares (COCYP, Central of Peasant and Popular Organizations); hence becoming the first collective brand of the region, called Don Quiri®. Also, PU7 and primary producers of the area established some other linkages to perform some experiments aimed at the improvement of amaranth seed, generating varieties of a new not registered creole seed, designed to endure planting in hillside spaces, which characterize the production area of Mexico City.

5.4. Marketing innovation, TGAs, and PUs

In terms of the implementation of new forms of marketing (innovation in marketing and commercialization), the trend and behavior of PU are highly contrasting. Only 28% (2 out of 7) of PUs have fully implemented some new form of marketing in the last 3 years; 14% (1 out of 7) is in the process of being implemented and 28% (2 out of 7) deny having generated any new marketing process whatsoever. Innovation strategies in the PUs surveyed, could materialize in actions such as: (i) promotion through social media and digital platforms; (ii) marketing in cultural spaces such as food fairs and bazaars; (iii) partnerships between micro-enterprises for collective brands use; (iv) PU's amaranth products positioning into self-service markets, naturist shops, shops specializing in artisanal, organic, and gourmet products.

In the field of marketing innovations, and as far as TGAs are done with the S&T structure, some examples are important to highlight. For instance, unit PU1, in accompaniment to the Instituto Politécnico Nacional (IPN, National Polytechnic Institute) formalized a collectively-based- company to boost the marketing of products in local markets, a novel marketing organization for PU1. Besides, a series of TGAs between the APS, including PU1 to PU7 and the UAM, the Instituto

Tecnológico del Altiplano de Tlaxcala (ITAT, Technological Institute of Tlaxcala), UACh, COLPOS, SEDEREC and the Instituto Nacional de Antropología e Historia (INAH, National Institute of Anthropology) signed as part of the "Algería of Santiago Tulyehualco, Xochimilco as Intangible Heritage of Mexico City" appointment in 2016. This formal and institutionalized recognition of the cultural, productive, agronomic, and social value of amaranth grain could contribute to the revalorization of amaranth grain in added value and specialized food markets.

Else ways, TGAs with the G&I structure have been done for developing marketing innovations; for example, 33% of PUs created new marketing channels, expanded the current market by 83%, or accessed accreditations or certifications by 17%, which provide certificates to dabble into the food market. On this matter, it is noteworthy that the management of spaces for the sales of their products, has been done within the framework of farmers' fairs, bazaars, artisan markets, local popular fairs, 'health weeks' and other public events, which constitutes a new form of marketing, for the PUs. For example, PU5 has generated collaboration agreements with some private organizations such as Fundación Santander to manage new artisan markets; and for PU1 to PU4, TGAs of a similar nature have been signed with SEDEREC for farmer's fairs. Also, with all PUs surveyed, TGAs for this type of innovation have been formalized, and institutionally recognized, through the installation of amaranth sales spaces during the 'National Amaranth Day', a commemoration celebrated each Oct 10th that, from 2016 to 2019, was carried out on the esplanade of Plaza de la República in Mexico City, a space of great importance for Mexican history and culture.

Finally, TGAs for marketing innovation, among stakeholders of the P&I structure, can be described as follows: in 70% of cases, the PUs surveyed have collaborated with other companies to create strategic marketing alliances, but especially with those stakeholders that do not manufacture the same amaranth products, and that do not represent direct competition for the PUs. These trade alliances, or formal governance agreements, are presented especially between PU2 and PU6, which have formed a productive link being PU2 the leader and main transformer of amaranth, and where PU6 has become the main supplier of amaranth as a commodity.

5.5. Organizational innovation. TGAs and PUs

Organizational innovations, the last type, acts as the main factor in adapting the organization to transformations and changes of the environment and, therefore, tending towards their sustainability; although it requires a binding component, it is a mostly endogenous process. Therefore, the appropriation and adoption of organizational innovations in companies are widely related to the transfer of information within the organization (Navarro *et al.*, 2018).

In this sense, for the PUs surveyed, concerning the incorporation into the company of some method of management of internal practices, work areas, business practices, and external relations of the company, only 42% (3 of 7) of the PUs have incorporated some new form of organization in the last 3 years. The organizational innovations of the surveyed PUs materialize in: (i) integration of PUs with civil associations such as the APS; and (ii) conformation of eco-guard groups formed by producers from the village area to implement conservation and care strategies for protected green areas dedicated to amaranth (Ramírez *et al.*, 2010).

