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AGRO-INDUSTRIAL CHAIN OF ADOBERA CHEESE IN THE JALISCO HIGHLANDS, AS A PROMOTER OF LOCAL AND REGIONAL DEVELOPMENT

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ABSTRACT

The objective was to determine, by analyzing Strengths, Opportunities, Weaknesses and Threats (SOWT), whether the agro-industrial chain of Adobera Cheese in the Highlands (Los Altos) of Jalisco could provide a focus for local and regional development. Structured surveys were applied to 55 milk producers, 13 cheese makers and 8 tradesmen, as well as open interviews with milk and cheese collectors, representatives of producer organizations and officials from back-up institutions. Information collected was organized based on the agro-industrial chain approach. According to collective memory in the region, Adobera Cheese from the Highlands of Jalisco is known by that name because the curd is placed in rectangular wooden molds, usually crafted from mesquite wood, producing a cheese similar in shape to an "adobe" brick, used in construction. Although this cheese is valued in the area and there are strategies that can be implemented to make the agro-industrial chain a focus of local and regional development, its main weakness must first be resolved, which is the producers' unwillingness to become organized. We conclude that good governance, as well robust social capital, is important for the chain to achieve this.

Keywords: collective action, family livestock farming, governance, product of animal origin.

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INTRODUCTION

World cheese production increased from 22 to 23.7 billion tons between 2017 and 2022, with an average annual growth rate (AGR) of 1.46% and it is forecast that in 2027 around 25 billion tons will be produced, which would represent a decrease in growth rate compared to the average recorded in the previous period (OECD/FAO, 2022).

In Mexico, Jalisco is the largest producer of milk, contributing a total of 2,629 million liters in 2020, with an AGR rate of 2.9% over the last 10 years (Agrifood and Fisheries Information System (SIAP), 2021). Los Altos is the main dairy basin in the state and the second most important in the country, after the Comarca Lagunera (National Institute for Federalism and Development, 2015; INEGI, 2012). This region is the main producer of an artisanal cheese, Adobera that is important for local gastronomy, which is produced throughout most of the state. The milk used in its production comes from Holstein cattle, mainly fed by grazing, with night confinement. Considering management and labor employed, this can be considered as family livestock that provides a very healthy and nutritious dietary input (Villegas de Gante *et al.*, 2014).

In Mexico, the dairy production chain, especially the cheese industry, is in a precarious state. Commercial expansion increased the diversity of cheeses, in terms of both quality and price, that are marketed in the country, a situation that damages small and medium-

sized producers due to the low volume of cheese they manage and the low prices of their product, as well as scarce dissemination and knowledge about the organoleptic properties of native cheeses (Cervantes *et al.*, 2019).

In Mexico, artisanal cheese production plays a significant role in the sustainability of microregions, boosting local economies, reducing migration, and preserving unique food traditions (Patiño *et al.*, 2021). Furthermore, the transformation of milk into cheese has multiple economic and social implications, as it permits the natural storage of milk for its transport to consumption centers or its preservation under challenging environmental conditions, such as tropical, or hot and dry areas (Villegas *et al.*, 2016).

Authentic Mexican cheeses represent the patrimony of territories that vary in size, with specific ecosystems; apparently the maturation of these foods is due to the fact that they are mainly found in wild areas, some of them with a high degree of marginalization and population displacement, making it necessary to revalue a product that may become a means of development, for which it is essential to improve production or marketing processes and establish legal protection certificates, such as collective trade marks (CM) or designation of origin (DO) (Agudelo *et al.*, 2017; Villegas and Cervantes, 2018).

An important aspect that affects the health quality of Mexican artisanal cheeses is their preparation with raw milk, due to the potential diseases that the consumer could contract. In this regard, the laws of different countries accept that, during the maturation process of a cheese made with raw milk, harmful germs gradually disappear until they become harmless. This is important, because, in September 2010, the Official Mexican Standard NOM-243-SSA1-2010 was published (Secretaría de Salud, 2010), which prohibits the production of cheeses made with raw milk, a situation that threatens the national gastronomic heritage. Adobera cheese is made with either raw or pasteurized milk.

