EFFECT OF RURAL ENTREPRENEURSHIP AND INNOVATION ADOPTION IN THE REDUCTION OF INEQUALITIES

EFECTO DEL EMPRENDIMIENTO RURAL Y LA ADOPCIÓN DE LA INNOVACIÓN EN LA REDUCCIÓN DE LAS DESIGUALDADES

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ABSTRACT:

This research examines the perceptions of agroecological producers' of "chacras agroecologicas" project about inequality reduction. This project was developed in Puyo Pastaza, promoted by the Pastaza Decentralized Autonomous Government (GAD for Gobierno Autónomo Descentralizado in Spanish). By interviewing ten project participants during the months of November and December 2018, we look forward analyzing how rural entrepreneurship can support the achievement of Sustainable Development Goals (SDG) promoted by the United Nations (UN). The conceptual framework used for the analysis was retrieved by a systematic literature review as well as the indicators to measure inequality perception. Data was collected through a convenience sample, where the main tool was a semi-structured questionnaire. Using Multiple correspondence analysis (MCA), two main clusters were obtained having a high representation in frequency by gender. Those clusters

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had diverse perceptions among inequalities, however, the frequency was higher in the first cluster and analyzed as the sample representative. Most producer's perception pointed out that the chacras as rural entrepreneurship along with innovation adoption in Puyo, are not the key for a better level of equality among producers.

KEYWORDS: Chacras, agroecology, inequality, SDG, Multiple Correspondance Analysis.

RESUMEN:

La presente investigación examina la percepción de productores agroecológicos del proyecto "chacras agroecológicas" sobre la reducción de inequidad. Este Proyecto fue desarrollado en Puyo – Pastaza y promovido por el Gobierno Autónomo Descentralizado (GAD) de Pastaza. Se entrevistaron a diez participantes del proyecto durante los meses de Noviembre y Diciembre, buscamos analizar cómo el emprendimiento rural puede incentivar al logro de los Objetivos del Desarrollo Sostenible (ODS) propuestos por la Organización de las Naciones Unidas (ONU). El marco conceptual usado para el análisis se basó en una revisión sistemática de literatura para obtener los indicadores de medición de inequidad. Los datos fueron recogidos en base a una muestra por conveniencia, cuya principal herramienta fue un cuestionario semiestructurado. Usando Análisis de Correspondencia Múltiple (ACM), se obtuvieron dos clústeres que mayor tienen representación en frecuencia por género. Estos clústeres nos brindaron percepciones diversas sobre inequidad, sin embargo, el primer clúster mostró mayor frecuencia siendo considerado el más representativo en el estudio. Mayormente, los productores apuntan a que las chacras, adoptadas en Puyo como emprendimiento rural de la mano con la adopción de innovaciones, no son factores claves para un mejor nivel de equidad entre productores.

PALABRAS CLAVE: Chacras, agroecología, inequidad, ODS, análisis de correspondencia múltiple.

INTRODUCTION

Agriculture in Ecuador is facing an important challenge regarding the Sustainable Development Goals[4] (SDGs), proposed as the 2030 Agenda for Sustainable Development, and adopted by all United Nations Member States in 2015 (United Nations, 2015). Many

[1] The United Nations (UN) promotes 17 goals to achieve sustainability.

authors are promoting the Agroecology as a means to achieve sustainability (Altieri, M., Hecth, S., Liebman, M., Magdoff, F., Norgaard, R., & Sikor, 1999; M. A. Altieri, 2002; Intriago, Gortaire Amézcua, Bravo, & O'Connell, 2017).

Then, sustainability becomes a complex and ambitious concept for the country where its practice can support the improvement of important issues like inequality, hunger, malnutrition and, the efficient use and management of natural resources (M. Altieri & Nicholls, 2012).

In Ecuador, around 25.5% of people are living in poverty while 9.5% in extreme poverty (INEC, 2018). Highest levels of poverty and extreme poverty are presented in rural areas, approximately 43.8% of people of rural areas are living in poverty while 17.9% in extreme poverty (INEC, 2018).

SDG number 10 aims to reduce inequality among countries it is imperative to go locally to achieve this goal. The indicator 10.3[5] states "Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices, promoting appropriate legislation, policies and action in this regard" (United Nations, 2015). However, in Ecuador, the [6]Gini coefficient in June 2018 is 0.472, while in Rural areas is approximately 0.448 (INEC, 2018), in Rural areas inequity is more evident according to this index.

