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# Strategies and socio-productive relationships in pig backyard production

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**ABSTRACT**

**Objective**: To determine socioeconomic relationships in backyard pig farms.

**Design/methodology/approximation**: The farms studied had 1 to 8 sows. We used semi-structured questionnaires and periodic monitoring to collect data. We determined the cost of production with the general cost formula and calculated the countable effect of family labor. Two groups were established: Group 1) Young married couples; and Group 2) Elderly couples who have been married for a long time and who do not have married children. Social Network Analysis was used to determine the strength of those relationships.

**Results**: Five socio-productive relations were discovered: 1) input supplier-producer; 2) piglet breeder-swineherd-butcher; 3) religious festivities-pigs; 4) season of the year-pig; and 5) producer-boar keeper. Income differed when family work was not counted.

**Limitations/implications**: Results showed that it was possible to combine qualitative data and statistical modelling in studies about social and economic behavior of backyard pig farms and small-scale farms.

**Key words**: Economic well-being, economic sustainability, livestock, social network analysis.

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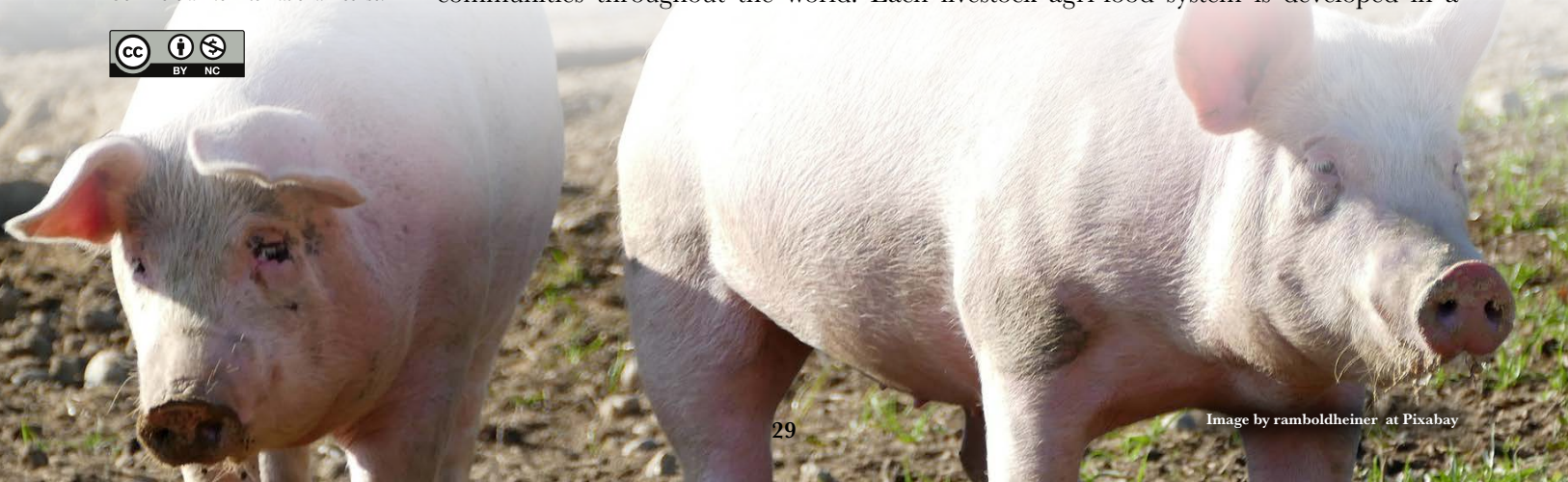
## INTRODUCTION

Neoliberal development models —which always seek greater competitiveness— generated enormous pressure on regional agri-food systems (Ploeg, 2010; Delgado, 2010). However, the socio-structural complexity of these systems (their constitution and dynamics), involve elements that do respond to both commercial and community criteria (Rendón *et al.*, 2019). The structural basis of agri-food systems is purely social, since its function is to feed societies by producing and transforming natural inputs (Steinfeld *et al.*, 2009).

