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Food Producers in The Peri-Urban Area of Mexico City. A Study on the Linkages between Social Capital and Food Sustainability

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Abstract: Small producers in peri-urban areas have been identified as key actors in building more sustainable urban food systems, but they often have limited capacities to develop and consolidate their initiatives. This article describes the conditions of peri-urban farmers in Mexico City who work with agroecological schemes, analyzing the role of social and cultural capital in their ability to consolidate their economic-productive projects and establish links with consumers in the city. The research was developed from an anthropological perspective based on field visits and interviews conducted in 60 production units located in the peri-urban area of Mexico City. The article discusses the literature on peri-urban agriculture and the contextual particularities of the case study and then describes a typology constructed based on the analysis of the documented cases, considering the objectives of the initiatives and the different types of social and cultural capital on which their activities and marketing strategies are based are considered. The discussion argues that the social and cultural capital of the production units are key elements in determining the viability of the agroecological transition, reaffirming the importance of social articulation and other sociocultural aspects for the promotion of sustainable food projects.

Keywords: small producers; peri-urban agriculture; food sustainability; food in cities; social capital; Mexico City

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1. Introduction

Food systems face significant environmental, health, and equity challenges that have been documented widely over the past decade [1]. This has generated a growing consensus on the urgency of moving towards more sustainable food production, distribution, and consumption schemes [2]. However, the construction and dissemination of the major global risks of food systems is not new and, from Malthus' approach at the end of the 18th century to the present day, the issue of the carrying capacity of the planet's resources to feed a growing population has been, to a greater or lesser extent, one of the central issues [3].

During this time, global risks to the food system have expressed themselves in various forms. The apparent "triumph" of technology to increase productivity and ensure food safety, at least in one part of the world, gave rise to global concern about obesity. In recent years, attention has turned to the environmental effects of the current food system, resulting in the need to manage one more risk in daily food decisions. The predictions of environmental actors have come true, and currently food systems are one of the sectors causing the most environmental degradation and generation of greenhouse gases [4]. We are thus facing a new sort of twist of food risks, and the flow of information warning of these risks is constant. Global agencies, environmental movements, and non-governmental organizations carry out actions and calls to change the way food is produced, distributed, and consumed, which, in one way or another, is influencing local actors. As a result, in the

last decade, local programs and actions that seek to build healthier and more sustainable food systems have multiplied. These initiatives have been documented in the literature; however, few works analyze the social dynamics underlying their design and implementation, factors that, according to Mancini et al. [5], are particularly relevant for urban and peri-urban food systems. Among other issues, in the discussion on food sustainability, the importance given to small producers, short marketing chains and local consumption stands out. In the context of growing urbanization, small producers in peri-urban areas where agricultural practices subsist have been identified as key actors in the construction of more sustainable food systems [6]. These production units have a diversity that largely reflects different ways of adapting to the profound changes of the last century: tertiarization of the economy, globalization of markets, reduced state intervention in agricultural food production and distribution, increased inequality, increased industrialized food, and changes in food prices, among others. From the point of view of late modernity, the agroecological transition is a manifestation of the risk society [7], a reflexive action that responds to the social and cultural recognition of the environmental risk of food systems.

The objective of this article is to describe and analyze cases of small producers in Mexico City who are in a process of agroecological transition and to show the importance of social and cultural capital in this process. The complexity of urban development in Mexico City, the social and economic differences of its inhabitants in peri-urban areas, as well as the rise of social movements interested in food issues, raise the need to consider sociocultural analysis as an indispensable tool to think about the future food system and possible ways to strengthen its sustainability.

In the literature on food sustainability, small producers are frequently mentioned for their contribution to sustainable food systems [8]; however, the social relations and cultural ideas that motivate and enable change towards an agroecological system are rarely analyzed. This article represents a relevant contribution by showing the diversity of ways in which producers interpret and carry out food production under the idea of sustainability, as well as their strategies and challenges to consolidate their projects. These represent relevant elements to better understand the sector and inform the development of public policies that strengthen the livelihoods of peri-urban farmers and contribute to the construction of more sustainable urban food systems. It is of particular interest that the research has been carried out among producers in the peri-urban area of a mega-city in the global South, marked by accelerated urban growth processes, with little or no territorial organization, growing social inequality and the presence of food insecurity and the double burden of malnutrition. This will allow us to compare the viability of sustainable food production in different contexts and to identify the challenges faced by these projects to consolidate themselves as supply options for cities. In the countries of the global south, modernization processes have given rise to expressions and arrangements of diverse local adaptation to global processes [9]. In this sense, this article is also a way to show how the response to global risks manifests itself in a particular context. Finally, this article has relevance for those who make political decisions about food systems, since it highlights that the ideal of a healthy and sustainable food system requires the management of diverse socio-cultural and political-economic elements that allow its profitability.

The general results of the analysis of the academic literature on peri-urban agriculture are presented below, followed by the methodological description and the results of the study. The academic production on peri-urban agriculture is present all over the world, and the issues addressed are variable. Our analysis of the literature on peri-urban agriculture considers a little more than 1000 publications; the strategy used for the construction of this corpus is described in the methodological section.

A substantial part of the literature on peri-urban agriculture focuses on describing different geographical and socioeconomic contexts. These descriptions coincide in identifying peri-urban agriculture as a small-scale practice, generally organized around the family unit, although some cases are reported where productive and marketing activities have a more entrepreneurial profile [10]. In most cases this practice gives continuity to

the agricultural activities of previous periods, but ones which have been adapting to the conditions imposed by urban growth [11]. However, some cases are documented in which peri-urban agriculture has recently been undertaken by urban actors, as a recreational activity [12] or as part of participation in social movements [13], cases that are concentrated in cities in countries with favorable economic situations.

Possibly the most recurrent theme in the characterization of urban agriculture is its multifunctionality, identified as a form of adaptation to the change of context imposed by urbanization and, at the same time, as one of the conditions for the viability and resilience of this type of initiative. Two scales associated with multifunctionality can be distinguished in the literature. In agricultural units, emphasis is placed on the diversification of economic activities, identified as a condition for their economic viability [14]. In the contexts of poverty and marginalization, on the other hand, multifunctionality is described largely as a response to economic constraints, configuring scenarios where peri-urban families retain some agricultural activities to supplement their income and cover part of their food supply [15]. In this case, diversification usually includes product transformation, tourism, and various activities in the tertiary sector, such as commerce, transportation services, etc. The territorial scale, on the other hand, refers to the diversity of goods and services provided by urban agriculture in environmental, socio-cultural, and economic terms [5,16,17]. The territorial scale is often the one considered in the design of public policies aimed at strengthening the sustainability of urban and peri-urban areas. This is the case of the multifunctional agriculture model promoted in the European Union, which includes, along with the productive function of farms, their ecological and cultural contributions, and the social services they provide.