In Puyo-Pastaza, producers are part of the Chacras project which aim is the integral development of the producers. The Chacras project is a rural entrepreneurship focused on ancestral indigenous family farming adapting into a new innovative farm system "as a family grove" and, mostly based on Agroecology principles. "Chacras" is a method of agriculture that is based on polycultures and develop diverse activities, especially forestry, agriculture, livestock, fish farming, beekeeping in farms that do not exceed 5 hectares (Gutiérrez, 2012).

This ancestral family farming is used in different countries of Latin America, mainly in the Andean Region, however, it is mostly used in Peru indigenous region. Parraguez-Vergara et al. (2018) defined this agricultural system of indigenous people and campesinos "as family-

[2] The UN apart from the goals, stablish potential indicators to measure the performance of countries.
[3] The Gini coefficient is a very popular measure in the analysis of income inequality statistical dispersion intended to represent the income or wealth. (Salverda & Checchi, 2015)

based traditional agriculture, as the majority of campesinos are small-holder mestizos which agricultural practices mostly derive from the indigenous agricultural systems used locally long before the Spanish arrival. Their systems are nested within the ecosystem, as many of the species used occur naturally in the surrounding areas."

Chacras commonly have a high level of diversity of plants or species (both cultivated and uncultivated), in the form of polycultures or agroforestry patterns (Gliessman, 1998). Planting different species, vegetables or medicinal, and a variety of crops minimizes risks, such as pests, and in turn, stabilizes long-term yields, promoting dietary diversity and maximizing benefits even, under low levels of technology and limited resources (Harwood, 1979).

Hodge & Midmore (2008) associated the socio-economic changes in rural areas as a doubtless relation with the breakdown of longstanding networks and linkages, such as associated with the supply of agricultural inputs and the marketing of agricultural products. Research supports the theory that the performance of farmers and associations is really an important issue for agriculture development to be successful. In Puyo, as part of the project, the producers' associations accomplish the support of the Pastaza GAD, obtaining different seeds to cultivate, and all the participants are cultivating similar products to sell in the closest dynamic markets.

Hodge & Midmore (2008), pointed out the fact that rural areas offer attractive environments in which to live and work and are also attractive to new forms of entrepreneurship. Rural Entrepreneurship and innovation technologies are both ways to get sustainable. Then we are looking forward to answering what effect has the chacras, adopted as Rural Entrepreneurship, in the mitigation of inequalities among the participants of Chacra Project in Puyo?

This study is divided into four main chapters: i) study case introduction containing the conceptual model and justification, ii) the state-of-the-art with supporting the research is used as the basis of the indicators and methodologies to be used, iii) the methods used for collecting data and analysis and, iv) the results, discussion, and conclusions.

Literature Review

The agroecology provides scientific bases for sustainable agriculture, which aims the researchers to develop the farmers and peasant's knowledge and abilities for identifying the

unrestricted potential of re-enforcing biodiversity in order to create useful synergies (M. Altieri, Funes-Monzote, & Petersen, 2011; Altieri, 2002).

According to Intriago et al. (2017), it is important to analyze local productive objectives and turn them into agroecological objectives that go towards all scales in the productive sector. Thus, the analysis of strategies to solve problems in chacras (as small production units) can also help meet local objectives, for example, water resources security, pollution mitigation and climate change (Bennett, Balvanera, & Folke, 2014). Sarandón (2002) emphasizes in contribution agroecology has for rural development, when peasants transform agriculture in a way of life to a wider view market related where the resources management is considered as a business. This could be promoted with the technological transfer, agricultural extension, and diffusion. Sarandón & Flores (2014) also remarks the current agricultural model is unsustainable through time. Green revolution and agriculture intensification have become into pollution and loss of productivity, that agroecology could overcome.

Furthermore, family farming is an important concept to analyze. Peasant Agroecological Family Farming is that "agriculture that is characterized by mainly using family labor (Gutiérrez, 2012). According to Juárez (2011): "family farming 1. has a strong dependence on the goods and services provided by the natural (ecological) environment and its own Agroecosystem; 2. works on a small and highly diversified production scale; 3. develops its own technologies adapted to its ecological, social and cultural condition; 4. promotes social justice and equity; and 5. is immersed in the development dynamics of its community and region"

To promote this Family Farming, it has been considered that resource management is of vital importance in the process. Altieri, (2002) describes an approach in natural resource management applied through an efficient strategy, which is applicable under diverse and heterogeneous conditions in which small producers develop, which at the same time is environmentally sustainable and based on local resources and People's know-how.

