







Socioeconomic study of cacao production units in San Vicente de Chucurí

Estudio socioeconómico de las unidades productivas de cacao en San Vicente de Chucurí

Hector J. Paz-Díaz¹   Mónica M. Pacheco-Valderrama¹  Martha Patricia Aparicio¹ 
Astrid-Yeritza Agudelo-Beltrán¹  Cesar Aguirre-Duran¹ 

¹Instituto Universitario de La Paz, Barrancabermeja, Colombia.

Abstract

Introduction

Cacao cultivation (*Theobroma cacao* L.) is one of Colombia's main agricultural products, with particular importance in the department of Santander, which accounts for the majority of the national production. However, cacao production units in the rural areas of this department face various challenges, such as lack of technical and financial support, poor infrastructure, and adverse climatic conditions, which negatively affect their competitiveness and sustainability. This study aims to comprehensively characterize these cacao production units in terms of their economic, social, environmental, and institutional dimensions, in order to provide a broader understanding of their operating conditions.

Objectives

The main objective of this research is to characterize cacao production units in the rural areas of Santander, specifically those belonging to the Asociación Municipal para la Promoción Integral de la Mujer Rural (APRIMUJER). Specific objectives include: Analyzing the socio-economic and productive characteristics of the cacao units. Identifying the main challenges faced by the women producers in terms of technical assistance, financing, and infrastructure, and proposing recommendations to improve the sustainability and competitiveness of these production units.

Methodology

The study was conducted with a quantitative approach, non-experimental and cross-sectional in design, with descriptive and explanatory scope. A non-probabilistic intentional cluster sampling method was used, selecting 30 cacao production units from APRIMUJER. Data was collected using a semi-structured questionnaire, which provided information on the economic, social, and productive conditions of the cacao units.

Results

The results show that the production units are entirely composed of women, with an average age of 46.86 years. 63% of the producers have cacao plantations ranging from 1 to 3 hectares, with an average annual yield of 548 kg/ha of dry beans. Despite these relatively good productivity levels, 90% of the producers earn less than a minimum monthly wage. Additionally, 83% face challenges related to limited technical assistance and pest and disease management. These findings highlight the difficulties faced by female cacao producers in improving their productivity and competitiveness in a resource-limited environment.

Conclusions

The study underscores the urgent need for comprehensive support programs targeting female cacao producers, particularly to improve access to specialized training and establish financing routes to invest in infrastructure and pest management. The inclusion of academic, governmental, and private stakeholders as part of a governance strategy could be crucial for the sustainable development of production units and the improvement of socio-familial cohesion within rural associations. These efforts would contribute to strengthening the competitiveness of cacao production units and improving the socio-economic conditions of rural women in the region.

How to cite?

Paz-Díaz, H.J., Pacheco-Valderrama, M.M., Aparicio, M.P., Agudelo-Beltrán, Astrid-Yeritza., Aguirre-Durán, C. Socioeconomic study of cacao production units in San Vicente de Chucurí. Ingeniería y Competitividad, 2024, 26(3) e-21314297

<https://doi.org/10.25100/iyc.v26i3.14297>

Recibido: 26-06-24

Evaluado: 06-07-24

Aceptado: 28-10-24

Online: 12-11-24

Correspondence

hector.paz@unipaz.edu.co



Keywords: Associativity, rural development, peasant economy, rural women, agricultural productivity.

Resumen

Introducción

La producción de cacao es una actividad agrícola clave en la zona rural de San Vicente de Chucurí, Santander. Este estudio busca comprender las características socioeconómicas de las unidades productivas de cacao en esta región, con el fin de evaluar su sostenibilidad y los factores que influyen en su productividad. La importancia de este sector radica en su impacto en la economía local y en las condiciones de vida de los productores.

Objetivos

El objetivo principal de esta investigación es caracterizar socioeconómicamente las unidades productivas de cacao en la zona rural de San Vicente de Chucurí. Los objetivos específicos incluyen: analizar las condiciones socioeconómicas de los productores de cacao. Evaluar las prácticas de cultivo y las estructuras productivas en las fincas de cacao. Identificar los desafíos y oportunidades para el desarrollo del sector cacaotero en la región.

Metodología

Se realizó un estudio descriptivo y de campo en varias fincas productoras de cacao en la zona rural de San Vicente de Chucurí. Se utilizaron encuestas estructuradas y entrevistas semiestructuradas con productores locales, y se recopiló información sobre variables socioeconómicas, técnicas de cultivo y factores productivos. El análisis de los datos se realizó utilizando herramientas estadísticas descriptivas y análisis cualitativo.

Resultados

Los resultados muestran que la mayoría de las unidades productivas de cacao en la región son de pequeña escala, con una prevalencia de cultivos familiares. La mayoría de los productores enfrenta desafíos relacionados con el acceso a financiamiento, la falta de capacitación técnica y la escasa infraestructura en la zona. Sin embargo, algunos productores han implementado prácticas innovadoras que han mejorado la productividad y la calidad del cacao.

Conclusiones

La investigación concluye que, a pesar de los desafíos enfrentados por los productores de cacao, existen oportunidades para el fortalecimiento del sector en San Vicente de Chucurí. Es necesario un enfoque integral que contemple el acceso a capacitación, mejor infraestructura y políticas de apoyo para mejorar la competitividad del cacao producido en la región. Además, el fomento de asociaciones y redes de apoyo entre los productores puede ser clave para el desarrollo sostenible del sector.

Palabras clave: asociatividad, desarrollo rural, economía campesina, mujeres rurales, productividad agrícola

Why was this research carried out?

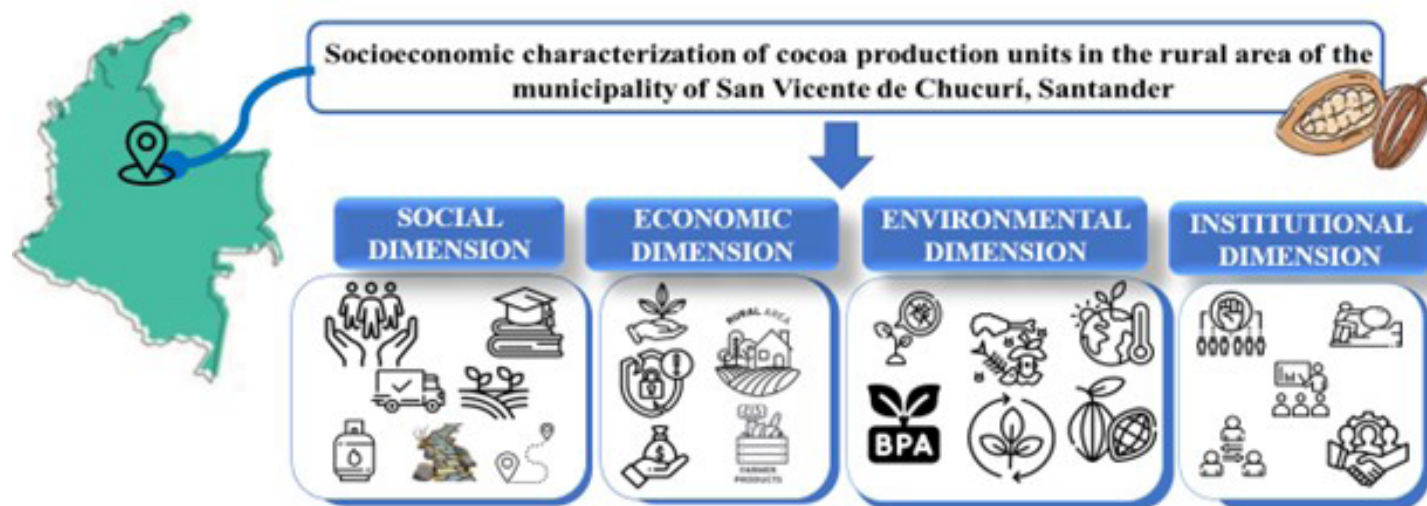
This research was carried out to comprehensively characterize the cocoa production units in the rural area of the municipality of San Vicente de Chucurí, Santander, in the economic, social, environmental and institutional dimensions, because cocoa is one of the main agricultural crops in Colombia and the department of Santander is the main producer nationwide. However, cocoa production units in rural areas face various challenges, such as the lack of technical-financial support, poor infrastructure and adverse weather conditions, which compromises their competitiveness and sustainability. Therefore, it is essential to know the characteristics and needs of these productive units to design strategies and policies that promote their development and sustainability.