Eighty-seven percent of the publications considered in this analysis are concentrated in the last decade, which reflects the growing attention that the topic is receiving. This is related to the identification of peri-urban agriculture as a practice favorable to urban sustainability, highlighting its contributions to the conservation of ecosystem services [18–21], the local economy and the livelihood of small producers, as well as the safeguarding of territorial heritage, the strengthening of the social fabric, and community development [22]. The works developed in this area also document the technologies and management practices that contribute to the sustainability of peri-urban agriculture, discuss the challenges faced by the consolidation of this type of initiative and propose evaluation schemes. Within this framework, we can also include works developed from the biological and environmental sciences that address various topics, such as soil and water conditions and management, ecosystem services, climate change, and pollution generated by pesticides. In the most economically marginalized regions, however, peri-urban agriculture is described above all as a livelihood strategy that contributes to food security, considering its contribution to the availability of healthy food and as a potential source of income.

The emphasis on the multiple potential benefits of urban agriculture in ecological, social, and economic terms has led peri-urban agriculture to be promoted by urban development plans and policies, especially in the countries of the global North. Several publications analyze the public policy instruments implemented, identifying peri-urban agriculture as a positive element for sustainable development and discussing the best strategies to "protect it" from urban growth and contribute to its economic integration into the city. Several studies also point out that enhancing the multiple benefits of peri-urban agriculture requires investment, mainly of the state type, e.g., Araujo et al. [23].

The boost that this sector has recently received responds both to the importance given to it by the narrative and public policy actions, as well as to the increase in urban demand for products from small-scale, local, and organic schemes [24]. In the studies that analyze the links between peri-urban agriculture and the market, the relationships with short marketing circuits and alternative food networks stand out. These relationships are the expression of public policies and the demand of certain groups of consumers and have been important in leading small producers to decide on the agroecological transition, although this often only involves a reduction in the use of agrochemicals. It has also generated

new spaces for interaction between urban producers and consumers around strategies that seek to distinguish themselves from globalized food systems [25]. This process is most noticeable in North America, Europe, China, Japan, and Australia, but is also present in countries with middle economies, such as India and various Latin American countries.

On the other hand, the literature review shows that the relationship between peri-urban agriculture and sustainability is not univocal. A relatively large number of publications document the risks of contamination of food produced in cities, the impacts that urban and peri-urban agriculture can have on water and soil demand and contamination, as well as the risks to food safety from the use of organic waste in production. Health risks associated with peri-urban agricultural activities related to hygiene management and food safety are also documented; in this field, livestock management and exposure to malaria in peri-urban agricultural areas stand out. It should also be noted that, despite multiple efforts to promote and protect peri-urban agriculture, it is a practice that faces strong pressures, mainly due to urban growth and the industrialization of agriculture [26]. Likewise, despite its growth and importance in academic circles, environmental activists and in the political discourse of urban sustainability, the reality is that it is a phenomenon that goes unnoticed by much of the population [27].

Another of the topics addressed in the literature on peri-urban agriculture is land use change. These papers document this process based on geospatial analysis, discuss the factors that promote it, as well as the socioeconomic dynamics involved, showing the challenges faced by peri-urban agriculture. Other topics discussed in the literature are the profitability of peri-urban agriculture in different contexts as well as possible investment mechanisms, migration, the participation of women and, to a lesser extent, youth, tenure, tourism, and education.

In general, it can be assumed that the literature on peri-urban agriculture has so far paid little attention to social capital. Some works do not explicitly use the term, but they deal with close topics, such as the analysis of organizational dynamics involved in the commercialization of peri-urban agriculture products, mainly in the framework of the organization of short marketing circuits or in linkage with social movements, or regional producer associations [28–30].

Only seven articles were identified that explicitly use the concept of social capital, three from research conducted in Brazil, three in Mexico and one in Kenya. For the purposes of this paper, the papers by Blanc [10] and Paiva and Amâncio [31], who identify the linkage of small producers with other social actors as key elements for the consolidation of agroecological projects, stand out among these publications. The article by Blanc [10] analyzes the linkage of small producers with distribution chains of organic products in Sao Paolo, identifying the relationships of producers with technicians, activists, and academics as key elements to contain the effects of the liberal logic of large-scale distributors and allow producers to obtain better profits. Based on this work, the author argues the importance of integrating the producers of short marketing chains into militant networks to strengthen their human and social capital, consolidate the conversion to organic agriculture and ensure the social regulation of local development patterns in the future. Paiva and Amâncio [31], on the other hand, analyze the links of small producers with civil organizations and a school of Agroecology in Rio de Janeiro, identifying these links as catalysts of the agency capacity of small producers, and as a factor that allows for the containing the pressure of urban growth in this area, in a context where there is a scarce presence of public policies. Caldas [32], on the other hand, focuses his analysis on the relationships of trust and collaboration between small producers to obtain resources such as technical training and access to marketing spaces, in addition to pointing out that these relationships reduce their exposure to public insecurity. From a nearby perspective, Torres-Lima and Rodríguez-Sánchez [33] also analyze social capital among members of peri-urban communities in the case of Mexico City, identifying it as a relevant factor in defining agricultural use patterns (traditional and/or commercial), and in facilitating collective action. In a slightly earlier publication, the authors [33] propose social capital as a relevant element for the design

and implementation of regional development policies aimed at promoting the sustainable management of peri-urban areas, emphasizing the importance of regional networks for the collection of and access to urban markets, the dissemination of agroecological technologies and the implementation of economic compensation mechanisms such as payment for environmental services. Del Ángel-Pérez et al. [34] and Ingasia [35] meanwhile discuss the results of public policy interventions in strengthening social capital in peri-urban areas. In the first case, the authors focus on relationships of trust and solidarity within the community in two Mexican cities, while in the second the author circumscribes the discussion to the empowerment of women based on a case study developed in Kenya.

Peri-urban agriculture has received increasing attention in recent decades. An important part of the studies carried out focus on the analysis of its relationship with sustainability, generally privileging environmental aspects. The present research is interested in the sociocultural dynamics involved in this phenomenon, with the objective of analyzing how social and cultural capital operates in the transition processes towards more sustainable food systems. Other studies that have addressed the issue emphasize the importance of trust and innovation processes. This study shows that the actors involved in peri-urban agriculture have access to different types of social and cultural resources, and that these determine the ways in which they interpret the postulates of the global agenda on the risks of the contemporary food system, mediating the ways in which productive units are established, their diversification and relations with consumers to consolidate their economic-productive projects.