Mexico is a country with an important artisanal cheese production; however, there are no specific and detailed studies providing information on the different agro-industrial chains of each cheese; the most complete study is that reported in the Atlas of authentic Mexican Cheeses Villegas *et al.*, 2014. Knowledge about these chains is important to preserve the cheeses and then select those that have the greatest potential to become foci of local and regional development. The objective of the research was to determine whether the agro-industrial chain of Adobera cheese from Los Altos de Jalisco can become a focus of local and regional development, as hypothetically, we propose that Adobera cheese will become a vector for development if robust social capital is generated between cheese makers and other actors in the chain.

THEORETICAL FRAMEWORK

Social capital and geographical factors as valuation requirements

To explain the dynamics detected in the production and distribution of cheese; we considered social capital, collective action and matters related to geographical indications. During the eighth decade of the 20th century, growing interest evolved concerning the use of the term "social capital", identifying as a starting point the works of Pierre Bourdieu,

James Coleman and Robert Putnam, who are considered pioneers in its conceptualization. (Natcher, 2015). For his part, Bourdieu (1986: 242) defined the term social capital as: "the sum of real or virtual resources that an individual or a group accumulates by virtue of possessing a lasting network of more or less institutionalized relationships, based on mutual and recognized knowledge".

This approach focuses on different forms of capital and their role in the reproduction of power relations that are unequal in nature (Ghauri *et al*., 2023); however, Putnam considered that social capital was derived from the networks, norms and trust that develops in a group working towards objectives that are shared by all members of an organization (Ghauri *et al*., 2023). In recent decades, it has also been pointed out that social capital is made up of economic, material or intangible goods, resulting from collective decisions, for the production of public commodities, property and common goods (Giovannetti *et al*., 2021). Furthermore, we speak of social capital, when the actors involved in exchange relationships provide different types of resources to those accessed by other members, for example, the processes of creating a geographical indication, as in the designation of origin or a collective brand. These quality schemes can only become a potential protection scheme, if the producers involved and local stakeholders, in general, cooperate and interact with public institutions to undertake the necessary steps to validate the product (Kokthi *et al*., 2021).

Geographical indications related to agri-food and artisanal goods have acquired special importance at the international level (Kokthi *et al*., 2021; Piñeiro *et al*., 2021; Ramírez *et al*., 2018). Authentic cheeses are artisanal foods that enjoy this legal protection, especially those of European origin (Enriquez-Sánchez *et al*., 2017) as a result of collective action and interest among the involved participants (Bernard-mongin *et al*., 2021). Notably, different factors can favor or limit collective action for the differentiation of specific food products, such as the number of key actors involved, which influences the frequency and regularity of face-to-face interactions and, therefore, the opportunities to strengthen "trust between producers" as a central element for successful collective action (Pachoud *et al*., 2020).

In this sense, Kokthi and collaborators (2021), have argued that collective action is a natural consequence of (i) the will to cooperate and (ii) trust and reciprocity between involved participants and from them towards the institutions. In turn, these characteristics are equally necessary for the development of geographical indications or designations of origin. These strategies function as mechanisms to reduce the effects of unfair competition, which is generated against local products, also seeking to increase the profits of producers. In short, educational and demographic factors can become an essential aspect concerning commitment and willingness to cooperate. It is important to emphasize that collective action does not simply evolve independently, but is preceded by the formation of a collective identity or a sense of "we" between individuals and groups (Bauermeister, 2016).