Backyard pig farming is a highly differentiated sector in the various regions and communities throughout the world. Each livestock agri-food system is developed in a



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particular way, in terms of the species, stocks, and inputs that are used, and the production method (Steinfeld *et al.*, 2009; FAOSTAT, 2017). According to FAOSTAT (2020), the 2019 world pig inventory was just over 850 million heads (Mexico contributed 2.16%), constituting the main source of animal protein worldwide. In Mexico, estimates suggest that backyard production represents 10 to 30% of the inventory and contributes just over 30% of the total meat produced. However, this system has been described as not particularly functional, as a consequence of its low productivity, deficiencies in the design and planning of the establishments, and the lack of training of the producers, among other characteristics. Despite these deficiencies, these low-technological, -energy, -economic, and -environmental systems (Martínez and Perea, 2012) are reservoirs of genetic variation (Martínez *et al.*, 2016; Montero and Martínez, 2016), support the food (and culinary), job, edaphological, and socioeconomic security of the communities (Brunori *et al.*, 2012; San Vicente, 2018; Santos-Barrios *et al.*, 2019) and produce high-quality protein (Velázquez-Villalva *et al.*, 2016).

Backyard pig farming includes production systems in periurban areas which have assimilated some characteristics of urban consumption, but which have kept economic, social and cultural dynamics that belong to the rural environment (Fernández and Morán, 2015; Hernández-Puig, 2016). Fernández and de la Vega (2017) point out that 43% of the population is involved in agricultural production —more than 70% of which is destined for self-consumption. Likewise, they are part of the family financial strategies of the users (Santos-Barrios *et al.*, 2019) and their socioeconomic resilience is a result of the convergence of such aspects as: "productive diversity, recycling of resources, cooperation, and mutual support" (López *et al.*, 2012).

The family livestock production units can be considered as integration nodes with various strategies to face scarcity and achieve a certain livelihood (Rivera *et al.*, 2015). Therefore, they are framed in complex socioeconomic compositions that allow farm family units to obtain a certain security, potentially impacting the development of an entire region (Montero and Martínez, 2016). The organization of the backyard implies the presence of multiple, diverse, and interrelated actors and (social, technological, and economic) factors; its particular management is determined by the psychology (interests, needs and resources) of the farmers themselves (Martínez and Perea, 2012).

The backyard means developing a structural discourse where products, strategies, inputs, and actors have an impact on the said social structures to which producers turn to in order to feed the herd. In the highly-competitive agro-industrial field, these types of extremely fragile structures are continually subject to a disruption process. For example, they face high and irregular production costs (Hernández-Martínez *et al.*, 2008), which are a sign of the inconsistent social structures to which the backyard pig farmer must turn to, in order to obtain the necessary inputs. Hence, the need to expose its complexity and socio-structural fragility.

In this context, the objective of this work was to determine the socioeconomic strategies and the relationship structure involved in backyard pig farming, in a determined rural community in Mexico, and to establish the resulting income of the producers.

## MATERIALS AND METHODS

This study was carried out in the community of San Miguel Coatlinchán, of Texcoco, State of Mexico. This town is located 9.4 km away from the municipal capital and 24 km away from Mexico City. It has an altitude of 2,250 masl, a temperate semi-arid climate, an average annual temperature of 15.9 °C, and an average annual rainfall of 686 mm (INAFED, 2016).

### Data collection

An ethnographic approach was used to tackle the social structure and the problem itself. The sampling frame was developed based on the lists of producers who participated in previous research (Santos-Barrios *et al.*, 2017), which were refined through periodic visits to livestock farms.

Forty-five backyard pig farms were studied from August 2015 to August 2017. We included farms that had from 1 to 8 breeding sows. Productive, social, and economic indicators were obtained.

We proposed an analysis by age groups to obtain a clearer visualization of the dynamics and strategies.

### Analysis of data

The production costs of a weaned piglet were determined (Muñoz and Rouco, 1995). The analysis included the opportunity cost of family labor (Bobadilla-Soto *et al.*, 2013).

The data were analyzed using descriptive statistical techniques and frequency analysis. An analysis of variance was used to compare variables between groups and the differences were analyzed with the Tukey Test.

According to the default network unit of analysis (producer-input) and the available information, organizational structures referred to by the producers of the analyzed population were extracted and the degree centrality of the said relationships was measured.

Data was collected through semi-structured interviews, complemented by periodic monitoring and recording of the above-mentioned indicators.

## RESULTS AND DISCUSSION

The pig farmers of San Miguel Coatlinchán have adopted production and distribution strategies that provide them with economic benefits, such as the sale of piglets with 40-day lactation periods, which allow them to sell heavier and more viable piglets, meeting the requirements of the buyers. Unsold piglets are fattened until they reach commercial weight and size (90-100 kg). These specimens can be sold in three ways: live, carcass, and processed meat (fried with lard).