2. Materials and Methods

This research is part of a broader project on food sustainability in Mexico City For more information please see the https://sdi.unam.mx/alisus/ (accessed on 24 November 2022). The literature review was carried out based on the analysis of a database built with the "Dimensions" application (https://www.dimensions.ai/ (accessed on 20 August 2022)), which was complemented with the "Redalyc" search engine (https://www.redalyc.org/ (accessed on 20 August 2022)), with the purpose of broadening the identification of works developed in Latin America. The search for references was based on the concept of "peri-urban agriculture"; this review included just over 1000 references, which were categorized according to the research objectives expressed in the abstracts.

The research is developed through the anthropological method, using observation tours as research techniques in the agricultural production units and semi-structured interviews conducted with their managers. Figure 1 describes the research phases in more detail. The empirical data were obtained in different periods of field work between 2021 and 2022. Visits were made to production units located in the municipalities of Xochimilco, Milpa Alta and Tlalpan, within the conservation land area of Mexico City, as well as 60 semi-structured interviews conducted with the members of the production and transformation units visited. The informants were selected from various directories generated by public policy programs that seek to promote sustainable production practices in this area. In the selection of the production units visited, we sought to include the diversity existing in the conservation land area in terms of type of ecosystem in which they work (hillside or lake system), type of agriculture (rainfed or irrigated) and type of production (vegetables, fruit trees, livestock, mixed systems). The interviews conducted reflect the diversity of trajectories, strategies, resources, and challenges faced by smallholders in the study area. The proposed typology is the result of the analysis of the data obtained; the categories used were not established a priori. The interviews were recorded and transcribed, and their systematization was based on qualitative content analysis techniques. Likewise, a map, shown in Figure 2, was made with Qgis software, showing the Metropolitan zone of the Valley of Mexico, conservation land, urban and rural areas in Mexico City, the lake area, and the study districts [36,37]. With this frame of reference, a typology is proposed that allows for the showing of existing diversity and discussing how social and cultural capital operates in the ways in which peri-urban agriculture is developed in Mexico City.

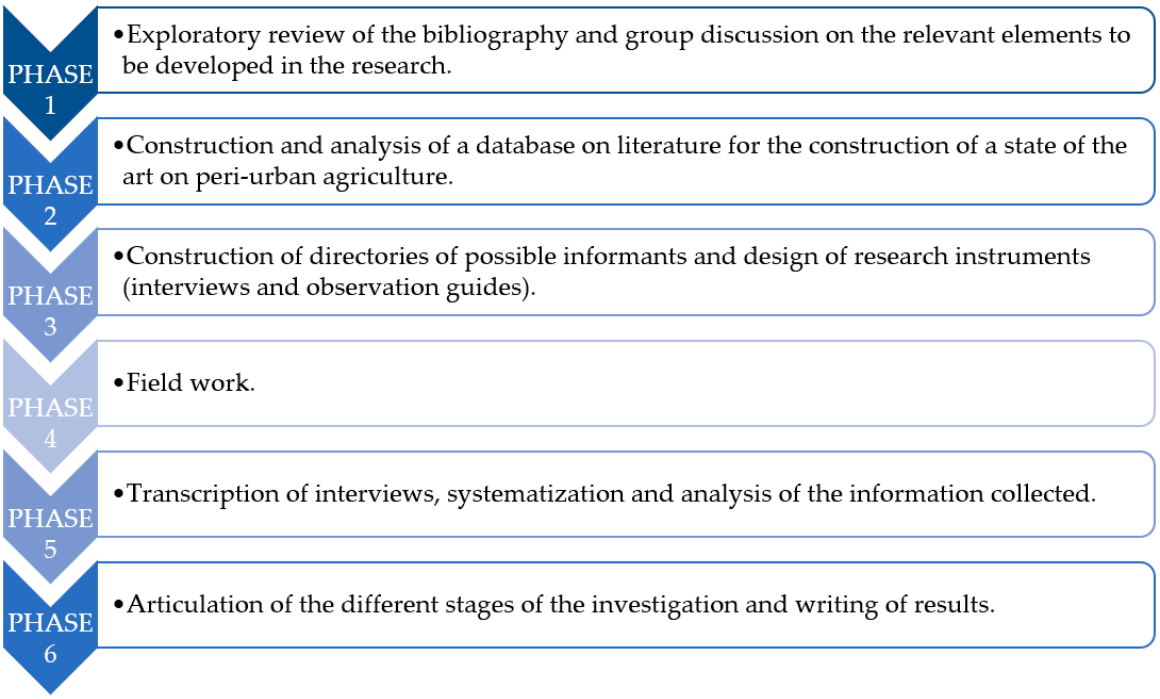

Figure 1. Research phases.

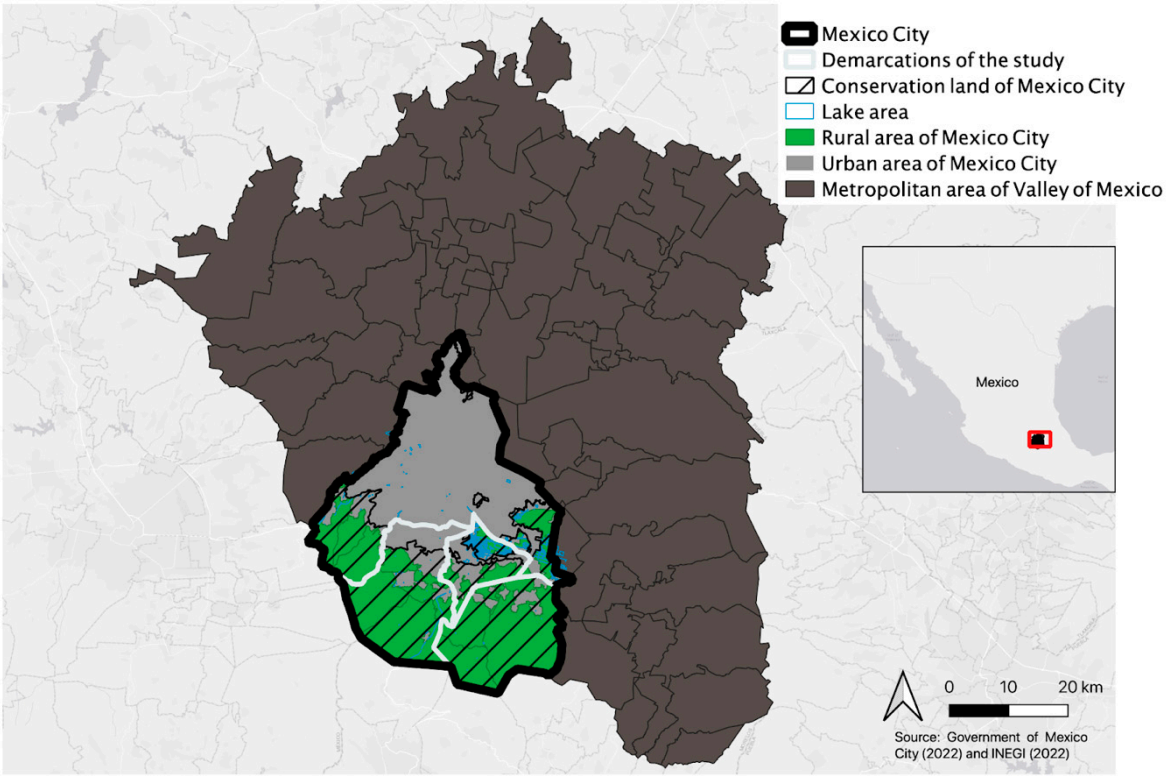

Figure 2. Map of the Metropolitan Zone of the Valley of Mexico.