Moreover, regarding the chacras project, promoted by the Pastaza Government is a mean of rural entrepreneurship, it is also considered a type of agricultural innovation using ancestral peasant knowledge among the participants. This is because the Government technicians are in charge of giving to the peasants the seeds and the type of crops, they include into the

chacra. Then for Barnett (2004, p. 1) innovation involves ‘‘the use of new ideas, new technologies or new ways of doing things in a place or by people where they have not been used before”.

According to (L. Klerkx, van Mierlo, & Leeuwis, 2012) rural entrepreneurial activity and innovation orientation among farmers have some complex and multi-faceted environments to handle within their regular operations. Small-scale farms experience similar innovation constraints to those small business owners that operate in other economic sectors. (Laurens Klerkx, Aarts, & Leeuwis, 2010)

Several studies include new empirical light on the dynamic and long-term linkages among agricultural growth, inequality and poverty in developing countries, also promoted key factors as gender equality and increase of food security (Galindo-Reyes, Ciruela-Lorenzo, Pérez-Moreno, & Pérez-Canto, 2016; Imai, Cheng, & Gaiha, 2017; Jones, Holmes, Presler-Marshall, & Stavropoulou, 2017; Rehman, Jingdong, Khatoon, Iqbal, & Hussain, 2016).

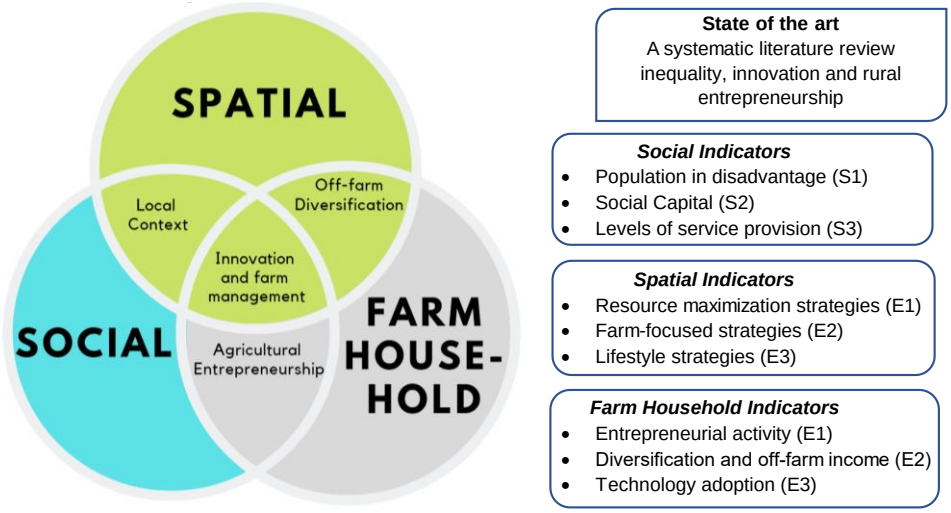
This study applies the term of rural entrepreneurship and innovation attitude in the farming context to explain rural farmers which are open to new ideas (Hurley & Hult 1998). According to Leeuwis, C., van den Ban (2004) in agriculture the term innovation refers as “new ways of doing things or doing new things, which are actually introduced and implemented in everyday practices, irrespective of whether they are new to the world or new only for the individual”.

Case study framework

Where analyzing the literature to find an accurate model, several authors use the classical sustainable development framework, which is Economic, Social and Environmental (Borrelli, 2016; Martin, Gross-Camp, Kebede, & McGuire, 2014). However, this framework, in some cases, fails to properly link the supposed benefits to the different categories of actors. It is imperative then, introducing into our model the heterogeneity of the areas and the categories of actors (Escobar & Berdegué, 1990).

This study is focused on the territorial model for rural development, where Morris et al (2017) adapted it into three components that were analyzed: a spatial, social and farm household context. Each element is defined as follows and is investigated through the research question.

Figure 1: Justification and Study Framework



Source: (Morris, Henley, & Dowell, 2017)

The first construct analyzes the population at a disadvantage and the association's levels in agricultural producers. The social capital then is a multi-faceted concept and analysis and measurement should, therefore, include a multi-faceted approach for our study (Teilmann, 2012).