What were the most relevant results?

The most notable results of the socioeconomic characterization of the cocoa production units in the rural area of the municipality of San Vicente de Chucurí, Santander, reveal a complex and multifaceted reality. On the one hand, it stands out that the productive units are made up entirely of women, with an average age of 46.86 years, which suggests greater experience and roots in agricultural activity. Furthermore, 63% of the producers have plantations between 1 and 3 hectares, which indicates small-scale production. However, despite good productivity, 90% of the members receive monthly income less than a minimum wage, which suggests low profitability and high economic vulnerability. This is due in part to a lack of access to finance and resources, as well as limited technical assistance and pest and disease management. In this sense, the results highlight the need to implement comprehensive support programs focused on improving access to specialized training for vulnerable peasant women, as well as establishing financing routes and access to the resources necessary to invest in the sustainability of the productive units.

What do these results provide?

The results provide a solid basis for the formulation of policies and support programs that address the specific needs of cocoa producers in the region. By identifying that the majority of producers are women and that they face significant challenges, it can be argued that it is crucial to implement training programs that not only improve their technical skills in cultivation and pest management, but also strengthen their business management capacity. Furthermore, it is necessary to establish the need to establish accessible and sustainable financing routes that allow them to invest in their crops and improve their quality of life. The inclusion of academic, government and private actors as part of a governance strategy can facilitate the creation of support networks and resources that strengthen cocoa production and promote gender equity in the agricultural sector. Consequently, these results not only highlight the current situation of women producers, but also offer a path towards improving their well-being and the sustainability of their productive activities.



Introduction

Cocoa (*Theobroma cacao* L.) is a botanical species belonging to the family Esterculiáceas and native to Latin America (1), which gives rise to a fruit known by the same name, which is used in the manufacture of various products, being chocolate the most outstanding among them (2). Currently about 90% of the production of this crop comes from small farmers residing in tropical regions around the world (3). This dynamic of dedication to the crop can be attributed to the interest in expanding planting areas by farmers due to the preference of a large group of consumers for cocoa products, which makes it a favorite food in various households (4,5), being the third most important player in the global market, after sugar and coffee (6).

At the national level, this crop stands out as one of Colombia's main commodities due to its social and commercial impact (7). It is an important part of the peasant economy and a means of subsistence for those who do not have regular access to technical assistance (8). This form of family farming covers approximately 65,341 cocoa units, with an average area of 3 hectares (9,10). Most of these productions achieve an annual bean yield of between 500 and 600 kg ha⁻¹, which represents 75% of the net income of small producers (11), and contributes significantly to the creation of between 62,000 and 93,000 direct and indirect jobs, respectively (12).

In this sense, the department of Santander is the main cocoa producer in the country (13), with production concentrated in rural areas and developed mainly in medium and small properties. However, despite reaching a production of 640 kg ha⁻¹ of dry cocoa, considerably higher than the national average of 450 kg ha⁻¹ (14), the cocoa sector in the department (Santander) continues to face production challenges, such as lack of formal financial support, access to agricultural inputs, poor infrastructure, limited transportation and market networks, ineffective economic policies, rural-urban migration, unpredictable weather conditions, as well as crop pests and diseases (15,16). This coupled with widespread poverty in cocoa-growing communities, poor working conditions, price volatility, loss of land governance from government and community control to extra-territorial actors, including multinationals (17).

In this circumstance, the municipality of San Vicente de Chucurí is no stranger to these difficulties and the negative impacts on its competitiveness, especially with regard to the infrastructure for the collection and processing of cocoa, where the family craft industry prevails, and in turn the technological perspective, are related to genetic quality and susceptibility to diseases, as well as phytosanitary management (18). Under these arguments, rural areas have undergone important socioeconomic changes as a result of modernization and deepening globalization (19), and these components have influenced basic needs such as health, education and housing, among others (20). Hence, it is essential to know the social, economic, institutional and environmental requirements of cocoa producers, so that the characterization emerges as a methodological tool to identify the limitations and potential of cocoa production units (9), therefore, there is a need to strengthen the structure of this type of data, since the information on cocoa producers by municipality or subregion is limited (2).

Therefore, the objective of this research was to integrally characterize the cocoa production units in the rural area of the municipality of San Vicente de Chucurí, Santander, through economic, productive, social, environmental and institutional dimensions and descriptions. This information could allow addressing possible scenarios for the improvement of the crop in terms of the potential and limitations of the territory, which is indispensable for the actions that intervene in the competitiveness of the sector and its long-term sustainability.

Methodology

Area of study

San Vicente de Chucurí is located in northern Colombia, in the Andean region; within this geographical framework, the agroecological conditions of the production units associated with the study vary between 500 and 850 meters above sea level. This altitudinal range, together with an average temperature that ranges from 25°C to 27°C and annual rainfall of approximately 2100 mm, creates a favorable environment for a wide diversity of crops grown in the area.

In relation to the study, this research is typified with a quantitative approach of non-experimental type, of transectional nature (transversal) and with a descriptive and explanatory scope. The productive units under study are constituted by the Municipal Association for the Integral Promotion of Rural Women - PRIMUJER, which groups 96 active members.

Population and sampling

The selection of the productive units was made by means of non-probabilistic purposive cluster sampling, following the methodology proposed by Otzen et al (23). This approach facilitates obtaining a representative sample by considering the clusters as selection units. Selection criteria based on the methodology of Cáceres Yparraguirre et al. (24), were applied with certain adaptations, which are presented below:

Inclusion criterion: member actively participating in PRIMUJER at the time of the survey, based on availability and interest.

Exclusion criterion: desire not to participate in the survey; not having any component of the unit (agricultural production, agricultural production).

Mobility criterion: refers to the resources available for travel, in terms of availability of transportation vehicles, fuel, accessible routes and the time required to reach the selected locations.

Sample: once the inclusion, exclusion and mobility criteria were met, the total sample was 30 units.

Collection Techniques

A semi-structured questionnaire was used as a collection instrument (101 multiple and open questions), descriptive statistics was used as an analysis technique, considering the socioeconomic (51 questions), environmental (28 questions), and institutional (22 questions) aspects according to the methodological adaptation described by various authors such as: Fonseca-Carreño, (25); Molina-Romero, et al. (26); Ortega-Pacheco et al. (27); Peralta, et al. (21); Sánchez-Galán et al. (28); Pérez-Abadía et al. (29). Within this research context, socioeconomic dimensions were characterized as: family structure, community participation, access to social and health services, educational level and training, support and collaboration networks, economic activities and sources of income, access to credit, employment and entrepreneurship opportunities, productive and technological capacities; environmental dimensions: use of natural resources, environmental impact of productive activities, management and conservation of the environment and finally, institutional dimensions such as: organization and governance, relations with governmental entities, access to rural development programs and projects, participation in collective decisions, competitiveness, associativity and sustainability.