3. Results

The results of this study are organized into two sections. The first places peri-urban agriculture in the context of Mexico City, identifying some of the conditions that influence the diversification of urban agricultural practices in the case study and the conditions under which they operate. The second describes five "types" of peri-urban agriculture, defined on the basis of the organizational schemes of the production units, the family trajectories

linked to rural activities and their positioning in relation to the global agenda on food sustainability, discussing how social and cultural capital operate in each case.

3.1. Peri-Urban Agriculture in Mexico City

Since the pre-Columbian period, Mexico City has been an urban zone surrounded by a rural area that supplied food to the city. Its extension remained relatively stable until the end of the 19th century, when it began its transformation towards modernity. Between 1940 and 1960 the city underwent a process of accelerated growth linked to industrialization policies. Between 1950 and 1970, the urban sprawl extended to the north and east, incorporating several municipalities of the State of Mexico and Hidalgo [38]. In the late 1970s, the Mexico City government recognized the need to contain urban growth in the forest and agricultural areas located south of the city by establishing an ecological conservation area. The ecosystem services provided by this area are important in terms of water production, climate regulation, soil retention, carbon sequestration, biodiversity conservation, agricultural production, and recreation [39]. Currently this area is 88,442 hectares, accounting for 59% of Mexico City's territory [40].

The conservation land area is historically subject to different property regimes, and 70% is social property; that is, it belongs to *ejidos* and agrarian communities, collective property schemes that were established by national agrarian legislation in the post-revolutionary period. Socially owned territories are composed of urban settlements, agricultural plots over which "ejidatarios" or "comuneros" have usufruct rights and common use areas regulated by communal assemblies, which is the status of about half of the city's ecological conservation area [38]. Thus, in addition to the forests, pastures, rocky areas and wetlands that make up this area, there are also landscapes that have been historically transformed by agricultural activities, such as the chinampas system in the lake zone and the agricultural terraces in Milpa Alta, but also housing areas made up of what are known as original peoples, i.e., those existing and identified at least since colonial times. Therefore, the legal regulations of the conservation land regulate the ways in which the territory can be used by its possessors and other holders of land rights, superimposing other social regulation schemes on the activities of its inhabitants and possessors. The different forms of land tenure, a combination of social and private, is fundamental to understand how and who may have access to land for production.

The designation of the area as conservation land limited to a certain extent the advance of the urban sprawl towards the southeast of the city and allowed the implementation of various public policy programs aimed at ecological conservation that, marginally, contemplated some initiatives for the sustainable use of resources (Figure 2). Nevertheless, this area faces great pressures and urbanization has continued to advance at the expense of forest and agricultural areas. Urbanization in this area has followed different patterns: the population growth of native peoples, the purchase of agricultural land where housing is built, the occupation of socially owned land by organized socio-political groups, and the construction of private houses and buildings. As a result of these processes, the conservation area absorbed most of the expansion of the urban area in the period 1980–2000, with an approximate growth of 300 hectares per year during that period [38]. Currently, the metropolitan area of the Valley of Mexico has almost 22 million inhabitants, representing 20% of the national population, and includes Mexico City and 60 municipalities in other states.

The new settlers in the southern part of the city are mostly low-income families from central areas of the city that the real estate market has expelled to the periphery. In most cases, these are irregular land occupations which, through "clientelistic" relationships between the organizations and the government in office, were regularized with property titles [41]. This process made it possible, on the one hand, to alleviate the lack of access to housing in the city, and on the other, generated political support to exert pressure on other levels of power. In addition to this, there are persistent processes of illegal logging, forest fires, changes in land use and lack of management and maintenance of forest areas,

which has led to a decrease in forest mass and its fragmentation. All of this has also led to the continuous reduction of socially owned areas, where land occupation has been concentrated. Thus, the advance of urbanization has fragmented the territorial organization, diminishing the management capacities of the historical settlers of these regions, who are still the owners of most of them and who have made their conservation possible until now. The conservation land area is currently a mosaic of zones with different degrees of conservation, territories of original populations that maintain, to a certain extent, their organizational and cultural traditions, as well as part of their economic uses of the territory, including agriculture, and new inhabitants who use these areas as residential zones.

In this context, and as part of the modernization and industrialization of Mexico City, farmers and the inhabitants of conservation areas in general have become increasingly linked to the city's way of life, organization and economy, developing a variety of family income strategies. In this process, agriculture has been losing importance and, in many cases, ends up being abandoned in favor to other more profitable options that coincide with the families' images of social progress. Currently, the primary sector of Mexico City represents only 0.04% of the state GDP [42], and its importance has been decreasing over the years, mainly due to the low profitability of agricultural activities, the precariousness of labor in the sector and the pressure of urban growth on agricultural areas. Nevertheless, agricultural activities maintain a certain importance for the local population, both in terms of self-sufficiency and income generation, as well as in cultural terms.

The conservation land area of Mexico City has been the subject of increasing interest from academia. Many of the published studies focus on the analysis of ecosystem conditions, such as soil and water quality, or make proposals to evaluate the quality of environmental services. In this context, agricultural spaces and producer families have been identified as key actors to preserve conservation soil and promote food sustainability in the city. Currently, about 22,800 hectares of Mexico City are dedicated to agricultural production, representing a third of the conservation land area, mainly in the municipalities of Tlalpan, Milpa Alta, Tláhuac and Xochimilco. The economically active population dedicated to agricultural activities in the city amounts to 16,000 people, grouped in 11,543 family production units, with between 1 and 3 hectares of land. Ninety percent of agricultural production is rainfed, 80% of the area is used for cyclical crops and 90% of the perennial crops are "nopales" (prickly pear). The main self-consumption products are corn, fruit, vegetables, and animals; there is also a larger scale production of nopal, amaranth, vegetables, and ornamental plants for urban markets. Figures 3 and 4 integrate the city's agricultural production data in more detail.