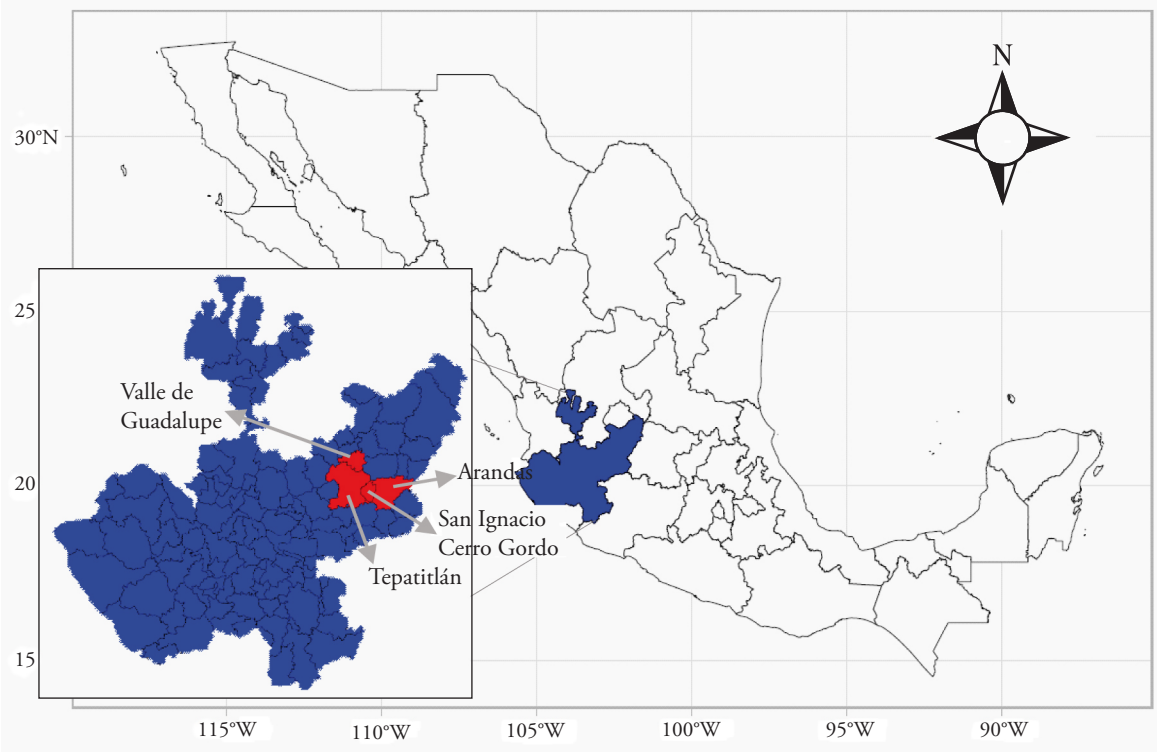
METHODOLOGY

The research was carried out in the municipalities of Tepatitlán, Valle de Guadalupe, San Ignacio Cerro Gordo and Arandas (Figure 1), pertaining to Los Altos and which have a historic dairy and cheese tradition.

Origin of information

The non-probabilistic sampling technique, known as "Exponential discriminatory snowball" was used to select the ranchers, cheese makers and tradesmen who participated in the survey (Scribano, 2007). This consists of asking local residents to identify individuals or groups with special knowledge concerning the phenomenon to be investigated; so that as progress is made, a set of resource rich information is compiled (Ulin *et al.*, 2006). Data were obtained by means of structured surveys of 55 milk producers, 13 cheese makers and 8 tradesmen, as well as open interviews with three milk and cheese transporters, two representatives of producer organizations and two from back-up institutions.

In the case of milk producers, transporters, cheese makers and tradesmen, a structured survey was designed, with the purpose of homogenizing asymmetries and precisely delimiting the information, using closed variables that made it possible to discern and



Source: self-elaborated.
Figure 1. Study region.

differentiate the status of the dairy production units, cheese factories and distributors. The structure of the questionnaires consisted of: i) general data on the producer, cheese maker or distributor; ii) costs and income; iii) vertical relationships; iv) horizontal relationships; v) back-up institutions. The questions in the open interviews intended to reveal the cheese-maker's perception of his activity. At the end, a SOWT analysis of amassed information was undertaken.

Information analysis

The statistical package SPSS, version 25 was used to obtain descriptive statistics of the information. Analysis of information was basically qualitative, exploratory in nature, examining and discussing each of the links in the agro-industrial chain, and their horizontal and vertical relationships.

Description of study region

This is an area of gentle hills, interspersed by shallow valleys. When traveling by road, you can see the stables of the dairy basin, on both sides of the road. It is known as "Los Altos", because the mountains and hills have altitudes that vary between 1,800 and 2,300 meters above sea level (Bassols, 1992; Institute of Statistical and Geographic Information of Jalisco, 2021).

RESULTS

The dairy basin known as Los Altos is located in the northeastern part of Jalisco state. It was founded by the Spanish who populated this part of the country during the colonial era, and who were familiar with the management of dairy cattle and their products. This allowed the transnational company Nestlé to establish itself in the region in the 1940s and collect milk from a production system based on family labor (Vázquez-Valencia and Aguilar-Benítez, 2010; Villegas *et al.*, 2014). Currently, this is the second most important dairy basin in the country and the place of origin of "Adobera" Cheese from Los Altos de Jalisco. This has occurred in spite of climatological and edaphic conditions, which are not conducive to the production of forage, as this is an area with low precipitation, with little potential for extracting groundwater, in addition to having shallow soils of poor fertility (National Meteorological Service, 2021). Thus, most of the livestock farms in the region must import fodder from surrounding states.