Information analysis

The socioeconomic, environmental and institutional characteristics were analyzed and systematized by means of descriptive statistics using Microsoft Excel® software as a tool for information processing. The data collected was organized through tabulations, calculation of means, frequencies and percentages, in order to determine the significance of the results.

Results and discussion

Social component

Sociodemographic characteristics: the 30 members of the APRIMUJER association are made up of 100% women, the average age of the members was 46 years; most are between 30 and 50 years old, representing 70%, and the remaining between 51 and 75 years, representing 30%. These results are in agreement with the average age of cocoa farmers in the department of Santander, which ranges from 45 to 54 years (30), and with the national average of 50 years reported by Perez-Abadía et al. (29). Similarly, the age of the associates could be related to a greater rooting to the field, a situation that is considered positive from the point of view of traditionality, but as some authors argue (2,7,31), in terms of improving the competitiveness of the sector, the resistance of the farmers to abandon traditional production practices can be an obstacle for the adoption of new production technologies (7). Consequently, the advanced age in the rural sector lacks a

generational relay, which is a challenge in terms of manpower for agriculture in the territory (2). Regarding marital status, 40% of the associates had stable marital status, a crucial factor given that those with a stable marital status are usually more committed to the family and, therefore, to their agricultural work (32).

Family role: economic dependency in APRIMUJER households averages 4 people, with the male breadwinner being the main breadwinner, reflecting traditional gender roles (33). Sixty-seven percent of the women are housewives, 13% are engaged in agriculture, 13% in household maintenance and sometimes in agricultural work, and 7% in other tasks. Although the association is exclusively female, a traditional family structure is maintained, with 7% of women contributing economically. Nevertheless, women play a crucial role in agricultural production, where they contribute to food security by adopting traditional and technological practices appropriate to each type of agricultural activity in which they participate. Despite being fundamental in the production and supply of family food, they face limitations in addition to cultural, traditional and sociological reasons, such as limited participation in decision-making (34).

Regarding the number of people living together as a family, it was found that 22% of the associates have children under 14 years of age, 46% have children between 15 and 24 years of age, 22% have children between 25 and 34 years of age and 11% have children over 34 years of age. This aspect is crucial because it involves generational replacement, which is currently deficient in Colombian agriculture, since the survival and growth of the productive units depend on a generational transition process, which is associated with factors such as the motivation, skills and characteristics of future successors (35). The highest educational level attained by the children is 41% with university studies, 34% with complete high school, 17% with incomplete high school, 3% with basic/primary studies, and 3% with technical/technological studies. Several researchers have pointed out a direct connection between the educational level of farmers and the adoption of agricultural technology (34, 35). Therefore, programs aimed at promoting new technologies in the agricultural sector could involve farmers' children as mediators in their adoption (7).

Educational level: in terms of the educational level of the respondents, 17% of the associates have primary education, 23% have incomplete high school, 23% complete high school, 6% have technical and technological training, and 30% have university education. There were no cases of illiteracy among the associates, which is positive, considering that illiteracy is related to poverty in the rural population (36). With respect to the results obtained, it can be seen that the associates surpass this study characteristic found by Pabón et al. (7) in Santander, where 79.8% of the growers had low educational levels. Other studies in the department of Sucre indicate that 34.8% lack secondary education (37), and in the South Pacific of Colombia, 16% are illiterate and only 0.8% have a technical or university education, which shows a basic level of education in the population (29). In general, Colombian cocoa farmers have low levels of education, with 16% illiterate, 64% with primary education and only 9.4% with secondary education (2). Within the higher education environment, only 0.8% have completed technical or university studies (38). These results obtained by the respondents exceed the national average, standing out as an influential aspect in the contexts of peasant family farming, although it is recommended by some researchers to implement the methodology of farmer field schools (ECA) as a strategy of associative governance with the

participation of institutional actors, since this can influence agricultural extension services and new ways of acquiring resources necessary for strengthening crops (34).

Population in special condition: the data show that most of the associates had a special condition (20% have been displaced, 47% are victims of the armed conflict, and 13% belong to indigenous communities). In addition, 84% are affiliated with a subsidized regime administrator through the System for the Identification of Potential Beneficiaries of Social Programs (Sisbén). This is consistent with the findings of several authors who state (21) that the subsidized health system covers 97.9% of the target population, which is a scenario of vulnerability that can limit the ability to progress in cocoa farming and other productive activities. Given this reality, it is necessary to implement comprehensive support programs focused on improving psychosocial care, technical assistance and the development of entrepreneurial skills. This includes access to new microcredit routes and training for affiliated members in order to strengthen management and leadership in the productive units. Given the high percentage of the population that is displaced, victimized by the armed conflict or belonging to indigenous communities, these initiatives can address not only their economic needs, but also promote their social and family development.

Figure 1 summarizes the demographic data including age, gender, marital status, family size, educational level, and special conditions of the surveyed population.

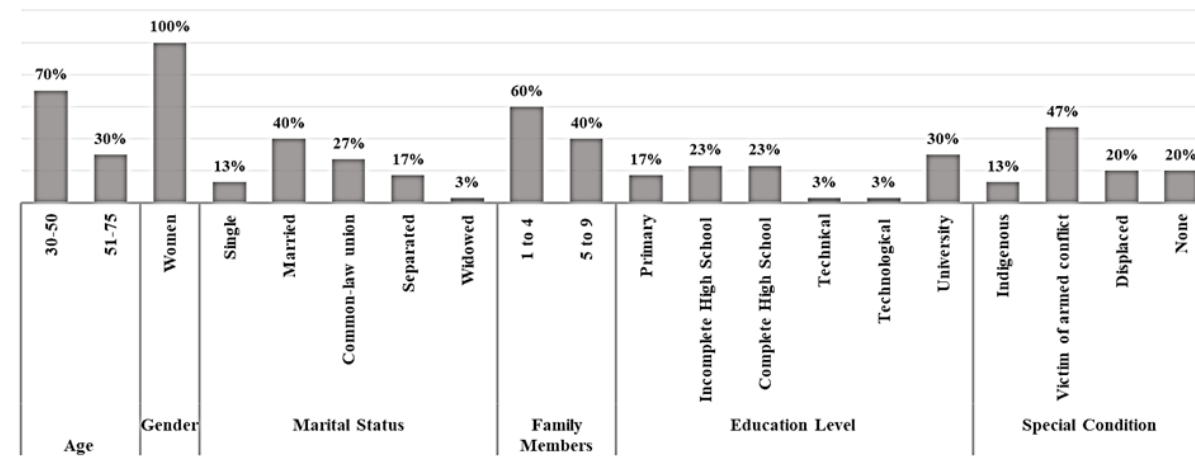


Figure 1. Demographic and socioeconomic profile of the surveyed population

Land tenure: on the other hand, in PRIMUJER 34% of the people have land rights, which is relevant in view of the fact that it has been shown that those who have land rights have more sustainable living standards (37). This is because having land rights allows access to other resources, such as natural resources, financial capital and fixed assets, as well as strengthening human and social capital (29). It should be noted that in this study most women did not own land, which could have an impact on land tenure and ownership relations among rural women, especially in societies with non-egalitarian gender agreements, which places them in a more vulnerable position than men (39,40).