To study the spatial construct, it is important to describe the pertinent information about resource use and management. It is important to analyze the way they produce and which strategies they use to protect and improve the resources management and use as soil, production supplies and/or water. Then, innovation adoption is related to food and crop production and the adoption of technology in support of management activity.

Finally, the farm household construct is related to the management and the production capacity will be analyzed through entrepreneurial activity. The profits per crop and the negotiation levels are important factors within this indicator. The production income through diversification and off-farm incomes are also important to analyze.

This framework will be used to validate the established hypothesis which is “If the level of well-managed rural entrepreneurship increases, (measured with the farm household indicators) then indicators for inequality perception get reduced (using social indicators)

METHODS

The study case was developed in Puyo and the research is predominantly descriptive with the objective of support the main hypothesis presented at the beginning of this research.

Systematic Review Methods

Peer-reviewed articles were conducted in a systematic method in October 2018 in Science Direct, and Google scholar, which was used to retrieve documents through hand search, mostly for related articles when carrying the lecture of the articles. An extension to the peer-review was made in November 2019, using Scopus and research gate, looking for recent articles to empower the methods and discussion raised.

Initially, search syntax was developed using the following key search terms ‘‘((inequality and adoption) AND development) AND rural” obtaining approximately 804 results. This search protocol yielded cases from the academic (e.g., scientific journal articles, dissertations) and gray (e.g., project reports) literature. It did not include non-scholarly materials (e.g., blogs, newspaper or magazine articles, pamphlets). For the peer-review extension, equal syntax was used, mostly reviewed by title and abstract, and then, selecting the more related articles for this research.

Articles’ full titles were screened by the first author. It was retained articles that were written in English and Spanish addressing research questions. Reviews were used as secondary sources for a hand search. A second screening was conducted by the second author, reading the abstracts and selecting only studies with innovation, associativity, entrepreneurship, and inequity. When it was not clear from the abstract what type of methodology was used, the paper was referred to the full-text review by the third author. We systematically extracted information as general study information, conceptual context, article design and methods for data analysis, and also, the results, discussion, and gaps related to our research (Atmadja & Sills, 2016).

Design

A semi-structured questionnaire was used to gather information about the investigation of farmer entrepreneurial types. The survey was conducted in the households of the participant's prior request for written consent. These data were obtained from a survey conducted across the agroecology producers in the “chacras” project of Puyo, which included items based on qualitative interviews. The sample was a convenience sample,

where the primary purpose of the survey was to investigate attitudes towards the entrepreneurial type (farm size and activities) and farmer characteristics (demographics).

The questionnaire had questions regarding the main indicators presented before by each studied construct with the calculation method explained.

Social Construct's Indicators:

- Population in disadvantage (S1): Perception if members of association/community are from the same socioeconomic level and gender.
- Social Capital (S2): Perception of equal opportunities to make decisions in the associations/community.
- Levels of service provision (S3): Linkage and nearness to population centers.

Spatial Construct's Indicators:

- Resource maximization strategies (E1): Level of adoption of sustainable production practices for the chacra.
- Farm-focused strategies (E2): Level of crop mechanization.
- Lifestyle strategies (E3): Level of training in best agricultural practices.

Farm Household Construct's Indicators:

- Entrepreneurial activity (E1): Return on crop per hectare.
- Diversification and off-farm income (E2): Off-farm activities.
- Technology adoption (E3): Number of equipment and irrigation availability.

Data Analysis

The data were analyzed according to Morris et al. (2017), using cluster analysis, a technique that characterizes overall samples into smaller segments. The cluster analysis was developed, on the other hand, using Multiple Correspondence Analysis (MCA) referred to Parchomenko *et al.* (2018).

MCA is a statistic multivariant analysis that has been successfully applied to graphically visualize the relationship between categorical variables in many fields such as the social sciences, marketing, health, psychology, educational research, political science, genetics, etc. (Fithian & Josse, 2016). MCA is also known as homogeneity analysis or dual scaling, then, it represents an exploratory method for graphical representation of associations

between variables of categorical data sets in order to explore their relationships (Clausen, 1998).

The goal of introducing the Correspondence Analysis is to obtain a graphical representation of the original data matrix within a few dimensions as possible (Hoffmann & Franke 1986). It is referred to as Multiple Correspondence Analysis (MCA) if the effect of each variable on every other variable is considered (Blasius 2001). Based on each of the 13 identified elements (mainly indicators), which have been introduced in R Studio, the metrics are structured, allowing for visualization of their associations.