The sale price of a weaned piglet was $33.68 USD. The monetary values are expressed in American Dollars (USD) with an exchange rate of 1 USD:17.8145 Mexican pesos, as of August 31, 2017. When the cost of family labor (SMOF) was not taken into consideration, average costs were $20.99±3.03 USD, with a maximum cost of $25.76 and a minimum cost of $16.50. The average cost of a weaned piglet, after taking into consideration the cost of labor (CMOF), was $24.02±3.48 USD, with a maximum cost of $33.62 and a minimum

cost of $18.13. The average CMOF profit was $12.68±3.03 USD, with a maximum profit of $17 and a minimum profit of $5.89 and of $9.54±0.02 USD, with a maximum profit of $15.54 and a minimum profit of $0.06, when CMOF was considered.

Backyard pig production in San Miguel Coatlinchán is organized on pre-established social structures, such as the family and the community. This is a family economic activity, in which all the members take part, depending on their age, physical, capacity, and gender. Based on the informants' narrative, we can infer that this backyard pig production model has been developed and reproduced for at least 150 years, which implies that between six and eight generations have made a cultural investment in its social reproduction (Martínez-Castañeda and Perea-Peña, 2012). The fact that all members of the family, be it nuclear or extended, are involved in the tasks that the activity imposes, ensures its social reproduction (Ruiz-Torres *et al.*, 2017). The producers reported that they sell both to intermediate consumers and to final consumers. Other members of the community are always the final consumers. However, producers prefer to sell to intermediate consumers (middle men), who buy all commercial-size pigs from their farms. It is worth mentioning that most of these intermediaries have their own butcher shops outside the State of Mexico, in other states such as Michoacán, Puebla, and Tlaxcala. Commercial transactions between producers and middlemen in these states place the former in the lowest link of the Agrifood Value Chain (CVA). According to Gonzales-Razo *et al.*, (2014), the middlemen determine the final price of meat by 74%.

**Pig farmers by age groups**

In order to have a more refined perspective on the social dynamics that are generated within this type of production, two age groups were established: 1) young couples with children; and 2) elderly couples with unmarried children.

1. This group was made up of people older than 25 years; 76% of the producers in the sample belong to this group. In the case of young couples, women usually tend the farm, while men work as formal employees, thus ensuring a regular income and access to social security. The incorporation of children around the age of 10 to farm work —carrying out minor, but still important tasks— in this first age group is a relevant characteristic that would help us to understand the generational change and the social reproduction of this economic activity. Child labor (caring for animals) becomes more complex as minors grow and acquire more experience. When young people are 17 years old or older, they spend more than 80% of their free time taking care of the farm; however, this does not give them the right to make management decisions. The parents are always and at all times responsible for the decisions regarding the investment in the farm and the marketing of the animals. Usually, ten to fifteen years after the children begin to work in the family farm, they achieve their independence from the house —and therefore from the farm. During this time, young people learn about the activity, develop the skills and abilities necessary to operate and manage a farm, and incorporate this activity into their livelihood strategies; this third element

guarantees the social reproduction of this economic activity. When a child becomes and adult and gets married, a change in family and social status takes place. When the son becomes head of the family, the parents help him to start his own farm. If the newly-weds do not have enough physical space to have a farm, the parents lend their son a pen. The son is expected to start raising pigs independently, initiating the social reproduction cycle of this activity.

2. The most outstanding phenomenon of the second age group, is the "return" of the husbands to the home: many of them retire, while others formally stop working and begin to "work" on the farm. Twenty-four percent of the producers in the sample belong to this group. In this group, the heads of families take up again the activities and management of the farm. Unmarried children of productive age allocate resources for the family economy, providing external financing for the farm.

Likewise, farms run by elderly couples were identified, where the fundamental workforce consists of grandchildren, nephews, and young relatives. These elderly producers are no longer the family's economic support, but they continue to fulfill an important social role as a source of experience and family cohesion. Very old producers usually become part of their son's family, to whom they transfer the work of their farm. The son is responsible for the maintenance and care of his parents, but at the same time, the farm of the elderly producer remains in operation, therefore allowing him to provide income to the new family nucleus. Consequently, he does not perceive himself as a burden and maintains his dignity, as an individual useful to the family and social group.

Although backyard pig production is not the main economic activity of the family nucleus, it does constitute an important income supplement that enables the family to overcome eventualities. The main headings to which the resources obtained from production are allocated are: a) annual school expenses, such as enrollment, school supplies, school uniforms, etc.; b) medical expenses; c) clothing and footwear; and d) civil, religious, and family festivities, in which the pigs themselves are used to prepare the food. No significative difference —resulting from age or schooling—was found ($P>0.05$) between the two groups, with regard to productivity, income, or herd size.