Also, the location of the farms is considerably far from the municipal capital, with a total average distance of 16.53 km from the urban area and an approximate travel time of 30 minutes, which makes it difficult to transport the products to be marketed due to the deterioration of the access

roads, This is due to the fact that San Vicente de Chucurí has a secondary road network that needs a major investment because it is in poor condition and is not paved, and 67% of the members do not have their own vehicle, which makes them dependent on third parties for transportation and can considerably affect the marketing or sale of the products grown by the association. Regarding permanence in the area, the women members have been cultivating in the area for approximately 29 years, which reflects their rootedness in the activity. The majority (33%) have been cultivating for more than 20 years, while a third have been cultivating for between 11 and 20 years. In this way, family tenure becomes a key factor, since the crop represents the livelihood and economic backbone of small rural producers, in addition, it was found that the average length of time they have been in the association is five (5) years.

These results provided by the survey can be interpreted by several interrelated factors such as family land tenure, since it provides women with a sense of stability and belonging, which allows them to develop a long-term commitment to agricultural activity. In addition, the experience accumulated over the years also allows them to adapt better to adversities, which translates into greater resilience. In addition, participation in these activities not only represents a source of income, but is also linked to their cultural and emotional identity, fostering deep roots in the community. Finally, access to public policies and productive projects that support family farming can enhance its permanence, providing resources and training that strengthen its role in rural development.

Household services and housing: access to public services is practically universal among the women surveyed, with full coverage of electricity, potable water and telephony. However, only 60% have access to fuels such as propane gas, and a third use firewood for household chores. Despite this, all have access to mobile telephony and 53% have access to the Internet. This may be beneficial given that some research agrees that poverty depends not only on monetary income but also on access to public services (41), and consequently, from these results, basic human needs are supplied, including food, drinking water, sanitation facilities, health, housing, education and information. Regarding the physical characteristics of the houses, the members are mainly built with bricks (81%) and to a lesser extent, with wood (19%). However, in rural areas, the precariousness of housing is not considered to be due to the wooden structure or the use of latrines, but rather to the lack of drinking water and the use of fuel for lighting (28). In short, 100% have electricity, 87% are supplied by the municipal aqueduct and 14% by groundwater, so the problem lies in the use of firewood, since gas cylinders tend to be expensive in relation to the income of the members, a situation that causes social inequity in the region, so they opt for firewood or charcoal as a source of heat energy for cooking food. Figure 2 represents a series of characteristics and socioeconomic factors related to the agricultural production of the associations.

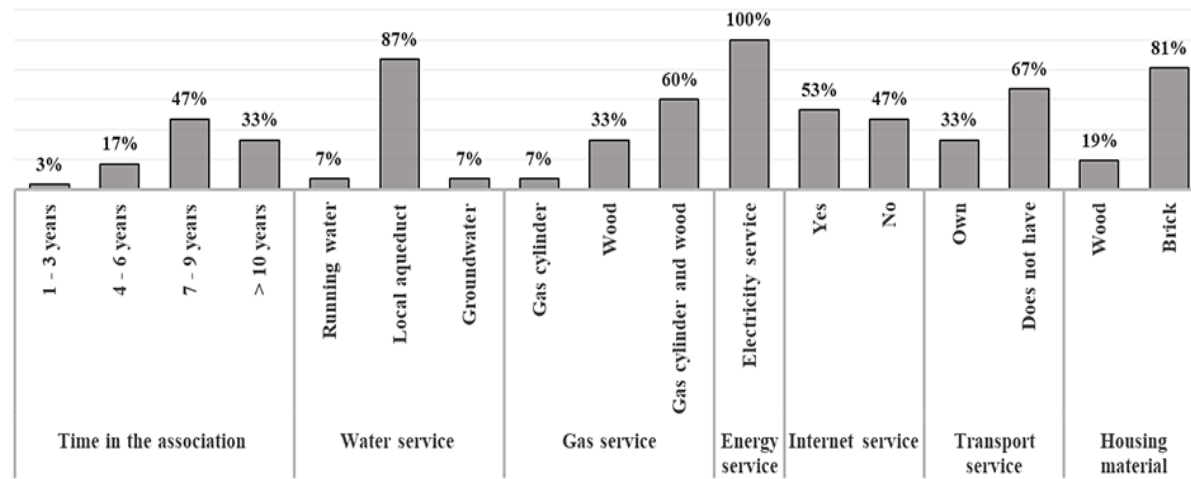


Figure 2. Conditions and services of households in productive units

Economic component

Use of family labor: eighty percent of the labor comes from the family itself, which saves money for the management activities of the production unit, and for the remaining 20%, the members hire permanent workers. On average, there are two or more people involved in production, mainly women (34%). It is worth mentioning that 97% of the family income comes from the production unit, mainly from agricultural activities. Producers who employed external labor 43% had a higher production and higher income. Thus, it can be deduced that family labor faces a challenge due to the aging of the rural population and the low participation of young people in agricultural activities, which reduces the effectiveness of the labor force when they reach the age of 60 and forces them to hire additional personnel, negatively affecting economic income (42).

Marketing and production activity: the 30 productive units of the association are mainly engaged in agricultural activities (74%), followed by livestock-agriculture (13%) and agriculture-commercialization (13%). Most of their agricultural production is occasionally sold in small quantities to the local market (27%), with intermediaries being the main buyers (63%), which is why eliminating intermediaries could improve the farmers' income and promote social innovation in terms of improved participation in commercial sales.

Productive land use: in relation to the size of the production units, 7% have less than 1 hectare, 30% have plantations larger than 4 to 7 hectares (ha^{-1}), and the remaining 63% of the producers have cocoa plantations between 1 and 3 hectares, being this comparable with the global data in cocoa production systems (3 ha^{-1}), likewise different studies agree that 90% of the cocoa beans in the world are harvested in small family farms with less than two hectares of land (11,12). In this sense, these units have an average of 4.5 ha^{-1} , but of this total only 2.5 ha^{-1} are dedicated to the cultivation of cocoa, resulting in the main productive vocation of the association, in addition to this activity there are hybrid varieties (50%), criollas (6%), and clones (86%).

The average annual yields of the cocoa crop association exceed the world (385 kg ha^{-1}) and national (450 kg ha^{-1}) average (11.37), since the annual dry bean production is 548 kg ha^{-1} in the study units. There is also a wide variability in production ranges, from 200 kg to 1000 kg, which

could be associated with challenges such as soil fertility, advanced age of plantations, poor pest and disease control, inadequate shade management in the crop, poor technical assistance, price volatility, and climate change. In addition, there is low technological adoption among small farmers due to lack of knowledge and limited use of obsolete agricultural practices (13,43-45). Similarly, there were agricultural crops such as avocado (43.33%), citrus (53.33%), and others (3.33%), mostly of the Creole variety and intended for self-consumption.

Income of associates: ten percent of the associates earned incomes that exceeded the current minimum monthly wage (SMMLV) of 335 dollars (USD), while 27% earned less than 1 SMMLV, with an average of 194 dollars (USD), and the remaining 63% received an average monthly income of 48 dollars (USD). In fact, it is observed that production units of less than 5.0 ha⁻¹ generate monthly agricultural income equivalent to 14% of the SMMLV, which is insufficient to support families. From this point of view, units with larger areas cultivated with cocoa tend to have higher incomes, while farmers with fewer hectares receive lower monthly incomes, within this scope these findings reflect a low economic impact of cocoa cultivation. In comparison with other similar studies, it was found that 33% of cocoa producers in the department of Santander received less than 1 SMMLV (13), and women with low socioeconomic levels may face difficulties in accessing sufficient and good quality food, as well as in adequately caring for their children and maintaining a favorable psychosocial environment in their homes.