Parchomenko *et al.* (2018) presented some keys for interpretation of the model which are imperative to analyze the proposed results in the next section:

- The distance between the two metrics shows how different or similar the metrics are. The closer the metrics are located to each other, the more similar is their categorization pattern.
- The center of the plot represents the average metric. Therefore, the distance of a metric to the center is another important property for interpretation. The higher frequency of their assessment is also the reason for their more central location.
- The frequency of an element influences also the weight of the element has when determining the location of a metric. Unique categorization patterns result in a metric's location being further away from the center.
- The relative positions of elements to each other reveal the degree of association. The higher association is indicated by higher proximity. A larger distance between elements means that they are usually not assessed by the same metric simultaneously.

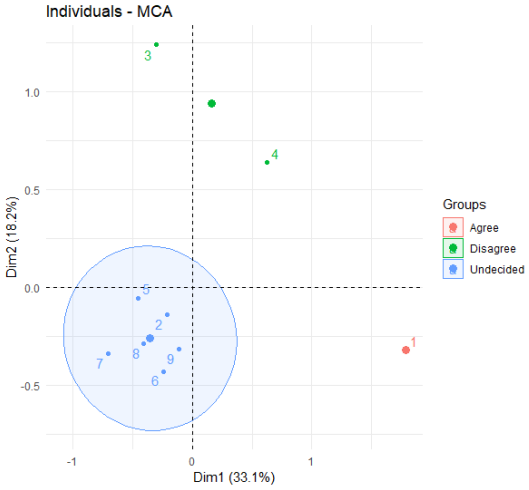
RESULTS

A quantitative analysis using the Multiple Correspondence Analysis (MCA) was designed with the qualitative variables of the questionnaire. We were looking to support the hypothesis with the data collected and to analyze them in different clusters as established in the framework.

At first, we present biplots that explain the better each dimension and the sample perception about three contexts. Then, it was created a biplot with all the variables to explore the

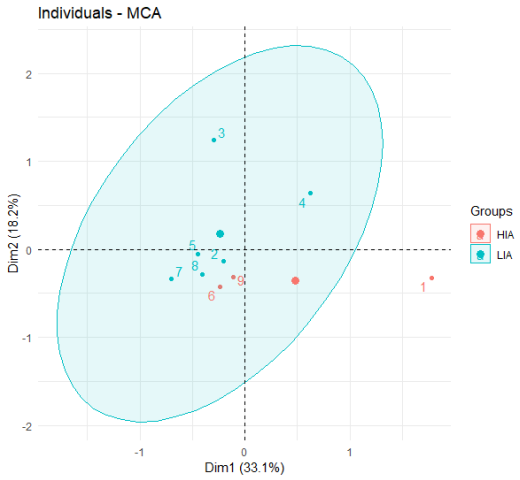
relationship between them. Figure 3 presented the perception of the producer's participation in the community decisions making processes. As the interpretation presented by Parchomenko *et al.* (2018) most producers could not decide if they could incise in the community decisions making process.

Figure 2: *Social Dimension-Community Decision*



Source: *The Authors*

Figure 3: *Farm-Household Dimension-Income Perception*

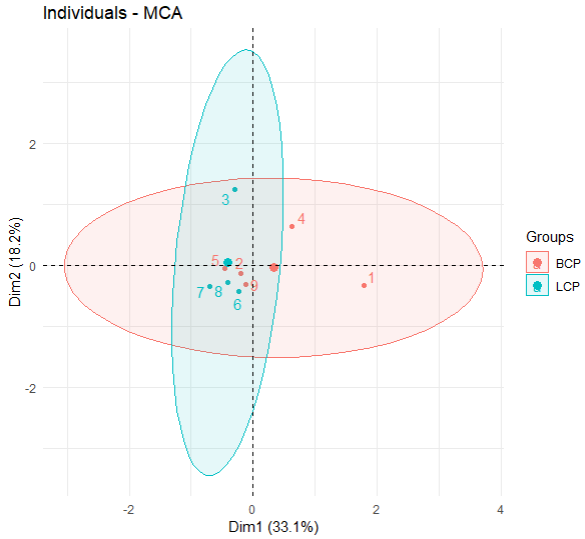


Source: *The Authors*

On Figure 4, it is presented the income perception indicator, which was formed by two questions of the survey: the ability of price negotiation and the off-farm income generation. The circle compared to figure 3 is bigger, then, the frequency is higher. The closer to the center is the Low-Income Access, which represents the majority of producers.