In this study, regular self-consumption was only observed on large family festivities.

**Relations of backyard pig production with other economic activities**

Although family farming activities fail to establish a link with the national Agrifood Value Chain (CVA), they generate local and regional links, before and after the said production. Backyard pig production, like any other family farming activity, generates links with other economic activities and various social actors. Key relationships were identified, which are fundamental for the successful operation of the activity:

1. Relationship between input suppliers and producers: the relationship established by the producer with the suppliers of the diet ingredients in the different stages of production. The first stage happens at the same time as the gestation period of the sow. The commercial exchange is established, on the one hand, with forage farms —

where the producer-forage farm relationship is direct— and, on the other hand, with bakeries and cake shops —where the producer-bakery relationship is supported by a middleman who obtains the by-products and sells them to the producers. However, it is not an open business relationship as the middleman sells to a specific group of producers. Likewise, the relationship extends to households, where the producer-household relationship is a closed relationship, since household members only give food waste to relatives or friends. The second stage takes place during the piglets' suckling stage. On the one hand, the nutritional requirements of the sow and the amount of feed consumed increase and, on the other hand, from 30 days of age the piglets are only provided fodder whose forage-production relationship can be identified. Given that the average lactation lasts 40 days, the social implications and relations between producer and suppliers are of vital importance; other actors do not place their product; this relationship is activated when the piglets are sold. The distributor and the producer have a sound trust relationship, as this ensures that good quality ingredients are always available at an affordable price.

2. Relationship between piglet breeders, swineherds, and butchers: The piglet breeder-swineherd relationship is a power relationship where the swineherd has the advantage: the lack of a deal or agreement for the purchase and sale of piglets means that the swineherd can buy half or a full litter at will. Consequently, the piglet breeder develops strategies, such as keeping one or two underweight piglets to fatten them and sell them later. We should point out that local consumers appreciate this type of production and they look for butchers that sell "clean", local, and tasty meat.
3. Relationship between religious festivals and pigs: Thirteen religious festivals were identified in the community of San Miguel Coatlinchán —of which Saint Michael (their patron saint), Holy Week, and Christmas are the most important—, in all of which a meal is offered to the faithful. This meal can include *carnitas*, chicken, turkey, etc., depending on the "tastes" of the patron who pays for the festivity. During the festivities of Saint Michael and Christmas pork is the traditional dish. The patrons of these festivities ask a swineherd to put pigs on lawaway or fatten them themselves. However, the swineherds depend on the suckling pigs providers to fulfill the task. The relationship between piglet breeders, swineherds, and religious festivals is supported by long-standing relationships between the patrons of the festival and the swineherds.
4. Relationship between the time of year and the pigs: As demand rises in December or the end of the year, butchers seek to buy and sell meat from community farms every third day. The rest of the year they do it every fortnight, selling it as fried meat and pork scratchings. This relationship makes some producers schedule their sales based on the needs of the swineherds, who are ultimately the ones who sell the pigs to the butchers.
5. Relationship between producers and boar keepers: This relationship is established between the piglet producer and another producer who has a boar in his herd, which the latter "rents or lends" to the former's farm for an average of 3 days, during which it provides reproductive service to the females that are on heat. Renting a boar costs

> $11.23 USD; the food expenses are borne by the person who receives the borrowed animal. Sometimes the mating is not paid in cash: instead, the owner of the boar agrees to choose, at the time when the piglets are weaned, females that will serve as replacements in the breeding boar farm or piglets that will be fattened for sale; optionally, the payment could be exchanged for a favor later on. Producers who own boars have access to different farms. Therefore, they have information about farms, including: production parameters, technology used, different ingredients used in diets, presence of diseases, and deficiencies. They are often an important medium for the transmission and adoption of information and technology.

Small-scale pig production in the study area is of utmost importance for the family economy, since it provides additional economic income that allows them to access material assets and services that would otherwise be impossible to obtain. Godínez-Montoya *et al.* (2015) point out that most agricultural households seek to diversify their subsistence base as a risk-reduction strategy. Likewise, they also point out that most non-farm income or self-employment are increasing. The rural population increasingly carries out non-agricultural activities, such as local commerce, the production of handicrafts, the extraction of raw materials, ecotourism, environmental services, or wage-earning work in various occupations, among others. The ability of households to develop livelihood strategies largely depends on their assets and how these are used to achieve a balance and a certain level of satisfaction (Gómez-Demetrio *et al.*, 2013).