Livestock activity: livestock activities make up 13% of the productive units, with a distribution of 42% in cattle, 27% in raising native chickens and 13% in laying hens. To a lesser extent, there are fish (7%), sheep/goat (6%) and swine (5%). This low level of livestock activity may be due to deficient infrastructure and technology transfer, which hinders its structured development. In addition, 45% of the associates use their own resources for the maintenance of animal species, due to the lack of financing. Nevertheless, 53% of the producers consider that the productive performance of their livestock activities is "Good", and in general, "They feel satisfied", which can be linked to the rooting and preservation of the patrimonial values of rural areas.

Figure 3 provides a series of statistics related to agricultural production and the socioeconomic characteristics of the productive units.

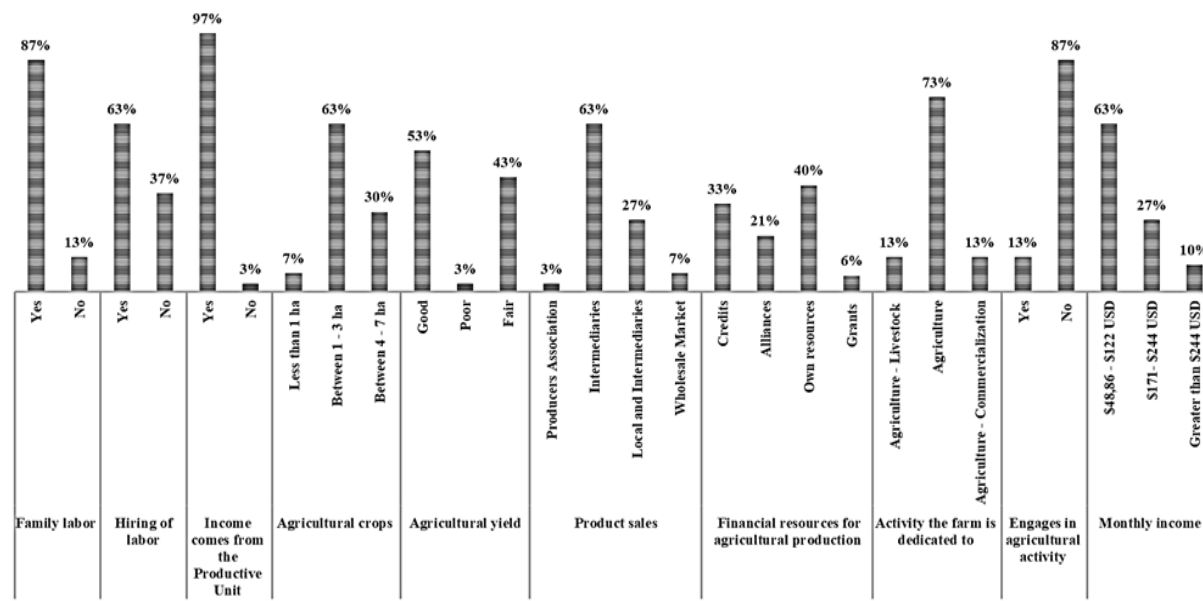


Figure 3. Analysis of socio-economic factors in agricultural

Environmental component

Quality certification and production mission: twenty-three percent of the respondents have adopted Good Agricultural Practices (GAP), which ensures food safety and prevents risks in primary production (25), while the remaining 73% do not have this certification, which is evidence of a traditional and low-tech agricultural production model. With respect to future productive orientation, the respondents selected the local market (33%), national market (31%), local consumption - exporter (22%) and export market (14%), for this reason, it is crucial that to be more competitive in an international market it is recommended to comply with GAP certifications, and maintain production averages above 1000 kg ha^{-1} , with minimum production units of 3 ha^{-1} (12,42).

Factors affecting production: the factors that affected the production units were climate (36%), economic resources (16%), phytosanitary (30%), and the effect of the price of the dollar (14%). In the research, 100% of the respondents stated that they had economic problems, which made it difficult to achieve full coverage, mainly for reasons of financing. For some researchers, cocoa cultivation is not profitable for small farmers, which should be addressed by governments to facilitate a real transition of cocoa farmers to a better quality of life in the countryside (12).

Production methods: production methods used included compost (27%), grafted plants (21%), certified seeds (14%) and chemical fertilizers (15%). The association also uses, to a lesser extent, insecticides (8%) and traditional production techniques (67%). The use of chemical fertilizers (45%) and proprietary extracts for pest control (78%) stand out. Farmers opt to use native seeds in their crops due to the high cost of certified seeds (36).

Cultivation practices: the problem of greater incidence in cocoa cultivation is evidenced in: diseases (83%), pests (63%), nutritional deficiencies (36%), weeds (20%) and droughts (13.3%). These results can cause annual losses of up to 40% (42), therefore, it is necessary to evaluate other integrated management strategies for the control and eradication of diseases, among which is the evaluation of resistant clones (46), in the same way weekly phytosanitary controls would reduce the

possibilities of disease propagation and loss in the quantity and quality of cocoa (13).

Figure 4 provides data on different aspects of agricultural production, such as certification, production for consumption, factors affecting production, raw materials used and type of production.

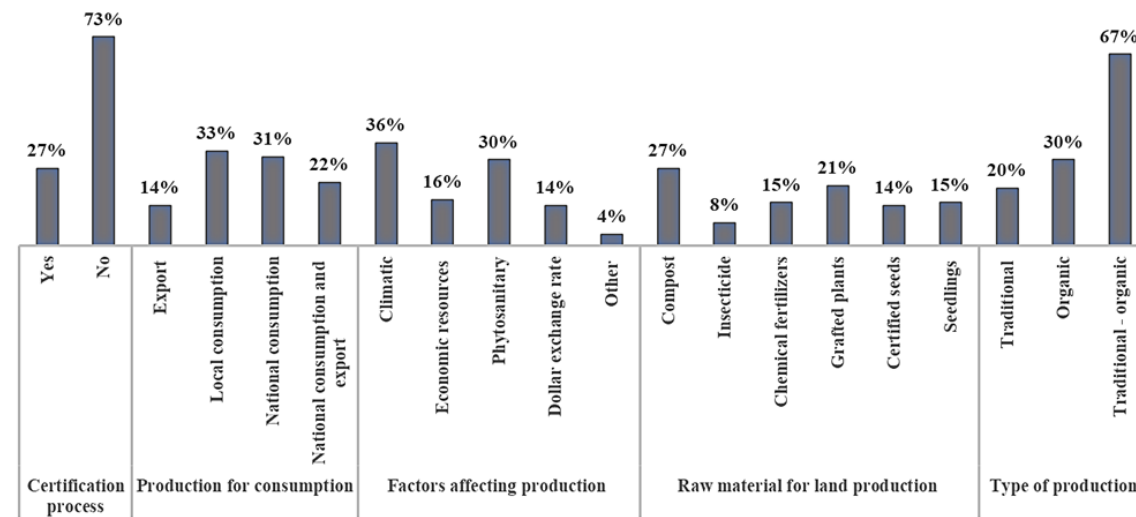


Figure 4. Factors and types of production in agriculture

Waste management and irrigation: for organic waste management, 86% of the respondents reuse them as organic fertilizer, 16% place them for collection by a municipal company, 10% perform controlled burning and 3% pay for the collection; as for crop irrigation, 83% do not observe any type of technification, being very dependent on the weather due to the action of rainfall.