These organizational innovations are presented, in the cases through the buildup of informal TGAs, especially with actors from the S&T and G&I structure through knowledge transfer processes, such as courses and training workshops around good manufacturing and food management practices, cost control, logistical and operational management, which ultimately could impact on the organizational structure of the PUs by creating new areas of marketing, delivery, social networks and sales, among others.

It is important to mention that, in all the forms of innovation observed (product, process, marketing and organizational), it highlights the absence of participation of consultancies or knowledge transfer agencies, which have not been able to penetrate the amaranth agri-food system and have not showed any interaction with the PUs; this mainly due to the reluctance of PUs to actively cooperate with outlander stakeholders.

Conclusions

Considering that stakeholders are vital actors in the territory that promote change and innovation in PUs, there is no doubt that agreements among these actors in any agri-food system are of great matter. This is explained because innovation is a complex, open, and interactive process, with a strong social component that requires collective actions. These formal and informal agreements put in place ever-changing cycles of knowledge and learning, allowing them to face changing and uncertain environments.

The case studies reveal that, although the level of product innovation in PUs is present in all cases, it is usually incremental innovation; and it mainly enhances due to the learning process that exists between the PUs, which have had to collaborate sometimes -by being part of the APS-, and to solve production issues such as supplies shortage or to solve some specific needs on the territory. Also, organizational innovations are presented to a lesser extent in the PUs mostly because they are considered as an internal change, so they do not completely depend on the TGAs, although it is precisely the breaking of some links with other stakeholders -as we could see in the descriptions of the case studies- that has precisely driven internal organizational transformations. On the other hand, process innovations could also be considered an element of internal change; however, they have been influenced by the existence of TGAs, especially because the knowledge to do so has been obtained from other actors -such as universities, research centers, or public institutions- which have provided tools for the change and improvement of processes. Lastly, market innovations are also linked to the knowledge obtained by TGAs, either with other companies or with the S&T structure, which have identified marketing strategies -such as the use of social networks-, while government institutions (G&I) have promoted the participation in local cultural and tourist events to promote local gastronomic heritage; which has ultimately driven market innovations in these PUs.

Also, this research, and the regression model estimated with the gathered data, have shown that has highlighted the fact that the TGAs that could have a higher effect on the level of innovation that occurs within PUs are those generated between them and the P&I and S&T structures. This is particularly because research centers, academic

bodies, and working groups have showed in the las decade an increasing interest around the study of Mesoamerican grains and cereals such as amaranth. This can be particularly linked to the recognition given to amaranth grain, by the United States Academy of Sciences and FAO in the 1980s, as one of the best plant-based foods used for human consumption and with the greatest potential for large-scale economic and nutritional exploitation (SADER, 2020).

Also, TGAs between the S&T structure and the PUs has materialized through the development of innovation projects where primary producers, and other stakeholders of the agri-food amaranth system, especially in the studied area, have carried out fieldwork, professional practices, sampling studies, knowledge exchange and recovery of know-how to of the amaranth-based-food cuisine. These interactions have sensitized the S&T structure to understand the real needs of productive stakeholders and have sometimes generated trusted links that transcend initial research projects, giving way to more synergistic collaborations with more homogeneous languages, which in return, enriches innovation. Besides, companies, agribusinesses, or producers perceived that the gap with the S&T structure has significantly narrowed down, so allowing both parties to learn from each other while developing accompanying schemes.

The linkage with the G&I structure, while showing a contribution to the level of innovation, usually has been restricted to one-way collaboration. This means that, since relationships have been limited to the application and formalization of agreements for obtaining financial resources, this have not always been precursors to innovation processes, especially since G&I resources have usually been used just for the purchase of some productive supplies; consequently, such agreements, while necessary, do not always drive sustainable innovative behavior, as it does not generate profound transformations in stakeholders' learning processes. Besides, the continuity of this kind of TGAs between PUs and G&I, depends on the permanence of public policy instruments and the continuity of financial programs aimed on this matter. Which in Mexico, it is already an enormous challenge because public policies in sectors such as science, technology, and innovation, are broadly subjected to administrative, regulatory, and budgetary changes, and currently rely on political swings, which in return creates institutional uncertainty.