**Backyard pig production: a network structure**

Backyard pig production exists and resists thanks to these community ties; otherwise, it would not exist, not even as an isolated unit. In fact, a backyard production unit implies social conglomerates through which it receives various types of inputs. A "unit of production" only exists as an autonomous entity in the statistical universe, not in the rural sociological notion of social construction, where social networks are established to provide coherence to this type of production (Figure 1).

**Social structure of nutrients**

Martínez-Castañeda and Perea-Peña (2012) described a network structure generated by the materials and ingredients mentioned by the analyzed producers (Figure 2A), where concentrated feed stood categorically over corn, bakery residues, tortilla, and swill in general, pointing out that "...the use of ingredients is more a situation of customs and logistics" (Martínez-Castañeda and Perea-Peña, 2012). When the degree centrality measure was applied to this network, assuming that backyard pig production mainly obeys a management structure for this type of nutrients, we observed that concentrated feed is, indeed, the actor that links and influences the pig production language; however, the second variable that links this system is swill, and thirdly corn, among others. This allows us to suppose the existence of a social structure that —in terms of the management of this type of inputs— builds a particular network of food stores and places where swill is collected (regularly, inns, restaurants, markets, etc.).

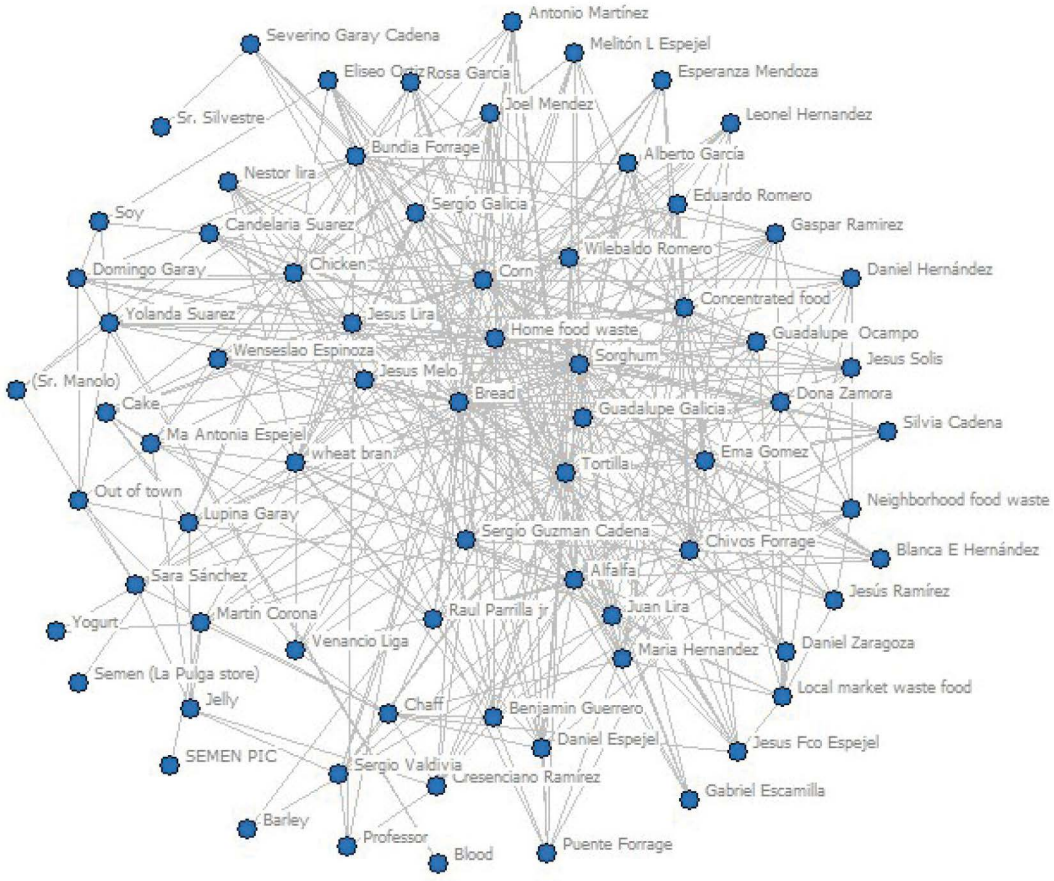


**Figure 1**. General structure of social inputs for backyard pig farming in San Miguel Coatlinchán, Texcoco, Mexico.

Therefore, regarding the nutritional input management structure of this study, we observed that 61.47% of the references of nutritional sources were: swill (16.71%), bakery residues (12.75%), sorghum (11.05%), tortilla waste (11.05%), and corn (9.92%). The centrality of the actors refers to a nutritional language different from the previous network, which is mounted on a network of places where swill is collected (inns, restaurants, markets, etc.), along with bakery waste, sorghum, waste tortilla, and corn. According to the resources available for the nurturing of the herd, these nutritional languages are constantly changing; hence, even in the analyzed communities, this will change for the next herds (Figure 2B).