Farmers initially made Adobera cheese due to the difficulties of transporting the milk produced in dispersed and poorly communicated farms. This enabled them to market a product that preserves its physical-chemical qualities for a longer period. According to those interviewed, Adobera cheese from Los Altos de Jalisco is considered to have been produced for more than a hundred years and is known by that name because the curd is placed in wooden molds, normally made of mesquite wood, shaped in a rectangular prism, resulting in a cheese similar in shape to an "adobe" or "brick" used in construction.

Currently, this product has widespread acceptance in the region, is valued for its typical gastronomy and purchased by a wide range of consumers (Villegas, *et al.*, 2014).

Participants

Milk producers. The typical rancher in the region is around 50 years old and most are education up to primary school level; ranchers were found to have dedicated 60 years to livestock farming and the tendency is for production units to have operated for more than twenty years, rather than new dairies being established. Private property is the norm, consisting of an average surface area of 28 ha, where maize cultivation is dominant, using the stubble for animal feed and grain for family consumption, on marginal, mainly infertile land. The native grass is preserved, but without any management and as there are no divisions within the property, paddocks are not rotated.

In most cases, livestock feed is based on maize by products, such as stubble or silage, in addition to commercial concentrate, rain fed grass and grain. Other forage or seeds, such as oats, barley and alfalfa, are grown by the dairy farmer or acquired in the market, either from the region or outside it. Being an important dairy basin, producers or marketers of forage in the surrounding regions have a regular market which they take advantage of. Mineral salts are used as nutritional supplements; these are necessary to avoid reproductive disorders in cows.

The plots are divided by dry stone walls or barbed wire; on average farmers own around 40 cows, of which 25% are dry. Average milk production per farm per day is close to 500 liters; and the number of hand-milkers depends on the number of cows and whether or not they have a mechanical milking machine, with four being the maximum number, which occurs in larger farms that have not been modernized. Milk is stored in galvanized steel jugs and for transport to the cheese factories, there are two options: in jugs (cans) of the same material (40% of the volume) or in plastic drums (60%), the latter can contain a greater quantity of milk for storage. In most farms, they do not wash the teats as part of the milking process and those that do wash them, do not dry them at the end, and nor is it the norm to pre-seal or seal them.

The milk is sold, to cheese makers, although some milk is kept for pasteurization. In the case of cheese factories, they consider that the region's milk meets the quality parameters they demand, which is why they do not reject the deliveries, although in most cases, there are no rewards or punishments, related to the quality of the product. There is marked seasonality in the region, as in most of the country's basins, with a notable peak in milk production occurring between June and October; the rainy season.

In Los Altos, cheese makers have implemented three strategies to collect and store milk:

a) The dairy farmer uses his resources to transport it from his farm to the cheese factory. The most common means of transportation is a motorcycle or truck that he owns; it is also carried on the back of animals or in carts pulled by animals. In this system, transportation costs are absorbed by the producer; the containers used for

transportation are 40-liter galvanized steel jugs. This method of collection represents 20% of volume and involves 35% of producers. In the case of all forms of collection, payment for delivery of 1 liter in 2019 ranged between 6.9 to 7.0 pesos and in 2023 it cost eleven pesos; the most faithful suppliers or those who have been providing milk for the longest time, were offered the best price.

b) A driver collects it and takes it to the cheese factory. A freight vehicle owned by the transporter is used for its collection; all transportation costs are assumed by the driver and are contemplated in the price paid at the cheese factory for the product. The milk is collected in plastic drums with a capacity of 120 liters, owned by the driver. This system of collection accounts for 30% of volume and 40% of farmers sell their milk in this way.
c) Cheese makers and collection. Cheese makers use a truck or van to collect the milk in plastic drums that they own with a capacity of 120 liters and they assume the transportation costs. Under this scheme, half of the total quantity is collected and involves 25% of farmers, but they are also those who deliver the greatest number of liters of milk, on average.

Cheese factories process an average of around 5,000 liters of milk per day, destined to produce four types of cheese: Adobera, 40% of the total volume, Cotija type (10%), Asadero (30%) and fresh cheese (20%). The cheese yield varies between 9 and 12%, depending on the percentage of total solids of the milk, the breed of cow, the food they receive, the time of year, the liters that the animal is producing, the stage in the lactation cycle of the cow, etc.