Regarding inter-PUs linkages (or P&I and P&I), it is important to highlight the relevant role that APS has had for the strengthening of the TGAs in the amaranth agri-food system because it has become a conciliatory and unifying figure, that all the surveyed PUs have benefited from just by being a member of it, as stated above. The APS has an important degree of legitimacy and convening power, important elements for the sustainability of TGAs created within the system. This binding actor, and its participation as a promoter of TGAs agreements for agri-food innovation, require further analysis and it is a promising future line of inquiry and research. In conclusion, the quantitative and qualitative analysis performed showed that the higher the levels of TGAs, the PUs showed an increasing level of innovation, especially product and process innovation, which leads to the conclusion that TGAs within stakeholders could foster innovations in the PUs of the amaranth agri-food system.

This work provides an innovative vision, from the perspective of TGAs between stakeholders and the role they play in the innovation of the PUs, since it allows us to glimpse a part of the agri-food amaranth system of Mexico City, an issue that has not been sufficiently explored. Likewise, there is a large window of opportunity to expand this study and integrate more productive units into the analysis, and even to glimpse the relation between TGAs and innovation behavior or tendencies in other agri-food systems.

References

Aguilar -Villanueva, Luis (2006), Gobernanza y gestión pública, *Fondo de Cultura Económica*, México.

Bartlett, Lesley and Frances Vavrus (2017), *Rethinking Case Study Research: A Comparative Approach*, Routledge- Taylor & Francis, London.

Camagni, Roberto (2003), "Incertidumbre, capital social y desarrollo local: enseñanzas para una gobernabilidad sostenible del territorio". *Investigaciones Regionales*, 2-Spring, pp. 31-57.

Contini, Caterina, Giuseppe Marotta and Biancamaria Torquati (2020), "Multi-actor approaches to implement cooperative strategies and value chains based on sustainability", *Agricultural and Food Economics*, 8(1), pp. 1-4.

Davoudi, Simin., Neil Evans, Francesca Governa and Marco Santangelo (2008), "Territorial governance in the making. Approaches, methodologies, practices', *Boletín de la Asociación de Geógrafos Españoles*" (46),

pp. 33–52.
De los Ríos, Ignacio., José María Díaz-Puente, Jorge Cadena-Iñiguez (2011), "La iniciativa LEADER como modelo de desarrollo rural: aplicación a algunos territorios de México", *Agrociencia*, 45, pp. 609-624.
Escalante-Escoffié, Martha Cristina (2010), *Rescate y revalorización del cultivo del amaranto*, 1st.ed., Fundación Grupo Produce de la Ciudad de México, Instituto Interamericano de Cooperación para la Agricultura (IICA), México.
Espitia-Rangel, Eduardo., Cristina Mapes Sánchez, Diana Escobedo López, Micaela De la O Olán, Patricia Rivas Valencia, Guillermina Martínez Trejo, Lorena Cortés Espinoza, Juan Manuel Hernández Casillas (2010), *Conservación y uso de los recursos genéticos de amaranto en México,* 1st. ed., Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias, INIFAP, Centro de Investigación Regional Centro, Celaya, México.
Etzkowitz, Henry and Loet Leydesdorff (2000), "The dynamics of innovation: from National Systems and `Mode 2' to a Triple Helix of university–industry–government relations", *Research Policy*, 29(2), pp.109-123.
Filippetti, Andrea and Maria Savona (2017), "University–industry linkages and academic engagements: individual behavior's and firms barriers", *Journal of Technology Transfer*, 42(4), pp. 719–729.
Fontaine, Charles., Antoine Haarman and Stefan Schmid, (2006), The stakeholder theory. *Research Paper.* Bordeaux France: Edalys Dévelopment Durable et Responsabilité d' Entreprise.
INEGI (Instituto Nacional de Estadística y Geografía) (2019), *"Directorio Estadístico Nacional de Unidades Económicas* <https://www.inegi.org.mx/app/mapa/denue/default.aspx> [September 19th, 2020].
Kooiman, Jan (2003), "Societal Governance: Levels, models, and order of socio-political goverance" in I. Katenhusen y L. Wolfram (Eds.), *Demokratien in Europa.* Wiesbaden:VS Verlag für Sozialwissenschaften, pp. 229–250.
Laursen, Keld and Ammon Salter (2006), "Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms", *Strategic Management Journal*, 27(2), pp. 131–150.
Manzo-Ramos, Fernando and Gabriela López Ornelas (2011), '"El sistema alimentario regional del amaranto. Participación para la autonomía de los productores agroindustriales en una comunidad de Xochimilco, México", *Revista de Agroecología*, September, pp. 14-15.
Martínez-Salvador, Laura and David Alvarado-Ramírez (2019), "Protección institucional de la agrobiodiversidad. Un análisis desde los Sistemas Agroalimentarios Localizados de quínoa boliviana y amaranto mexicano", in Marie Renard and Jessica Tolentino Martínez, (coords.), *Red SIAL México*. Diez años de contribución a los estudios de los Sistemas Agroalimentarios Localizados, IICA-CONACYT-RedSIAL, Mexico, pp. 165–183.