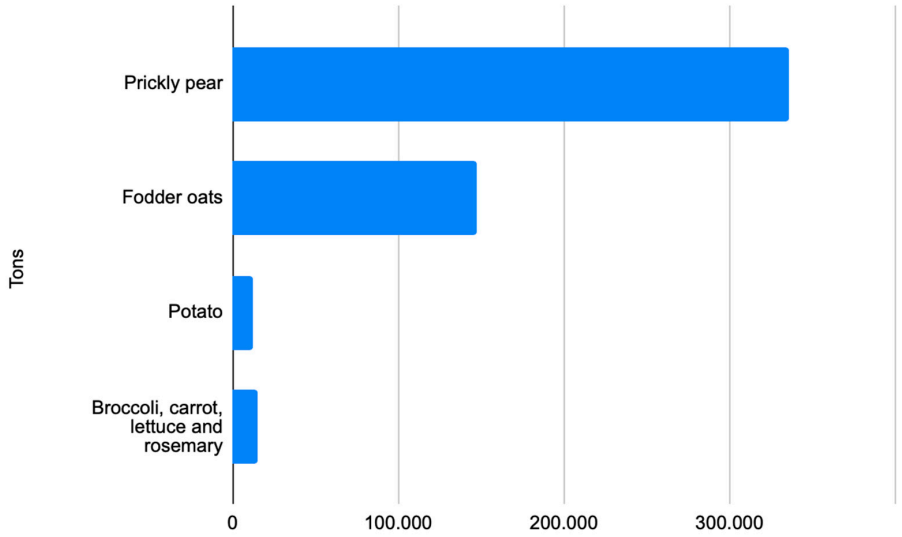

Figure 3. Agricultural annual production in Mexico City. Source: Based on the data presented in the Compendium of indicators 2017, Mexico City. SAGARPA [43].

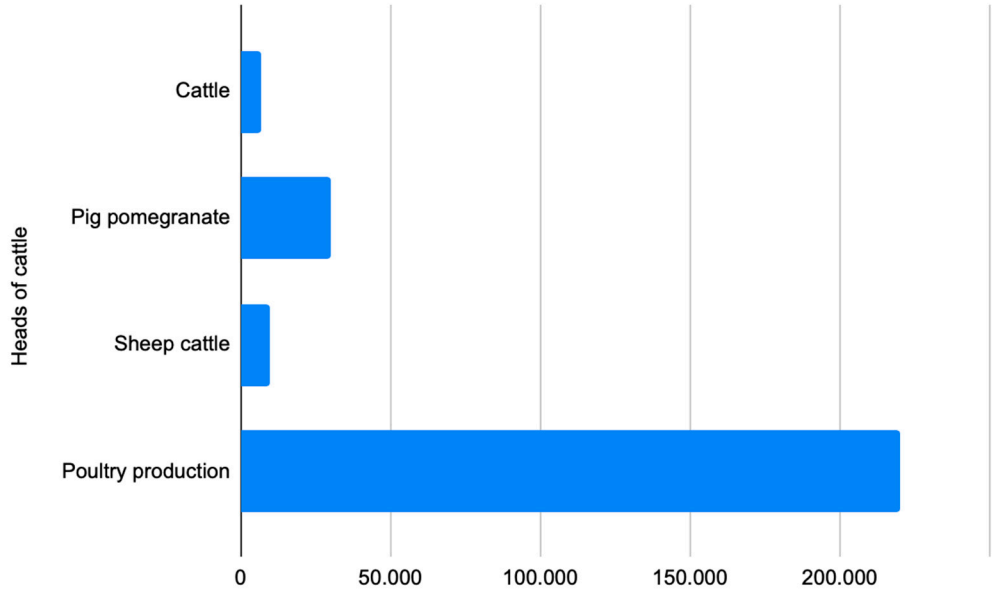

Figure 4. Annual production of livestock in Mexico City. Source: Based on the data presented in the Compendium of indicators 2017, Mexico City. SAGARPA [43].

Agricultural activities have adapted to the conditions imposed by the context of urban growth, the outsourcing of the economy and the demographic transition. An example of this is the substitution of corn for nopal, a perennial crop that requires less labor, or the production of Christmas flowers in greenhouses located in the *chinampas* that used to be used to grow food in the open air. It is worth noting that despite being developed in an area recognized as conservation land, most of these initiatives do not follow agroecological management patterns. Many of the cultivation areas in Mexico City can be considered peri-urban, located mainly in the less populated regions of Xochimilco, Tlalpan, and Milpa Alta, while others have been "enclosed" within the city, as is the case in the southern zone of Xochimilco and Tláhuac. In both cases, backyard livestock and small semi- stabled dairy cattle farms persist. The production dynamics in both areas are similar and differ from the more recent urban agriculture spaces that have been generated in the center of the city, within the framework of urban regeneration initiatives in middle-class neighborhoods.

The conservation land areas are largely inhabited by native families. Production is predominantly carried out by family production units, although some of them have some employees, either temporary or permanent. Marginally, they are also reception zones for migrants, both from other parts of the country and from other parts of Latin America, who arrive as day laborers working in the production units or renting a space to live and plant.

3.2. Description of Typology and Relationship with Social and Cultural Capital

The definition of agricultural production units in academic literature and public policy usually distinguishes between subsistence and market-oriented activities [44], but this dichotomy does not reflect the diversity that exists in this sector. The development of typologies has been used to show this diversity in various contexts. [45–47]. The elements taken into account by the typologies developed are variable, e.g., whether the activities are agricultural or livestock and the degree of specialization vs. diversification of activities (European Union Commission), whether the farmers have a peasant, entrepreneurial or capitalist profile [48], or the type of management in terms of its environmental inputs [49].

As previously stated, this study is interested in peri-urban agriculture in Mexico City, focusing on producers in the conservation land area whose productive systems are recognized as having low environmental impact and who distribute their products through socially fairer schemes. In a previous publication we described and analyzed the ideas and perceptions that producers have about sustainability, showing that it is a concept that

is understood in different ways. In some cases, it is related to the forms of production and their impact on the environment; others perceive it as a way of obtaining safe and healthy food, and still others consider that sustainability has to do with self-consumption and cooperation [50]. These data show that the discourses of global and local agencies are understood in different ways.

In addition to the location, the size and the production system, peri-urban agroecological agriculture projects have other common characteristics: they are initiatives that have economic but also ideological-cultural objectives. Among others, the most common references are the continuation of a family tradition, a "moral" commitment to the environment, a political ideal, the search for a different way of living, both in terms of time management and food. All of these elements are important insofar as they locate in or use productive activities as a reference for the construction of their cultural identity based on the notion (real or imagined) of "peasant". In economic terms, these types of production units have low profitability, so they are articulated with other transformation activities or with other urban jobs in the tertiary sector.