Cheese factories have both permanent and occasional direct buyers. Besides this, the cheese is sold to merchants in the local market and nearby municipalities, where clients include restaurants, creameries, pizzerias, neighborhood stores, specific clients, street vendors and the general public. The period of greatest demand is from October to January, during Easter, Christmas and holidays, and principally when there are "long weekends". Likewise, it is sold in restaurants in Guadalajara, Michoacán, and in small quantities in establishments in Mexico City. The main clients are the stall holders in the municipal market, which may still expand; however, it would be preferable to expand the market outside the region. It is estimated that total daily production represents half a ton of cheese. However, exact data is unknown, because a census of producers was not carried out.

Horizontal and vertical relationships between participants

The cheese makers of this region are traditional and have inherited the profession and know-how from their parents; knowledge reinforced by experience and learning acquired in the process.

In this region of the country, the culture of individualism predominates: "each person makes their own world," is the saying frequently expressed by those who participate in the

production chain, affirming their preference for individual decision-making, as opposed to collective action, which would also imply an increase in the social capital of the region, a process that is without doubt very difficult to implement. Everyone knows each other, but their geographical proximity has induced more jealousy and enmity than cooperation (Villegas *et al*., 2014).

Among cheese makers, competition for the market has increased individualism, cheeses manifest elasticity, in terms of price and demand, so producers seek to reduce their production costs, in order to be more competitive and thus create their niche market, which they protect and are not interested in sharing. However, cooperation increases when cheese makers have problems marketing their product.

By increasing social capital, cheese makers could organize to market their products jointly, reducing transaction costs; adobera cheese would compete as an entity, rather than the companies that produce it. Moreover, they could promote the quality of the cheese and seek its recognition, with some geographical indication, but in this strategy, merchants must also be involved, as success depends on the commitment assumed by those responsible in the chain of participants, for the production and marketing of a typical and high quality product.

At present, cooperation between cheese makers does not exist and, as the key informants express, the relationship between cheese makers can be described as "indifferent": they have known each other for "a lifetime," as is common in rural areas; they greet each other, but are not interested in cooperating. Sporadically, there is informal exchange of information, mainly regarding the use of inputs. Some cheese makers know other cheese factories, although generally from another region. Few know another cheese factory in Los Altos and normally, this is only because they are related to the owner or because they have worked there.

The relationships between the different links in the production chain are characterized by strong asymmetries, firstly, concerning information: the quality of the product, milk or cheese, is generally known only by the producer. The risks of adulteration are high, generating distrust between agents: milk can be adulterated with water or with a mixture of water and flour, or any other product, therefore, the density test is not always adequate, as cheese can be adulterated, replacing animal fat of dairy origin with vegetable fat, a situation that is hard to identify easily and directly, as is the case with powdered milk, starches, etc. (Villegas *et al*., 2014).

Asymmetries also occur in the distribution of the added value of the chain; in relative terms, it is the farmer who obtains the lowest profits per liter of milk (it is difficult to calculate his share, due to the home-production of part of the inputs and family-type labor), likewise, the majority of producers market small volumes of milk. The collector earns approximately 10% of the price paid for each liter of milk and delivers around 1,000 liters/truck/day.

Cheese makers are responsible for between 15 and 20% of the value per liter of processed milk, a figure that varies depending on various factors (yield of cheese from milk, quantity

of products and by-products obtained, marketing outlet used, etc.) and they transform around 5,000 L/day. The highest profit margin corresponds to the merchants, their operating costs are low, the point of sale, fixed or mobile, is generally managed by the owner and his family, therefore, they do not pay salaries, some operate informally and, in the case of miscellaneous items, cheese is just another item.

At the end of the agro-industrial chain, we find a consumer in a situation of information asymmetry, who cannot usually differentiate the quality of the products available on the market, in addition to being unaware of the production processes, meaning that the decision to purchase is mainly based on price and the cheese with the highest price is not necessarily the one of the best quality. In fact, producers prefer to produce quantity at a low price; the explanation for this lies in the fact that cheese shows elasticity, in terms of price and income variations; if the price decreases or income increases, consumption increases.

The cheese making process

The detailed production process of Adobera cheese can be found in The Atlas of Authentic Mexican Cheeses (Villegas *et al*, 2014).