Méndez, Ricardo (2006), "Difusión de innovaciones en sistemas productivos locales y desarrollo territorial", in *Memorias del III Congreso Internacional de la Red SIAL "Alimentación y Territorios, ALTER*, Consejo Superior de Investigaciones Científicas, IEG, Madrid, pp. 29.

Morgan, Kevin (1997), "The learning region: institutions, innovation, and regional renewal", *Regional Studies*, 31.5, pp. 491-503.

Navarro-Alvarado, Alberto, Rosario Cota-Yáñez, Cynthia González-Moreno (2018), "Conceptos para entender la innovación organizacional", *Revista de Comunicación de La SEECI,* 22(45), pp.87.

Nooteboom, Bart (1999), "Innovation and inter-firm linkages: New implications for policy", *Research Policy*, 28(8), pp. 793–805.

Nooteboom, Bart (2000), "Trust as a governance device" in M.C. Casson, A. Godley (eds.) *Cultural factors in economic growth,* 1st.ed Springer, New York, US.

Organización de Cooperación y Desarrollo Económicos, (OECD) (2005), *Manual de Oslo: Guía para la recogida e interpretación de datos sobre innovación,* 3rd.ed., Grupo Tragsa: Madrid.

Perkmann, Markus., Valentina Tartari, Maureen McKelvey, Erkko Autio, Anders Broström, Pablo D'Este, Riccardo Fini, Aldo Geuna, Rosa Grimaldi, Alan Hughes, Stefan Krabel, Michael Kitson, Patrick Llerena, Francesco Lissoni, Ammon Salter, Maurizio Sobrero (2013), "Academic engagement and commercialization: A review of the literature on university-industry relations", *Research Policy*, 42 (2), pp. 423-442.

Piovani, Juan Ignacio and Nora Krawczyk (2017), "Los Estudios Comparativos: algunas notas históricas, epistemológicas y metodológicas", *Educação & Realidade*, 42(3), pp. 821–840.

Poméon, Thomas and José Fraire (2011), "SIAL: un enfoque para el desarrollo territorial" in *Proyecto FONCICYT,* 1st.Ed. Red Científica en Sistemas Agroalimentarios Localizados, México City.

Price Water House Coopers, (PWC) (2020), Innovation: Government's Many Roles in Fostering Innovation. <www.pwc.com/gx/en/technology/pdf/how-governments-foster-innovation-2010.pdf> [October 24 , 2020].

Rama, Ruth (2017), "Innovation and the strategies of food and beverage multinational enterprises: A survey", *Systèmes alimentaires* / Food Systems, (2), pp. 31–48.

Ramírez-Meza, Beatriz., Guillermo Torres Carral, Pedro Muro Bowling, José Muruaga Martínez, David López Monroy (2010), "Los productores de amaranto en la Zona de Conservación Ecológica Teuhtli", *Revista de Geografía Agrícola,* 44, pp. 47-69.

Rosales-Ortega, Rocío and Ludger Brenner (2015), *Geografía de la gobernanza: Dinámicas multiescalares de los procesos económicos-ambientales,* 1st.Ed, Siglo XXI Editores, México City.