Based on the diversity of forms of peri-urban agriculture observed during the fieldwork, five types of production units were identified with different forms of social organization, origin and access to land, multiple functions, and articulation with consumers, which allows us to describe and analyze social and cultural capital. The proposed typology uses "ideal types", understood as a methodological construction for their categorization and not as closed models, since some cases may have characteristics of several types.

3.2.1. "Traditional" Peri-Urban Agriculture

These are production units of organized family labor, which sometimes includes a second generation of adult children. They are families of the native peoples in the conservation land area, with indigenous ancestry, though they may not recognize themselves as such. Their access to land is mainly through social tenure, where the head of the family is the rights holder. Given the high fragmentation of the territory, they usually have access to several plots, separated but with little distance between them.

Its production revolves around the *milpa* system, with corn being the main product, which is planted in a polyculture accompanied by beans and squash. The seeds used are mainly creole, reproduced from the production itself or through local exchanges. The production units sometimes include a few head of cattle and/or two or three dozen poultry. In these cases, there is usually a rotational management of pastures. They may also include other primary activities such as beekeeping, ornamental flower production, etc. Production is mainly for self-consumption. While it is not enough to cover the family's basic food needs, it provides a good part of the annual supply of corn tortillas and some complementary foods. Some surpluses are sold in local markets without any distinguishing strategy regarding the type of management.

The members of this type of productive unit usually have low incomes and a basic level of schooling (between primary and secondary). These types of production units are not economically autonomous and depend on other income obtained in the tertiary sector. These activities may include the sale of prepared food and wages generated by employment in the city, which is usually precarious, or participation in informal commerce.

Their productive practices are a mixture of family land management and some training workshops given by public institutions, on subjects such as making compost, for example. The abandonment of agrochemicals is related to a personal concern of the heads of household about the effects on their health due to the handling of these inputs.

In terms of social capital, these are families with strong local community ties in the framework of which they participate in the territorial governance of communal or ejido lands, but with few relationships with producers in other parts of the city. They often have experience in dealing with public sector actors in the management of urban services (electricity, water, etc.) and agricultural inputs. The participation of some women as skilled

mediators with the institutions stands out, although always with an unequal and often "clientelistic" relationship.

3.2.2. "Traditional-Innovative" Peri-Urban Agriculture

This category has several aspects in common with "traditional peri-urban agriculture" described above, such as family organization, ancestral ties to the territory, being part of a community structure of local governance and the type of land tenure. However, it is composed of families with stronger ties to the city, often with more schooling and access to formal jobs in public institutions, which allows them to have more resources and greater stability. Their production tends to be more varied, integrating corn and other cornfield products, as well as some market-oriented crops, such as tomato, potato, fruit, and some handmade processed products. Sometimes they have small herds of cattle, and their market products include various dairy products (pasteurized milk, yogurt, and artisanal cheeses).

In these production units there are experiences of the formal certifying of products as organic, although they often criticize these processes as bureaucratic and too expensive. Nevertheless, they make use of this type of mechanism to expand their market possibilities. These processes and their links with sectors dedicated to the promotion of agroecology, for example through academia or civil society organizations, give them a more specialized knowledge of agroecological management techniques; however, their learning is adapted to their own personal interests. Their decision to work under this perspective is often more complex, being associated both with considerations about the health of their families, as well as factors such as access to market niches, environmentalist convictions and, increasingly, a quest to reduce investment (and dependence) on agro-industrial inputs whose cost has increased significantly in recent years.

In terms of social capital, they highlight their community ties, which are often complemented by relationships with other agroecological producers in the city and other actors in the city interested in promoting agroecology and the preservation of the conservation land area. This facilitates, among other things, access to commercialization spaces with different profiles, including supermarkets that offer certified organic products, stores specializing in this type of product, and various alternative food network schemes. These relationships have also allowed them to have contact with global discourses on the risks of the agro-industrial system, so that in the different marketing spaces they can mobilize different claims to generate added value to their products, such as human health, care of the territory in ecological terms, and the promotion of a fairer and more solidarity-based economy.

3.2.3. "Politicized Projects"

These types of projects have multiplied in the last decade and have to do with the participation of young people, from urban or peri-urban origins, with university education, both as a lifestyle option and as a form of activism favoring sustainable food. They promote an alternative to the dominant agro-industrial system by promoting agroecological production and direct distribution to the consumer. They have a political narrative that is more accentuated in both ecological and social terms. It is common that they refer to "traditional food", understood as a combination of an ideal arising from hegemonic global discourses and a local cultural reference. Their political intentions do not leave them out of the market; their products are aimed at consumers sensitized to socio-environmental issues, which is a real target. The use of digital technologies is fundamental for distribution. Their livelihoods depend to a large extent on these projects, so there is a strong daily investment in market linkage work, as well as in various means to obtain subsidies (governmental or from civil society organizations).

Their access to land is restricted and is generally through private property schemes and, to a lesser extent, through the participation of some local actor with a small plot of land or through agreements with owners of idle land who grant them temporary use rights. Their production consists mainly of vegetables, with a variety of products that respond to both market demands and agroecological management criteria, favoring polycultures

and crop rotation. These types of projects have a strong ecological focus and often have close links with conservation projects, both academic and of the public sector. It is common for this type of project to combine production, training, transformation, and distribution activities, becoming alternative food networks.

In terms of social capital, these types of projects do not usually have strong community roots; however, farmers invest considerable effort in strengthening their ties to similar projects, as well as with certain sectors of academia and the government sector through their formal participation in various "projects" or as beneficiaries of scholarships and other types of subsidies that allow them to have a constant flow of volunteers with small salaries. On occasion, some of the participants in these projects have personal links with public institutions linked to the agricultural or environmental sector. In this sector, the growing presence of women in leadership positions is noteworthy.

3.2.4. "Educational/Tourism Projects"

Over the last few years, several projects have been developed that seek to promote agroecology through the development of cultivation areas whose main objective is demonstrative. The most common scheme is a civil society organization that promotes the initiative and works in collaboration with local actors, creating training spaces for farmers in the area. This type of project is usually a space where young urban people, with training in the biological sciences or related subjects do professional internships or volunteer work. Local actors also participate in these projects, and their involvement is fundamental to gaining access to plots of land, although they do not always have a relevant role in decision making.

These spaces usually also include among their objectives the sensitization of external actors, operating through different proposals, including what could be called "experience tourism" –which may include walk-through natural conservation areas, a meal and some planting or harvesting activities–, as well as environmental education workshops. Production may be for self-consumption or for alternative markets, but income from the sale of production is secondary to the resources generated by tourism activities. Often these projects also receive external funds, from public calls for proposals or private financiers, earmarked for environmental education.