Method for tasting

It can be consumed cold, as a snack, or accompanying dishes; when crumbled or cubed, it can be added to soups, beans, flautas (inside a rolled, fried tortilla) or salads. When chopped, it is used in sandwiches, tacos and quesadillas; grated as a filling; when melted, it is used in "chilaquiles" and countless typical and contemporary Mexican snacks. It is particularly appreciated for making quesadillas, as it can be cut into thin slabs and melts easily.

The SOWT analysis of the agro-industrial chain

Table 1 presents the factors in the SOWT analysis.

Strategies proposed by SOWT

E1. Training dairy producers in pasture management to optimize livestock feeding resources.
E2. Training cheese producers in good production practices, use of whey and fabrication of other dairy derivatives.
E3. Encourage the participation of municipal or state governments to include Adobera cheese as part of the gastronomic routes and branded products, marketed in the Pueblos Mágicos of the region.
E4. Implement campaigns to promote the nutritional characteristics, know-how and cultural roots of Adobera cheese.
E5. Educate potential consumers about the organoleptic properties of authentic Adobera cheese.

Table 1. SOWT analysis of the agro-industrial chain of Adobera Cheese from Los Altos de Jalisco.

Strengths	Opportunities
S1. The classical nature of Adobera cheese, linked to traditional know-how.	O1. Los Altos is the second most important dairy basin in the country, so there is sufficient raw material.
S2. Appreciation for this cheese by local consumers.	O2. Due to its classical nature, the cheese is a candidate to obtain a geographical indication that enhances and protects it.
S3. It is a cheese purchased by consumers of all social levels.	O3. This cheese ripens well, so this practice can be increased to lengthen shelf life, reinforce its organoleptic qualities and increase its transportation without depending on refrigeration
S4. There is sufficient generational replacement in the cheese factories.	O4. Due to the type of livestock farming, it is a priority dairy area in government programs.
S5. Cheese made from raw milk has outstanding organoleptic qualities.	O5. It is a cheese that is widely accepted among migrants, you can take advantage of the nostalgia market.
S6. As it is made with whole milk, it is a highly nutritious food.	O6. In the region there are tourist areas and Pueblos Mágicos (Magic Towns), which represent potential markets for cheese.
S7. The remittances received by the cheese makers have enabled equipment purchase for the cheese factories.	
S8. These are family-type artisanal businesses, inherited from one generation to the next.	
Weaknesses	**Threats**
W1. Lack of interest on the part of cheese makers to become organized.	T1. NOM 243 requires the pasteurization of milk, forcing a change in processes, with the loss of traditional know-how and the organoleptic qualities of the cheese.
W2. Being a region with a deficit in forage production, milk production costs increase.	T2. The presence in the region of large milk collectors, which compete with cheese makers for the acquisition of raw materials.
W3. In some cases, the new generations prefer to dedicate themselves to activities other than cheese making.	T3. Due to the seasonal shortage of milk, and/or the quest for greater profitability, some cheese factories use adulterants such as milk powder and vegetable fat. (Villegas *et al*, 2014).
W4. It is difficult for traditional producers to change their production processes, which complicates training in good manufacturing practices, which would contribute to guaranteeing that the cheese is salubrious.	T4. Limited government support for artisanal cheese making.
W5. In some cases, there is low profitability from cheese production (Patiño Delgado *et al.*, 2019)	T5. In 2023 the strong peso, resulted in an exchange rate that stimulated imports of milk powder and cheese.

Table 1. Continuation.

Weaknesses	Threats
W6. Cheese production is an activity that requires several hours of work a day, at extreme hours and although it offers the means to preserve a highly perishable input (milk), it is also a job that must be undertaken every day.	T6. Cheese production in surrounding entities
D7. To improve consumer acceptance, cheese makers add titanium dioxide.	T7. The price of inputs generally increases at rates that exceed the price of milk (Patiño Delgado *et al.*, 2019), discouraging the production of the main input for cheese factories.
D8. Milk is a delicate ingredient that is easily contaminated. If this occurs, the cheese will not have the desired organoleptic qualities and the shelf-life of the product will be reduced.	

Source: self-elaborated.

E6. Create links with market niches that pay for authentic products (producers' markets, for example, stimulating the participation of producers in gastronomic fairs).
E7. Organize events that augment cooperation between cheese makers, as a way of building social capital.