Institutional Component

Technical and institutional management: the perception of the level of crop technification was 30% (“Adequate”). In addition, when asked about the implementation of Good Agricultural Practices (GAP), environmental responsibility and the generation of added value to their agricultural products, the respondents answered that these tasks are carried out in an “Adequate” manner. With respect to product marketing, the respondents indicated that the sale of their products presents significant difficulties because most of the profits are controlled by intermediaries, which generates discontent and dissatisfaction, in addition to the high cost of agricultural inputs. This, from the perspective of several authors, reflects poor government and agricultural management, which poses significant challenges such as poverty; these conditions have led many farmers to compensate for low incomes through other activities, including illicit crops (2,12).

Sense of belonging and empowerment: the results show that the sense of belonging of the associates is “Adequate” (93%). Similarly, the survey asked about aspects such as the level of participation of the association in the formulation of proposals to obtain support from public and private institutions and NGOs, in this sense 50% responded adequately, while 43% considered it inadequate and 7% qualified it as ideal. In addition to this, it was corroborated that the perception of support from the State and bank credit facilities are inadequate according to the answers given by the associates. According to Pérez-Abadía et al. (29), this perception of access to agricultural

credit causes producers to resort to informal credits, which carry high interest costs in comparison with the traditional financial system (29).

In contrast, training and technical assistance are few, receiving an average of one per year, and the actors with the greatest presence in the territory according to the farmers are: the Instituto Universitario de la Paz, Servicio Nacional de Aprendizaje, Federación Nacional de Cacaoteros and Cámara de Comercio de Barrancabermeja. The training addressed by these actors are: crop management, environment, food safety, intensive pruning, enterprise management, good agricultural practices, composting, and transformation processes. It is essential that agricultural researchers from these actors strive to provide farmers with technological packages that help them increase their productivity and quality of life through technical assistance (13), in line with research by Achmad et al. (47) who state that a better development of collaborative actions between researchers, farmers and government to increase access to information, technology and markets, although still difficult to achieve, agroforestry systems based on cocoa, have the potential to increase the income of growers (47).

Finally, as mentioned above, technical assistance can be the key to improving the sustainability of cocoa production, since it facilitates the adoption of adaptable and applicable technologies (12, 32). It should be noted that the low level of training in the production units, the high presence of intermediaries and the high fluctuation in the price of cocoa lead producers to manage their crops empirically or traditionally (48); therefore, it is important to provide training and information on technological offers linked to the production chain (14). However, cocoa cultivation faces a high level of abandonment due to low economic income and the lack of an effective extension model on the part of the State (46).

Conclusions

It is important to mention that the inclusion of academic actors, government entities and the private sector as a governance strategy would contribute to the long-term development and social cohesion of the APRIMUJER association. The support of territorial actors (Fedecacao, Barrancabermeja Chamber of Commerce, Instituto Universitario de la Paz, Servicio Nacional de Aprendizaje, Universidad Industrial de Santander, Alcaldía Municipal de San Vicente de Chucurí) is key in the community, as well as social enterprises and community leaders, to foster collaboration and teamwork.

It is also necessary to implement various development paths through concrete actions and inclusion policies that facilitate legal mechanisms to ensure both land tenure and gender equality, which would allow women to assume a more active role in the cocoa sector. In fact, strategic directions are needed to facilitate access to resources, given that they often depend on external or internal financing, whether from international donors, development agencies, foundations or financial credits (state and private entities). However, through these institutional actors, financing and commercialization channels could be developed that allow consumer confidence and increased demand, in accordance with certification processes that validate these sustainable practices. In summary, collaboration in education (agreements or alliances) for training in specialized skills and



entrepreneurial capacities is important to meet the productive requirements, but also to foster the sociocultural and family growth of the association.

CRediT authorship contribution statement

Conceptualization - Ideas: Héctor Julio Paz Díaz, Mónica María Pacheco Valderrama. Data Curation: César Aguirre Duran, Martha Patricia Aparicio. Formal analysis: Héctor Julio Paz Díaz, César Aguirre Durán, Martha Patricia Aparicio. Acquisition of financing: Mónica María Pacheco Valderrama. Research: Héctor Julio Paz Díaz, Astrid Yertiza Agudelo Beltrán, Martha Patricia Aparicio. Methodology: Héctor Julio Paz Díaz, Astrid Yertiza Agudelo Beltrán. Project management: Héctor Julio Paz Díaz, Mónica María Pacheco Valderrama. Resources: Héctor Julio Paz Díaz, Mónica María Pacheco Valderrama. Software: César Aguirre Durán, Martha Patricia Aparicio. Supervision: Héctor Julio Paz Díaz, Mónica María Pacheco Valderrama. Validation: Héctor Julio Paz Díaz, Astrid Yertiza Agudelo Beltrán, Martha Patricia Aparicio. Visualization - Preparation: Héctor Julio Paz Díaz, César Aguirre Durán, Martha Patricia Aparicio. Writing - original draft - Preparation: Héctor Julio Paz Díaz, Martha Patricia Aparicio, César Aguirre Durán. Writing - revision and editing - Preparation: Héctor Julio Paz Díaz, César Aguirre Durán, Martha Patricia Aparicio, Astrid Yertiza Agudelo Beltrán.

Conflict of interest

The authors no declare.

Ethical implications

yes, were declared within the text.

Financing

Yes, the authors received resources from Instituto Universitario de la Paz.

References

1. Martínez Reina AM, Grandett Martínez LM, Novoa Yáñez RS, Martínez Atencia J del C, Contreras Santos JL, Berrio Guzmán EE. Análisis técnico-económico del sistema de producción de *Theobroma cacao* L. en el departamento de Sucre, Colombia. *Rev Investig Innovación Agropecu Recur Nat.* 2022;9(3):46–55. Disponible en: <https://doi.org/10.21897/jar7m208>
2. Ballesteros Possú W, Navia JF, Solarte JG. Caracterización socioeconómica del sistema agroforestal tradicional de cacao (*Theobroma cacao* L.). *Revista de Ciencias Agrícolas.* 2021; 38(2):17–35. Disponible en: <https://doi.org/10.22267/rcia.213802.156>
3. Akoa SP, Onomo PE, Ndjaga JM, Ondobo ML, Djocgoue PF. Impact of pollen genetic origin on compatibility, agronomic traits, and physicochemical quality of cocoa (*Theobroma cacao* L.) beans. *Sci Hortic.* 2021; 287:1–8. <https://doi.org/10.1016/j.scienta.2021.110278>
4. Martínez-Reina AM, Grandett-Martínez LM, Novoa-Yanez RS, del Carmen Martínez-Atencia J, Contreras-Santos JL, Berrio-Guzman EE. Typification of cocoa-producing farms (*Theobroma cacao* L.) in Montes de María and La Mojana, Colombia. *Agronomía Mesoamericana.* 2023;34(3):1–12. Disponible en: <https://doi.org/10.15517/am.2023.54574>.
5. Niether W, Jacobi J, Blaser WJ, Andres C, Armengot L. Cocoa agroforestry systems versus monocultures: a multi-dimensional meta-analysis. *Environ Res Lett.* 2020;15(10):1–13. Disponible en: <https://doi.org/10.1088/1748-9326/abb053>