**Supply social structure**

According to the physical structure of some of the supplies indicated by the producers, an image was obtained that refers to a support network —social, rather than commercial (Figure 3). Although commercial establishments have a certain importance in the supply of inputs, the main degree of centrality was presented by swill, which is usually almost all given away, although it could be commercialized. This implies a two-way community social bond: on one hand, management of urban solid organic waste; and, on the other hand, the transformation of the said solid waste into high-nutritional products with a considerable economic value (Martínez and Perea, 2012).

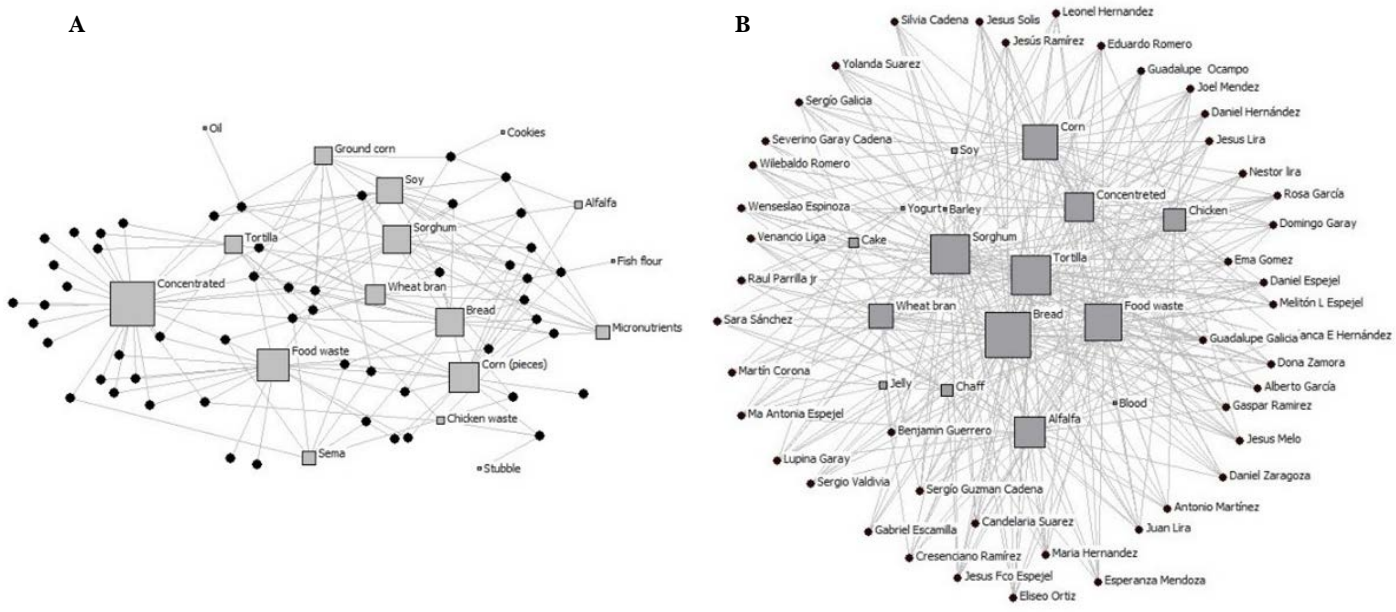


**Figure 2.** A) Nutritional ingredient degree used by producers (developed with data from Martínez-Castañeda and Perea-Peña, 2012); B) Nutritional ingredient degree used by producers in the study.

## Social structure of boar keepers

One of the most complex social structures is generated by the exchanges of the local pig seed stock, since these structures play a major role in the maintenance of the reservoirs of genetic variation, even for commercial productions (Martínez *et al.*, 2016; Montero and Martínez, 2016).