DISCUSSION

Adobera cheese is produced by hand with whole raw or pasteurized milk and is typically fresh, soft, uniformly ivory white in color, with cheeses usually weighing one kg. It can be matured, although this is not very common, its soft paste, is acidified by the natural microflora of the milk and lightly compressed. Given its low pH, around 5.2, it behaves like fresh pasta filata cheese, which melts easily when heat is applied, in a way similar to Mozzarella. Its aroma is light, balanced and pleasant, denoting an aura of fresh milk. Although originally from Jalisco, it is currently produced in surrounding entities: Zacatecas, San Luis Potosí, Aguascalientes, Guanajuato, Michoacán, Colima and Nayarit. According to Aguilar (2003), Adobera cheese is produced in a short agro-industrial chain, with producers predominantly from a defined region, who employ traditional knowledge and artisanal means and instruments, derived from accumulated experience that is transmitted inter-generationally; factors that are valued in local and regional markets. Consequently, the dominant core of the chain relates to artisanal cheese factories.

Concurring with this author, the milk quality criteria applied by the cheese factories are related to the volume and timeliness of delivery; at no point arequality controls applied to the Agro-industrial Chain (AIC), nor is it supervised by any official body. Based on the above, quality is founded more on traditional “savoir faire” or “know how” in cheese

production. Means of production also tend to be scarce and rustic, their comparative advantage residing in traditional "know how" and familiarity with a local commercial network to obtain inputs and market products. The latter is also traditional, in the sense that cold storage infrastructure and access to distribution channels are limited. The results reflect that this AIC has poor individual and global efficiency; however, its permanence and development over time is due to the existence of the local and regional market niche, upheld by the demand it has in the area.

The main weakness of this AIC is the unwillingness of cheese makers to become organized, implementing individual survival strategies, which in some cases has led to adulteration of the product, such as adding powdered milk or vegetable fats, to reduce production costs and remain active in a regional market, dominated by collectors. This AIC has potential as a focus of local and regional development, only depending on the extent that poor collective action is resolved, promoting association, by for example establishing an organization of cheese makers.

Agents, united in an association dealing with any link in the chain, will lead to better governance and offer advantage in the market (Gutiérrez *et al*., 2017; Schmitt *et al*., 2016; Tolentino and Valle, 2018). In this regard, Belletti *et al*. (2007) indicate that collective organizations play a fundamental role in a process of internationalization of goods, which is also applicable to anyone whose objective is the relocation of trade in products with attributes of origin, through direct activities, such as collective or indirect promotion, or support in production and management processes, as well as in the construction of social networks providing links to other sectors. The formation of organizations contributes to the empowerment of producers and integration of the chain.

Association represents the first and most important step towards implementing strategies, although transport to a local market implies an increase in the complexity of procedures that must be accomplished. Successful marketing therefore requires a number of resources including: investments, knowledge, experience, facilities and strong social capital to achieve better integration and collective management. Notably, the operation of these chains is based on relationships of trust and reciprocity (Schmitt *et al*., 2016; Voors & D 'Haese, 2010).

Of strategies indicated by the SOWT analysis, emerges the option of selling the cheese with a quality seal linked to its origin; studies confirm that this option has been used for cheeses and other products, such as wine in Italy, (Jaster *et al*., 2014; Olivieri and Giraldi, 2015), Boznia Herzegovina (Samardzic *et al*., 2014), Romania (Magdas *et al*., 2018). Historically, Europe has had more experience in these types of strategies. Cambra and Villafuerte (2009) mention that the linking of products with territory has a long tradition in the European Mediterranean countries; since 1666, exclusive rights were granted to the inhabitants of Roquefort for the curing of cheese and later, regulations began to be established for wine and olive oil, given the strong influence of the environment on their characteristics, as well as the presence of imitations in the market, which could put consumer health at risk. Officially, the first DO (Denomination of Origin) was granted

to Roquefort cheese in 1925, and currently France, Italy and Spain have about 90 DO for cheeses made from raw cow's or sheep's milk (Cambra and Villafuerte, 2009; Villegas and Cervantes, 2011).

In this regard, there have also been critical voices. Sgarbi and Menasche (2015) warn that, more than GIs (Geographical Indications), a better option for the valorization of local products would be a broader evaluation of the territory, seeking to identify the best possible alternative for producers, which will also contribute to the protection of traditional forms of production. The relative success of Tequila in Mexico, Coffee from Colombia, Pisco from Peru and other Latin American products, especially spirits, covered by these seals, have responded to very particular dynamics, but this is atypical for most local products, with those who only have in common their connection with their territory.