However, in Figure 5, the metrics are both closer to the center at a similar distance. To measure conservation practices, it was used the three indicators on the spatial dimension, regarding four questions on the questionnaire: Soil conservation, agroecological practices, best agricultural practices, and extensions programs received. The perceptions are divided regarding this dimension, there are producers that consider they have

Figure 4: *Spatial dimension - Conservation Practices*



Source: The Authors

Figure 5: *Biplot - Technology Adoption*

Source: The Authors

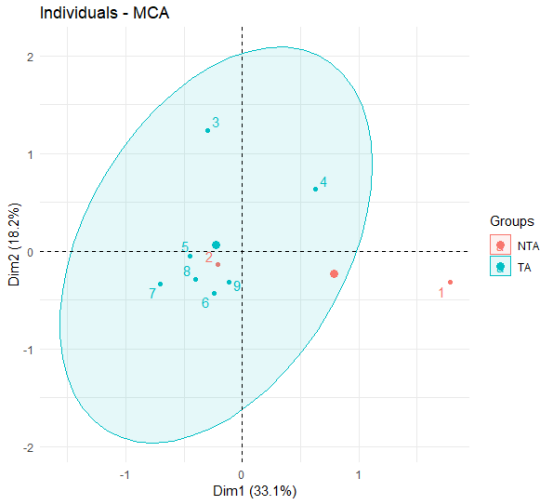
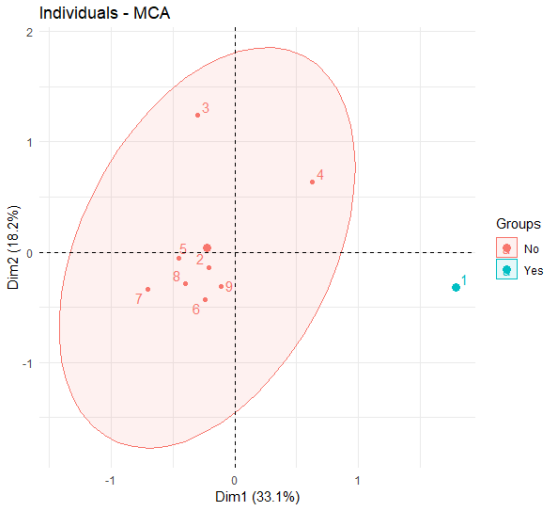


Figure 6: *Biplot - Social Capital*

Source: The Authors



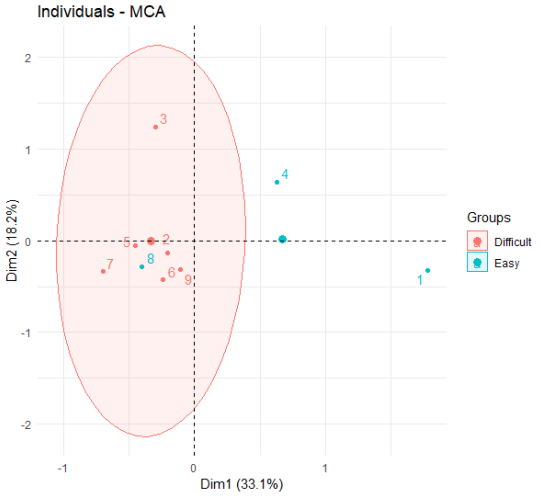
Best and low conservation practices, but mostly the BCP is predominant, due to the circle dimension, which represents higher frequency in this matter.

It was also important to validate other indicators that would validate the hypothesis, then it is presented four biplots that represent the producer's perception about the level of Technology Adoption, Social Capital, Chacra Access and Gender Equality.

Figure 6 presents information about the perception of technology adoption, which was measured with the answers about the access to equipment and irrigation. Mostly, the producers have adopted agricultural technology. In Figure 7, we could validate that social capital is not presented within participants of the Chacra Project.