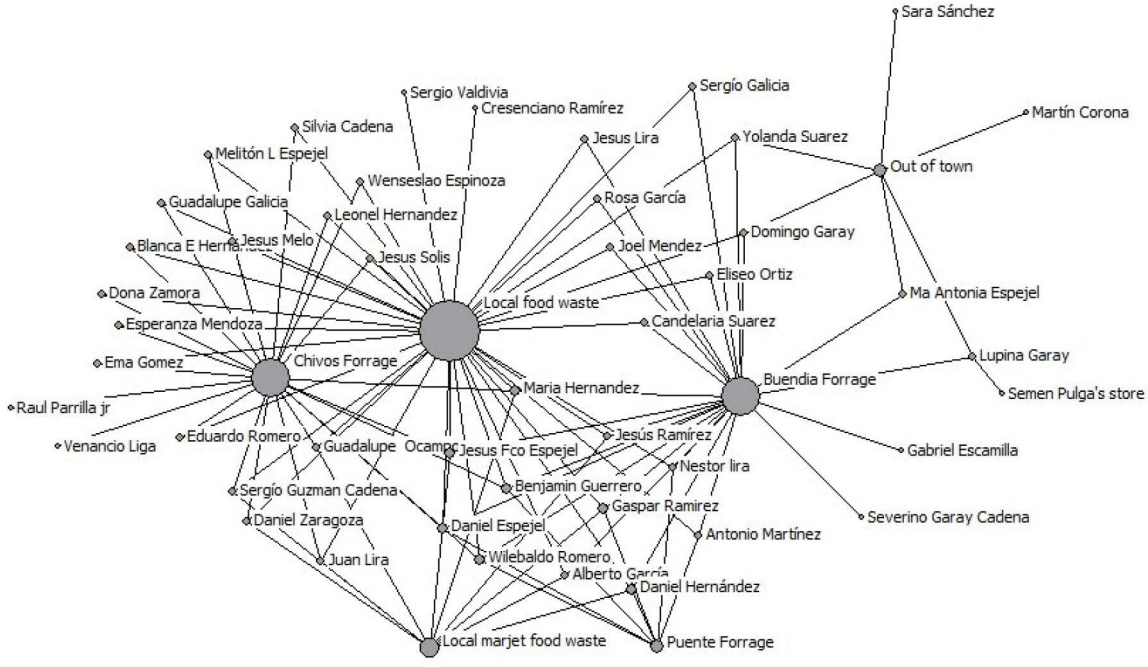


**Figure 3**. Network structure degree of input supply sites for pig production in San Miguel Coatlinchán, Texcoco, Mexico.

It should be noted that, at some point, the population of pig farmers analyzed acquired a great amount of seed stock from PIC (Pig Improvement Company), the international swine genetics company. The idea behind the purchase was to increase meat production; however, the results were not as expected, since this technological package must be accompanied by other specific inputs that, given their socioeconomic characteristics, are not accessible to backyard pig farmers.

In this context, the analyzed network structure (seed stock exchange) had three reticular behaviors (Figure 4).

1. Sociocentric component (green box): It is the most complex social values structure, where most of the producers can be found. The following values were observed: trust (a producer works with a single boar keeper), negotiation (a producer obtains seed stock from two or more boar keepers), and concentration (a boar keeper concentrates several producers).

   The presence of potential local seed stock circuits is highlighted, which could potentially represent a much larger and more complex circuit in the dispersion of the biological assets.
2. Triads in an intransitive state with centralized prominence (yellow box): In this type of structures, a remarkable situation takes place: a single boar keeper works with several producers. Regularly, they are recognized boar keepers in the community.
3. Intransitive state dyads with centralized prominence: These are the simplest types of structures and usually indicate relevant relationships.

Considering the service that boar keepers provide as part of a social and commercial structure —in which a particular input is managed—, the prominence relationships show the major actors of the said structure. Therefore, they are determining nodes in the