Likewise, leaving aside the required production volume, the operation of these seals depends on the degree of cohesion between the various participants, to ensure the management of resources and their constant administration for the benefit of the collective; a situation that in the context Latin America presents difficulties, given that experience is reported in the management of commercial brands, but not in the context of GI. As Bonvini (2010) argues, in Latin America not all countries have the required institutional and human capital in industrial property institutes. However, it is a strategy that exists, and in Mexico it has been insufficiently explored, currently no cheese has a DO and, unfortunately, the collective trademarks granted to cheeses have not been successful.

Another alternative would be to sell the product outside the production area. In this sense, GIs provide security to the consumer who purchases the products outside the region where they are produced, and this area is close to important cities such as León, Guadalajara and Aguascalientes.

It is known that all procedures that increase the shelf-life of the product contribute to improving its distribution channels, such as the case of Costeño cheese, which has a high impact on the Colombian Caribbean, where producers have implemented biotechnological resources to reduce the risk of contamination, when using native lactic cultures, increasing the shelf-life of refrigerated cheese (Gutiérrez *et al.*, 2017). In this way, Adobera cheese could be matured to increase its shelf life and be marketed in other regions, even the United States, where it is valued by the migrant population from Los Altos.

Furthermore, maturation can be reinforced by improving hygiene practices. Sánchez-Valdés *et al*. (2016) point out that the stability of cheeses and the confidence in their consumption can be achieved by implementing simple practices, such as the use of appropriate clothing and drinking water, as well as disinfection of hands, tables and work utensils. Another option is to promote it through tourism, as part of the agri-food fairs, gastronomic routes and "Pueblos Mágicos" in the state of Jalisco. It can be affirmed that the majority of fairs of this type, are spaces valued by producers and consumers, which are managed and administered by local governments, with the participation of producers, therefore representing an appropriate strategy for according value (Velarde *et al.*, 2015).

However, it is necessary to consider multiple options for choosing an appropriate strategy, for example, the participation of various government agencies and other actors is required, in order to finally induce producers to a become autonomous and assume leadership (Blanco and Masís, 2012; Otero, 2013); the seasonality of these fairs (generally annual) means that cheese makers have to generate additional strategies in order to compete the rest of the year. Other limitations for participation are related to costs, you have to pay for transportation of the staff and the product, cover the costs related to tastings, promotions, accommodation and food. Additionally, the opportunity cost related to the time invested, which may involve hiring employees, must be considered (Blanco and Masís, 2012). Despite this, these are options that should be explored.

With respect to gastronomic routes, as strategies to attribute value, these are contexts where tourists can find images of the product and their approach to local culture can be encouraged (Espeitx, 2004; Moreira, 2006; Prats, 2006). Contrarily, artisanal cheeses are produced in specific territories and generally far from important urban centers (González-Córdova *et al*., 2016); however a route of this type may be of interest to foreign consumers and enhance the resources of the region.

CONCLUSIONS

In the Los Altos region, Adobera cheese is an emblematic product, which has been produced for more than a hundred years. However, upon further study, insufficient collective action among cheese makers is apparent, with individual survival tactics predominating; the result of poor social capital.

Strategies exist that can be implemented to help the agro-industrial chain of Adobera cheese from Los Altos de Jalisco become a focus of local and regional development, but if these are to function, their main weakness must first be resolved. This is a lack of willingness on the part of producers to become organized, which in some cases has prevented the consolidation of shared commitments, regarding consistent level of quality of the product. Each cheese maker has managed this in the way that seemed best, which has occasionally resulted in them replacing the original product with substitutes, even non-dairy inputs. Therefore, for this chain to become a pole of local and regional development, the poor collective action detected must first be resolved, which can be achieved through common commitment, by forming an organization of cheese makers, for example. However for this to occur, it is necessary that they have a common problem that they cannot solve individually, which will oblige them to become integrated.

With good management (governance) of the Adobera cheese agro-industrial chain of Los Altos de Jalisco, it is possible that it could become a vector of local and regional development, due to the impulse it could generate towards other sectors of the territorial economy, especially dairy farming.

A problem for conducting research on cheese in Mexico is the absence of a reliable register of producers that allows for probabilistic sampling, partially caused by the fact that an indefinite number of cheese factories operate informally; it is important that physical-

chemical analyzes be carried out on Adobera cheese, as part of the requirements for obtaining a geographical and desirable indication, so that a study is made of cheeses that can contribute to the development of the regions where they are made.

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