Roseboom, Johannes (2003), "The contribution of agricultural input industries

to agricultural innovation", *International Journal of Agricultural Resources Governances and Ecology,* 2 N° ¾, pp. 295-311.

Sabato, Jorge y Natalio Botana (1986), "La ciencia y la tecnología en el desarrollo futuro de América Latina". *Integración*, 3, pp. 2-11.

Sabato, Jorge and Natalio Botana (2011), "La ciencia y la tecnología en el desarrollo futuro de América Latina" in Sabato, J. (comp.) *El pensamiento latinoamericano en la problemática ciencia-tecnología-desarrollo-dependencia,* 1st.Ed., Ediciones Biblioteca Nacional, Buenos Aires, pp. 215-231

Sanz Cañada, Javier and Ana Moragues Faus (2016), *Gobernanza territorial y redes de difusión de innovaciones y conocimientos en las denominaciones de origen de aceite de oliva andaluzas.* XII Congreso Español de Sociología, 1–17. Gijón: Asociación Latinoamericana de Investigadores en Campañas Electorales.

Secretaría de Agricultura y Desarrollo Rural, (SADER) (2020), *Amaranto, el mejor alimento de origen vegetal.* Sistema de Información Agroalimentaria y Pesquera (SIAP) <https://www.gob.mx/siap/articulos/amaranto-el-mejor-alimento-de-origen-vegetal> [October 28, 2020].

Salcido-Torres, Gerardo., David Morales-Córdova and Víctor Velázquez Durán (2016), "Gobernanza territorial e innovación social en las áreas rurales. Dos estudios de caso", in A Sánchez Albarrán (ed.) *México rural ante los retos del Siglo XXI.* Mercados agrícolas globalizados. Tomo VI. Primera. AMER, 1st.ed. Universidad Autónoma de Nayarit, Universidad Autónoma Chapingo, Universidad Autónoma Metropolitana Azcapotzalco, México City, pp. 97-116.

Santiago, Priscila, Klaus Tenbergen, Elier Vélez Jiménez, María Anaberta Cardador-Martínez (2014), "Functional Attributes of Amaranth", *Austin Journal Nutrition Food Sciences,* 2 (1), pp. 1-6.

Secretaría de Agricultura, Ganadería y Desarrollo Rural, Pesca y Alimentación, (SAGARPA) (2020), *Amaranto, Sistema de Información Agroalimentaria de Consulta SIACON*. <https://www.gob.mx/siap/prensa/sistema-de-informacion-agroalimentaria-de-consulta-siacon> [October, 14th 2020].

Secretaría de Medio Ambiente, (SEDEM) (2016), *Programa de acción climática, Xochimilco 2016-2020* <www.data.sedema.cdmx.gob.mx/cambioclimaticocdmx/images/biblioteca_cc/PACdel_Xochimilco.pdf> [February 12, 2020].

Solleiro, José Luis and Albertina González (2002), *Políticas de Innovación: Concepto y experiencias internacionales*, 1st.ed., COMECYT, Consejo Mexiquense de Ciencia y Tecnología, México.

Tavitas-Fuentes, Leticia., Leonardo Hernández Aragón, Maribel Valle Veleros (2012), *Paquete Tecnológico para el cultivo de amaranto en el Oriente del Estado de México,* (No. 62) 1st.ed. Instituto Nacional De Investigaciones Forestales Agrícolas y Pecuarias (INIFAP), Secretaria de Agricultura, Ga-

nadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA) and Fundación Grupo Produce, México.

Torre, Andre and Jean Baptiste Traversac (2011), *Territorial Governance. Local development, rural areas and agrifood systems,* 1st. ed., Spring Physica Verlag, Heidelberg.

Valverde, Álvaro (2016), "La gobernanza ambiental como enfoque para la cogestión adaptativa", *Revista Integra Educativa*, 9(1), pp. 159–168.

Yin, Robert (2009), *Case study research. Design and methods*, 3rd. ed., SAGE Editors, New York.

Zubriggen, Cristina and Alejandro Milanesi (2008), "La gobernanza territorial: la brecha entre paradigmas y realidades", in CLAD (Eds.) *XIII Congreso Internacional del CLAD sobre la Reforma del Estado y de la Administración Pública.* Buenos Aires, pp. 4–7.