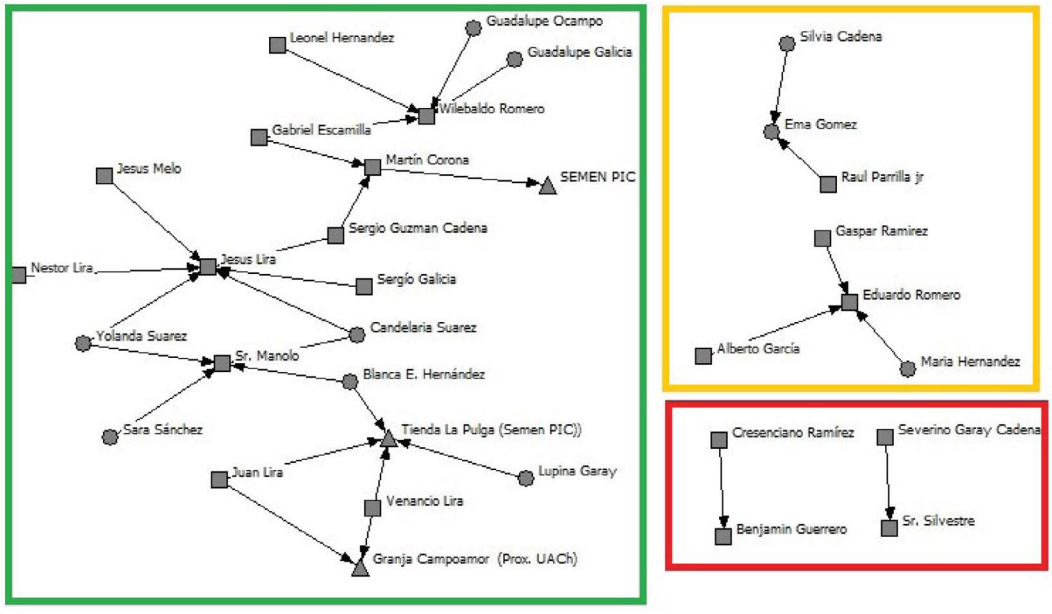


**Figure 4**. Social structure in boar keeper services in San Miguel Coatlinchán, Texcoco, Mexico.

said structure. In this case, they can be key actors for the analysis of this type of social complexities (Figure 5).

## CONCLUSIONS

In rational terms, backyard pig production is not a matter of capitalization and/or savings by the producer, but rather a defined economic activity: the sale of piglets and the slaughter of adults are scheduled. They depend on defined expenses (emerging activities that require immediate payment): tuition fees, purchase of medicines, scheduled financial activities, self-financing, etc. And the qualities of this type of livestock production are sustained by a socio-structural basis.

In this sense, the inventories (breeding males and females, piglets, etc.) and income of backyard livestock production provide key information to determine the economic sustainability of the producers. However, based on the vital importance of the structural element, we were able to accurately determine the sources from which those resources arise. In this study, we were able to describe some of the socio-productive relationships established between the different actors participating in these input and information management mechanisms. The relationships were: 1) input supplier-producer; 2) piglet breeder-swineherd-butcher; 3) religious festivities-pigs; 4) season of the year-pig; and 5) producer-boar keeper. These relationships are imperceptible to the naked eye, but they are part of a series of strategies that allow the reproduction of the livestock system in question. Hence the importance of a continuous analysis of these social components.

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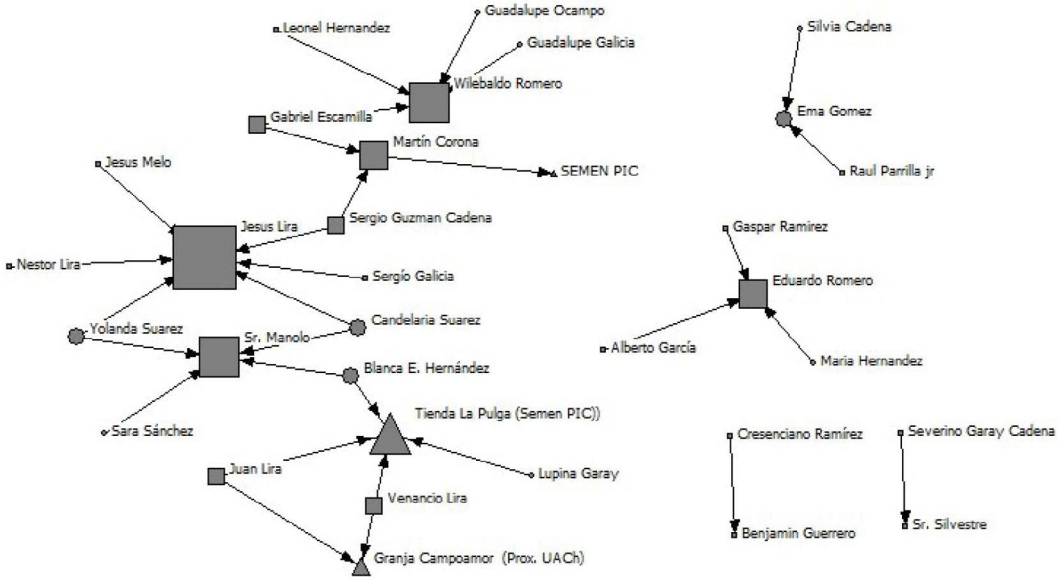


**Figure 5**. Local boar keepers structure degree in San Miguel Coatlinchán, Texcoco, Mexico.

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