The identity of this type of project is built on a narrative that emphasizes the ecological aspects of the activities promoted, recognizing the value of local knowledge mixed with technical training from academic or public institutions. The available resources allow for the salaried monitoring of some people, whose work is sometimes complemented with volunteer work by students. There is some investment capacity building, but it is limited, and production is not a priority in the distribution of resources. The participation of men and women tends to be balanced, especially with respect to external stakeholders. Among local stakeholders, it is common for men to be more involved in production activities and women more involved in activities related to visiting groups, although there may be collaboration in all activities.

In terms of social capital, these projects have, as in the previous case, limited local roots, a certain interest in similar projects, while the strongest ties are with external actors and institutions, private or civil society organizations. Occasionally some participants—especially those in managerial positions—have links with public institutions in the environmental sector.

3.2.5. "Business Projects"

The growing demand for local and organic products has been identified as a commercial opportunity for business groups, whose interests in this field are often combined with a certain degree of "environmental conviction". Thus, a growing number of projects have emerged in various zones of the conservation land area that have acquired access to land either through the purchase of land or rent and whose management is of a business type. In these projects there is a clear hierarchical division of labor, with a small group of investors at the head, and two types of employees: an operational team of urban origin

and with high technical and managerial training, in charge of technical decisions, and a group of salaried workers who take care of the land and animals.

These projects have a commercial design focused on efficiency, with extensive use of electronic platforms as privileged sales spaces, although they are also suppliers of some certified organic product stores. Although their productive capacity and market linkage stand out in comparison with the other cases, some of the actors involved comment that they are projects whose income covers operating expenses but generates little profit.

These types of projects have good investment capabilities, which gives them privileged access to infrastructure for production, processing, and distribution activities. This results in a considerable level of technification, although it is still small-scale and adapted to the principles of organic agriculture.

They are often financed by private donors and sometimes by corporate donations. Sometimes these projects also include environmental education activities, aimed mainly at schools and sometimes at companies, as well as small spaces (cultivation beds) that are rented to urban families so that they can plant, mainly recreationally, with technical advice. Production is entirely aimed at the market. The main demands are ecological.

In terms of social capital, these projects tend to have limited and hierarchical local roots, marked by their economic capacity to buy or rent land and hire personnel. Their links with academia and civil society organizations are limited, with a predominance of links with middle- to high-income private sectors, where their main interlocutors are located, for the distribution of products and educational and recreational activities, but also as potential donors.

Table 1 summarizes the general characteristics of the typology described above. The following section discusses their similarities and distinctions, focusing on those related to the social and cultural capital of the different initiatives and how this affects their objectives, strategies, and scope.

Table 1. Synthesis of peri-urban agriculture typology in Mexico City.

	"Traditional"	**"Traditional-Innovative"**	**"Politicized Projects"**	**"Educational/Tourism Projects"**	**"Business Projects"**
Tenure	Social	Social	Private	Social/Private	Private
Investment capabilities	Low	Medium	Medium	Medium	High
Access to infrastructure	Low	Medium	Medium	Medium	High
Economic dependence	High	Medium	Medium	Low	Low
Importance of self-consumption	Priority	Secondary	Secondary	Irrelevant	Irrelevant
Articulation with the market	Commercialization of surpluses in the local market	Multiple marketing channels	Alternative food networks	Multiple marketing channels	Market niches
Age	Retirees	Retirees	Youth	Middle-aged and young	Middle-aged and young
Schooling	Low	Medium	High	High	High
Cultural frames	Local	Mixed	Global	Global	Global
Main claims	Health	Socio-ecological	Socio-ecological	Predominantly ecological	Predominantly ecological
References	Tradition	Mixed	Innovation	Innovation	Innovation
Generic division of labor	Men responsible for production and women responsible for processing, sales, and links with institutions.	Men responsible for production and women responsible for processing, sales, and links with institutions, with some exceptions.	Mixed	Men responsible for production.	Men responsible for production.
Subsidies	Low, mainly of public origin	Medium: public and private	Medium: public and voluntary work	Medium: public and voluntary work	High: private origin

Source: Own elaboration.

4. Discussion

Food sustainability is one of the major problems of global agendas with impacts on local public policies. Just as with food security and safety, the eradication of hunger and malnutrition, and more recently obesity and related diseases, today sustainability is an issue worthy of attention in the international food system. The number of articles published in the last 10 years is proof that it is a well-established issue in academic centers. However, as we showed in the literature review, there is little mention in the literature of the social and cultural dynamics involved in peri-urban agriculture projects with an agroecological vocation. This article aims to contribute to the discussion on these topics, although with the difficulty of not having enough references to establish hypotheses. In this sense, the use of the anthropological method made it possible to distinguish the sociocultural diversity of the productive units.

Mexico City has one of the largest urban concentrations in the world. Although historically the city has had a rural part dedicated to food production, urban growth and modernization in general has articulated a food system based on a large central supply center where food arrives from all over the country and different parts of the world. The growth of a mega-city not only implies an increase in population, but also a social and cultural transformation of lifestyles, in which second and third sector activities are prioritized, a monetarized economy, the articulation between the periphery and the center of the city, access to higher levels of schooling and changes in the forms of access to and consumption of food, among other things. This whole process took place in a context of unequal and disorderly modernization, which largely explains the diversity of peri-urban agricultural units.

Agroecological peri-urban agriculture is far from being sufficient to feed a population of more than 20 million inhabitants. These productive projects are, then, small efforts that combine political-ideological, cultural, and economic objectives. On the one hand, they respond in some way to the insistent calls for a dike to contain the impacts of the agro-industrial system; on the other hand, they respond to the search for economic diversification strategies for sectors of the population that have some form of access to material resources (land, mostly) but also social and cultural resources to engage in primary activities. In this sense, our work coincides with the studies reported on small peri-urban agroecological production units in the cities of the global South, which show that they are part of the strategies to improve economic income and food security [51–56]; in fact, their viability and eventual reproduction depends to a large extent on other economic income. In developed countries, on the other hand, as reported in the literature, this type of production has educational and/or recreational functions [57–60].

The typology we present is a scheme that can be useful in identifying different trajectories towards agroecological production systems, and the characteristics that motivate and enable the transition. Those who come from farming families in rural areas of the city have found the central values of the sustainability agenda in the inherited knowledge and in the forms of production that have been used for generations. In this sense, it is a trajectory that starts from a different origin and historical path than those who have been transformed as part of a political ideology. Age, origin, level of schooling and social relations, all elements that make up social and cultural capital, are different. Some have high levels of schooling and come from urban areas, with social relations based on economic activity, while others have lower levels of schooling, and their social relations are anchored in the community sphere and go beyond the objectives of the productive unit. In between, there are various types that show different ways of articulating functions, objectives, organization for production and social relations with groups of distributors, activists, government projects, among others. The same has also been observed in different parts of Brazil, according to the studies we reviewed [10,31].