6. Asigbaase M, Dawoe E, Lomax BH, Sjogersten S. Biomass and carbon stocks of organic and conventional cocoa agroforests, Ghana. *Agric Ecosyst Environ.* 2021;306:1–11. Disponible en: <https://doi.org/10.1016/j.agee.2020.107192>
7. Pabón M. G, Herrera-Roa L. I, Sepúlveda WS. Caracterización socio-económica y productiva del cultivo de cacao en el departamento de Santander (Colombia). *Revista Mexicana de Agronegocios.* 2016;38:283–294. Disponible en: <https://www.redalyc.org/articulo.oa?id=14146082001>
8. Schroth G, Läderach P, Martinez-Valle AI, Bunn C. From site-level to regional adaptation planning for tropical commodities: cocoa in West Africa. *mitig adapt strateg glob change.* 2017;22(6):903–27. Disponible en: <https://doi.org/10.1007/s11027-016-9707-y>
9. Flórez Ramos LV, Marín Tangarife AC, Mejía Córdoba CA, Velásquez Vélez MI. Baseline for cocoa cultivation in Antioquia (Colombia): methodology, attributes, and implementation. *Revista Colombiana de Investigaciones Agroindustriales.* 2022;9(2):15–25. Disponible en: <https://revistas.sena.edu.co/index.php/recia/article/view/linea-base-para-el-cultivo-de-cacao-en-antioquia-colombia-metodo>
10. González SR, Moreno AP, Yanes MT, Medina CLC, Arango PCZ. CACAO Agricultura climáticamente inteligente con énfasis en agroforestería. *Editorial AGROSAVIA;* 2019:78. Disponible en: <https://doi.org/10.21930/agrosavia.institucional.7403152>
11. Góngora-Duarte AF, Morales-Espitia FJ, Trujillo-González JM, Torres-Mora MA. Caracterización de los procesos en el beneficio del cacao (*Theobroma cacao* L) en producciones a pequeña escala en el municipio de Guamal del Piedemonte llanero colombiano. *Tecnol.* 2023;26(57):e2633:1–15. Disponible en: <https://doi.org/10.22430/22565337.2633>
12. Solarte-Guerrero JG, Ballesteros-Possú W, Navia Estrada JF, Solarte-Guerrero JG, Ballesteros-Possú W, Navia Estrada JF. Socioeconomic analysis of cocoa (*Theobroma cacao* L) agroforest in a tropical dry forest. *Rev Cienc Agric.* 2022;39(2):108–27. Disponible en: <https://doi.org/10.22267/rcia.223902.186>
13. Bustos M, Molina R, Suarez J. Factores agronómicos y socioeconómicos que inciden en el rendimiento productivo del cultivo de cacao. Un estudio de cacao en Colombia. *Rev FAVE - Cienc Agrar.* 2021;20(2):59–73. Disponible en: <https://doi.org/10.14409/fa.v20i2.10625>
14. Suárez YYJ, Castañeda GAA, Daza EYB, Estrada GAR, Molina JR. Modelo productivo para el cultivo de cacao (*Theobroma cacao* L.) en el departamento de Santander. *Editorial AGROSAVIA;* 2021:1–187. Disponible en: <https://doi.org/10.21930/agrosavia.model.7405538>
15. Attipoe SG, Jianmin C, Opoku-Kwanowaa Y, Ohene-Sefa F. The Determinants of technical efficiency of cocoa production in Ghana: an analysis of the role of rural and community Banks. *Sustain Prod Consum.* 2020;23:11–20. Disponible en: <https://doi.org/10.1016/j.spc.2020.04.001>
16. Castillo MA, Legarreta González MA, García Fernández F, Olivas García JM. Caracterización socioeconómica de pequeños productores cacaoteros de dos cooperativas en el norte centro de Nicaragua. *Trace (Mex DF).* 2023;(83):137–60. Disponible en: <https://doi.org/10.22134/trace.83.2023.806>
17. Nelson V, Phillips D. Sector, Landscape or Rural Transformations exploring the limits and potential of agricultural sustainability initiatives through a cocoa case study. *Bus Strategy Environ.* 2018;27(2):252–62. Disponible en: <https://doi.org/10.1002/bse.2014>
18. Rueda Barrios GE, Farfán LB, Reyes Figueroa JC. Caracterización de la piscicultura en Santander. *Editorial. Montoya JCR, editor.* 2021. 143 p. Disponible en: <http://hdl.handle.net/20.500.11912/9782>
19. Arboleda Jaramillo C. A, Arias Arciniegas C. M, Pérez Sánchez E. O, Correa Janne P. Innovación social como estrategia para fortalecer el turismo rural comunitario en Colombia. *Revista Venezolana de Gerencia.* 2020;25(89):92–104. Disponible en: <https://www.redalyc.org/articulo.oa?id=29062641008>
20. Muñoz Villamizar E. Desminado Humanitario: Impacto Socioeconómico En El Municipio De San Vicente De Chucurí, Santander, Colombia. *Revista Facultad de Ciencias Contables Económicas y Administrativas-FACCEA.* 2021;11(2):150–67. Disponible en: <https://doi.org/10.47847/faccea.v11n2a4>