The different forms of access to land are not only matters of material resources, as long as there are forms of social land tenure, group membership is a determining factor. However, the size of the productive unit as well as its capacity to insert itself into formal

distribution systems (supermarkets, restaurants, and specialized stores) can explain the viability and speed with which it transitions towards agroecological forms, as has been described for other cities in the global south [61].

The social relationships that underpin much of the small production units we have described are based on trust, an issue for which there are few references, but which is especially important in shaping alternative production and distribution systems. On this point, Wang, Si, Ng & Scott [62], in the analysis of social relations in Beijing agroecological produce fairs, make an analysis of several social factors such as direct and indirect reciprocity, information, endogenous institutions and altruism, and how they have contributed to generate new forms of trust in a context of food safety problems. Their results show that, as in the case of Mexico City, trust is an essential part of social capital insofar as these networks are often outside formal institutions, both private and public. A study done in Mexico among small orange producers in the State of Veracruz found that social networks and the level of trust among producers was a determinant for the adaptation of innovations, techniques, and organization [63]. Although this case does not concern agroecological production, this research is interesting because it highlights that subjective and intangible elements are involved in the establishment of changes in small units, which are expressed in relationships of cooperation and reciprocity based on socially accepted norms that generate trust. Other works have also highlighted the relationships of reciprocity and trust [34,38], and propose that in the implementation of peri-urban agriculture programs, these relationships should be considered and promoted as an axis for their viability, access to technical resources and negotiation capacity with buyers, among others. In this sense, the analysis of social and cultural capital is essential for the transition to more sustainable food systems. In societies with high levels of social polarization, this is particularly important since, as we have seen, the relationship with government agencies, civil society organizations and distribution systems allows access to more specialized forms of production and sale.

Social organization for food production is an old topic in the social sciences; peasants and rural life have been one of the central interests of sociology and social anthropology. Narotzky [64] reviews the various discussions in this regard and posits that, in contemporary societies, among others, small-scale agroecological production seems to manifest itself as a new form of rurality. In this sense, he points out that it is essential to make deeper explorations to know whether these producers are contracted farmers who depend on solidarity consumer groups or who are autonomous actors who are generating an emerging solidarity economy. What is clear is that, as our data show, these production units, some with kinship relationships, combine their agricultural activities with other economic strategies. They are viable over time, i.e., sustainable, to the extent that there is some form of subsidy, either through self-exploitation, the use of unpaid family labor, income from other employment or retirement income, sometimes even directly with economic subsidies from individuals and agencies that finance the agroecological transition. In this regard, Pérez-Belmont, Lerner, Mazari-Hiriart and Valiente [65] recently showed in the case of Xochimilco that the subsistence of these small peri-urban production units is possible to the extent that they are part of a diversified economy. Access to all these forms of subsidies is possible depending on social relations and cultural knowledge. It should also be noted that these relationships can generate different levels of dependency and power. An investigation on the role of the impact of government programs for the promotion of backyard family farming in different areas of Mexico shows that it has effects on the generation of social capital, trust, and the emergence of emerging leaders with certain ethical-moral standards [34].

The promotion of sustainable forms of food production and distribution, as the literature review reveals, is a matter of growing academic interest which can be interpreted as both a cause and a consequence of the discussion on the risks of contemporary food. In the university institutions themselves, as described by Pasquier [66], these issues have been promoted, both in academic activities and in their own food systems for their community. Most of the studies reviewed approach the subject from a "functional" logic in economic, political, and biological/ecological terms, while social and cultural dynamics are of little

relevance. In this sense, it seems that we are facing the dominance of approaches that prioritize environmental objectives (as was once the case with the health objective), leaving social relations and cultural characteristics in the background. Studies such as the one presented here show that sociocultural characteristics are part of food systems and reaffirms what has been stated by other studies in Mexico [38], which is that it is essential to consider sociocultural aspects for the promotion of sustainable food projects.

As we mentioned, the process of moderation of Mexican society has been unequal, proceeding at different paces and even at different starting and finishing points. In this context, it is relevant to discuss how the discourses of international global agendas and nations affect the action and social change on food production in small units on the periphery of a megacity in the global South. From the logic of reflexive modernity, it could be argued that the agroecological transition is the result of an individual process of recognition of environmental risks that leads to the search for alternatives; but it is inevitable, at least in the Mexican case, not to consider the different socioeconomic and cultural characteristics of each case. In this sense, it seems useful to consider the discussions on action and social change in late modernity, where it is argued that individual decisions based on reflexivity are inexorably limited by socioeconomic conditions and shaped by culture [67]. Neither social nor cultural norms are so strict and immovable as to constrain social change, nor is individual reflexivity alien to the sociocultural framework. The types of production units we have described have different ways of responding to food system risks according to their ideals, values, material resources, and social and political relations.

5. Conclusions

The findings and discussion of this research led to the conclusion that production units willing to make an agroecological transition in Mexico City are diverse with regard to their socio-cultural characteristics. This diversity is expressed in social relations, inherited cultural knowledge, and learned technology, as well as access to land, links to distribution channels, the ability to recognize market demand, and political ideology and activism. Likewise, social, economic, and environmental functions are varied, and respond to the social inequality typical of peri-urban areas of large cities in the global south.

This research opens the door to future investigation. On the one hand, the typology of production units we proposed was useful to describe the different forms of organization and their socio-cultural characteristics, but it is necessary to test it in other contexts, as well as the distribution and magnitude of each type. On the other hand, this social and cultural diversity of the units studied can be analyzed in the light of discussions on the new forms of rurality in contemporary societies of the global south in the context of late modernity.

Scientific production on food sustainability has been dominated mainly by biological-ecological and/or economic approaches; it is essential to promote a research agenda from the social sciences to identify the different forms of social organization for agroecological food production and distribution. Particularly in the populations of the global South, before undertaking programs that promote more sustainable food systems, it is necessary to consider the diverse trajectories and characteristics of production units.

At the last UN Food Systems Summit in 2021, it was stated that to move towards a more sustainable agriculture, the cultural characteristics of indigenous populations must be considered. We agree with Ueda [68] that this should be extended to all human groups in the world, regardless of their ethnicity and economic levels. International organizations tend to draw broad lines of action to carry out projects to improve global health and environmental conditions, assuming that, except for what they consider to be indigenous groups, there is cultural homogeneity based on hegemonic ideas about the world's major problems. Specifically, based on the analysis of ideas and values about nature in Japan, this author points out that the cultural perception of how to use natural resources is a relevant issue to consider in the design and implementation of agroecological transition programs. This includes, considering our data, how and by who food production, food distribution

and food consumption systems are organized, how the different parts of the system are related, and what knowledge is involved.

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