21. Pertuz Peralta VP, Pérez Orozco AB. Caracterización socioeconómica de los productores de cafés especiales de Pueblo Bello (Cesar, Colombia). *Punto de vista*. 2017;7(11):119–40. Disponible en: <https://doi.org/10.15765/pdv.v7i11.982>
22. Arciniega-Alvarado GA, Jiménez-Pereira DJ, Ruiz-Ordóñez RE. Caracterización y diagnóstico socioeconómico para el fortalecimiento de las Microempresas del sector Agroindustrial del Cantón Loja, 2017 – 2018. *Revista Científica Dominio de las Ciencias*. 2021;7:744–71. Disponible en: <https://doi.org/10.23857/dc.v7i1.1674>
23. Otzen T, Manterola C. Técnicas de muestreo sobre una población a estudio. *International Journal of Morphology*. 2017;35(1):227–32. Disponible en: <http://dx.doi.org/10.4067/S0717-95022017000100037>
24. Cáceres Yparraguirre H, Julca Otiniano A, Cáceres Yparraguirre H, Julca Otiniano A. Caracterización y tipología de fincas productoras de vid para Pisco en la región Ica-Perú. *Idesia (Arica)*. 2018;36(3):35–43. Disponible en: <http://dx.doi.org/10.4067/S0718-34292018005001002>
25. Fonseca Carreño NE. Caracterización socioeconómica y biofísica de agroecosistemas en el municipio de Pasca en la provincia del Sumapaz-Cundinamarca. *Revista Científica Profundidad*. 2021;14(14):2–14. Disponible en: <https://doi.org/10.22463/24221783.3159>
26. Molina-Romero AM, Ostos-Triana ME, Buenaventura-Baron MS, Argüelles-Cárdenas JH. Caracterización y tipificación socioeconómica en productores de cultivos transitorios ubicados en Piedemonte y Altillanura plana. *Rev. Orinoquia*. 2020;24(1):113–27. Disponible en: <https://doi.org/10.22579/20112629.596>
27. Gortaire Díaz D, Wilder RV, Cañarte EC, Ortega Pacheco D, Santos Ordoñez A. Environmental sustainability analysis of agro-ecological producers in Manabí-Ecuador: case study Membrillal. *Revista Ciencia e Investigación*. 2020;5(2):2528–8083. Disponible en: <https://doi.org/10.5281/zenodo.3820760>
28. Sánchez-Galán EA, Espinosa MI, Castillo GA, A. ÁE, Quintero MD, Díaz YM, et al. : Caracterización socioeconómica y zootécnica de explotaciones bovinas de doble propósito asociadas en cooperativa, en las localidades de Tortí, río Congo Arriba y Agua fría. *Revista Investigaciones Agropecuarias*. 2022;4(2):96–108. Disponible en: <http://portal.amelica.org/ameli/journal/222/2223233008/>
29. Pérez-Abadía DF, Medina-Arroyo HH, Navarro-Hevia J. Tipificación y caracterización de sistemas productivos agroforestales en comunidades del departamento del Chocó, Colombia. *Cienc Tecnol Agropecu*. 2024;25(1):1–26. Disponible en: https://doi.org/10.21930/rcta.vol25_num1_art:3176
30. Mata Anchundia D, Rivero Herrada M, Segovia Montalvan E. Sistemas agroforestales con cultivo de cacao fino de aroma: entorno soc. Disponible en: io-económico y productivo *Agroforestry systems with fine aroma cocoa cultivation: socio-economic and productive environment*. 2018;6(1):103–15. Disponible en: <http://cfores.upr.edu.cu/index.php/cfores/article/view/280/>
31. Jurado Mejía AG, Pardo Rozo YY, Hernández Londoño CE. Tipificación de sistemas agropecuarios familiares y la seguridad alimentaria en el piedemonte amazónico colombiano. *Rev Fac Cienc Econ*. 2023;31(1):31–51. Disponible en: <https://doi.org/10.18359/rfce.6239>
32. De La Cruz-Landero E, Córdova-Avalos V, García-López E, Bucio- Galindo A, Jaramillo-Villanueva JL. Manejo agronómico y caracterización socioeconómica del cacao en Comalcalco, Tabasco. *Foresta Veracruzana*. 2015;17(1):33–40. Disponible en: <https://www.redalyc.org/articulo.oa?id=49742125005>
33. Florez Vaquiro N, Luna Contreras M. Hogares rurales y estrategias familiares de vida en México. *Rev Latinoam Poblac*. 2018;12(23):109–147. Disponible en: <https://doi.org/10.31406/n23a6>
34. Mejía-Valvas R, Gómez-Pando L, Pinedo-Taco R. Caracterización de las unidades productivas del cultivo de kiwicha (*Amaranthus caudatus*) en las provincias de Yungay, Huaylas y Carhuaz, departamento de Ancash, Perú. *Cienc Tecnol Agropecu*. 2021;22(1):e1440. Disponible en: https://doi.org/10.21930/rcta.vol22_num1_art:1440
35. Jiménez-Barbosa WG, De la Portilla E, Zúñiga LA, Zambrano DF, Rojas JS, Delgado RA. Relevo



- generacional para la continuidad de producción cafetera familiar. Caso municipio de Albán, Nariño-Colombia. *Rev Colomb Cienc Soc.* 2019;10(1):67–92. Disponible en: <https://doi.org/10.21501/22161201.3060>
36. Ramirez-tixe EE, Salazar-Irrazabal M, Castro-bedriñana J. Caracterización socioeconómica y producción agropecuaria de pobladores de Junín-Perú. *Revista Ciencia Nor@ndina.* 2021;4(1):54–64. Disponible en: <https://doi.org/10.37518/2663-6360X2021v4n1p54>
 37. Martínez AM, Tordecilla L, del Rodríguez M V, Grandett LM, Díaz AT, Ballesteros HA, et al. Análisis técnico y económico del sistema de producción de Theobroma cacao L. en el sur del departamento de Córdoba, Colombia. *Temas Agrarios.* 2023;28(2):193–207. Disponible en: <https://doi.org/10.21897/jar7m208>
 38. Vásquez-Barajas EF, García-Torres NE, Bastos-Osorio LM, Lázaro-Pacheco JM. Economic analysis of the cocoa sector in Norte de Santander State, Colombia and at an international level. *Revista de Investigación, Desarrollo e Innovación.* 2018;8(2):237–50. Disponible en: [10.19053/20278306.v8.n2.2018.7963237](https://doi.org/10.19053/20278306.v8.n2.2018.7963237)
 39. Benjamin EO, Ola O, Sauer J, Buchenrieder G. Interaction between agroforestry and women's land tenure security in sub-Saharan Africa: A matrilineal perspective. *For Policy Econ.* 2021;133:1–11. Disponible en: <https://doi.org/10.1016/j.forpol.2021.102617>
 40. Roa-Ortiz SA, Forero Camacho CA, Bautista Cubillos RA, Zabala Perilla AF. Have public policy and family farming been an unhappy marriage for the past 20 years. *Ciencia y Tecnología Agropecuaria.* 2022;23(2):1–17. Disponible en: https://doi.org/10.21930/rcta.vol23_num2_art:1949
 41. Orellana VJ, Pinos BK, Apolo DE, Zambrano XW. Perspectivas para la superación de la pobreza: una revisión de literatura sobre estudios que directa o indirectamente inciden en la educación. *Revista ESPACIOS.* 2020;41(06):1–11. Disponible en: <https://www.revistaespacios.com/a20v41n06/a20v41n06p03.pdf>
 42. Fernández Jeri A, Torres Armas E, Chávez Quintana S, Julca Otiniano A, Fernández Jeri L. Caracterización socioeconómica y ambiental de las fincas productoras de cacao nativo en la Provincia de Bagua, Perú. *Idesia (Arica).* 2022;40(2):67–75. Disponible en: <https://dx.doi.org/10.4067/S0718-34292022000200067>
 43. Nelson, V., & Phillips, D. Sector, Landscape or rural transformations. Exploring the limits and potential of agricultural sustainability initiatives through a cocoa case study. *Business Strategy and the Environment.* 2018;27(2), 252–262. Disponible en: <https://doi.org/10.1002/bse.2014>
 44. Alho CFBV, da Silva AF, Hendriks CMJ, et al. Análisis de los productos básicos de exportación de banano y cacao en la transformación del sistema alimentario, con especial referencia a los esquemas de certificación como impulsores del cambio. *Sec Food.* 2021;13:1555-1575. Disponible en: <https://doi.org/10.1007/s12571-021-01219-y>
 45. Curry GN, Nake S, Koczberski G, Oswald M, Rafflegeau S, Lummani J, et al. Disruptive innovation in agriculture: Socio-cultural factors in technology adoption in the developing world. *J Rural Stud.* 2021;88:422–431. Disponible en: <https://doi.org/10.1016/j.jrurstud.2021.07.022>
 46. Mariscal Aguayo DV, Quintero HE, Salas Barboza JE. Caracterización del sistema de producción de cacao en el sureste de México utilizando el modelo de asesoría Chapingo-AGROPEC Star. *Revista de Geografía Agrícola.* 2023;(71):1–20. Disponible en: <https://doi.org/10.5154/rga.2023.71.10>
 47. Achmad B, Sanudin, Siarudin M, Widiyanto A, Diniyati D, Sudomo A, Hani A, Fauziyah E, Suhaendah E, Widyaningsih TS, et al. Subsistence-based traditional agroforestry systems of smallholders in Indonesia: A review. *Sustainability.* 2022;14(14):1–33. Disponible en: <https://doi.org/10.3390/su14148631>
 48. Burgos-Cañas D, Fonseca-Pinto DE. Asociatividad empresarial: una estrategia para las organizaciones del sector cacaoero del municipio de Fortul Arauca. *Aibi Revista de investigación, administración e ingeniería.* 2020;8(1):91–100. Disponible en: <https://doi.org/10.15649/2346030X.621>