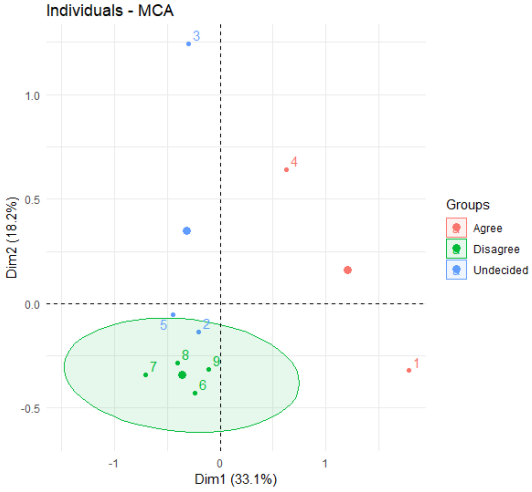
Figure 8, it is a biplot of the level of difficulty to access to the chacra. Most of the producers indicate that it is difficult, which could become an issue when carrying their products to the closer market. The last biplot, presented in Figure 9, presents the perception of gender equality. Most producers disagree about gender equality and, it is relevant to state that men are the major respondents in this indicator.

Figure 7: *Biplot - Chacra Access*



Source: The Authors

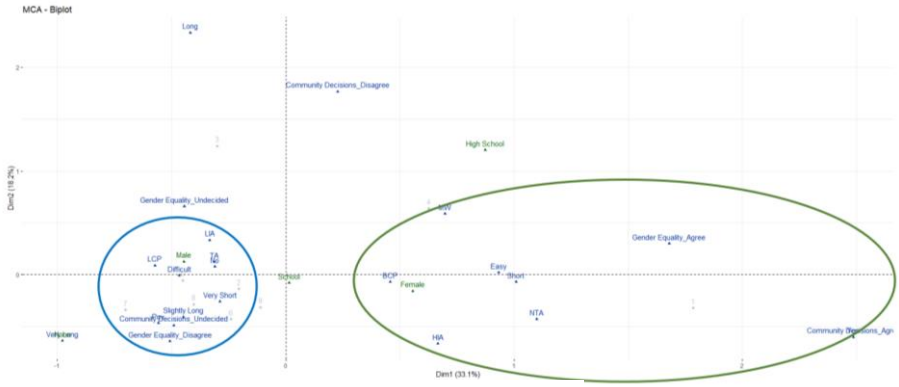
Figure 8: *Biplot - Gender Equality*



Source: The Authors

The Biplot, presented in Figure 10, groups the variables into two main clusters, leaving some variables as outliers. The first cluster present values with the higher relationship, while the second cluster represents a cluster that has more disperse variables, but still present relation among them.

Figure 9: *Biplot of MCA*



Source: *The Authors*

The variables that better explain the model are presented in Figure 11. The first two dimensions are able to explain 51.3% of the total data variance, taking into account each of the element's influence on each metric's location simultaneously, which is a distinguishing quality of the MCA method and provides a high information density of the resulting plot.

The first dimension explains around 33.1%. The main variables that contribute to this dimension approximately 5% to 15%, and those are: i) Community Decisions: Agree, ii) Social Capital: Yes, iii) Gender Equality: Agree, iv) Chacra Acces: Easy, v) Market Distance: Short, vi) No Technology Adoption and, vii) Income Level: Minimum Wage

Table 2 present the indicators introduced in the conceptual framework and its comparison among both clusters. Cluster 1 has a higher number of producers than cluster 2.

Table 1: *Cluster comparison*

Dimensions	Metric	Cluster 1	Cluster 2
Farm-household	Number of species	Average level	Higher-level
	Technology Access (Agricultural Equipment and Irrigation)	Technology Adopted	No Technology Access
	Income Access (Off-farm activities and Price Negotiation)	Low	High
	Income Generation	Line of Poverty	Minimum Wage
Social	Community decisions	Disagree	Agree
	Gender Equality	Disagree	Agree
	Market Access	Slightly and Very Long	Short
	Chacra Access	Difficult	Easy
Spatial	Low Conservation Practices: Agroecological practices BPA Extension and Training	Low	Best

Source: *The Authors*

Cluster 2 producers have the greatest access to resources, in the three dimensions measured through the study. The producers of cluster 1, despite incurring the technological packages provided by the GAD, do not reach a level of fairness like the one represented in cluster 2.

DISCUSSION

The results of the Multiple Correspondence Analysis reveal the relationships between individual metrics, associations between elements and the relations between elements and

metrics. The results presented two principle cluster to analyze: Most associated with male and female perception.

Cluster 1

It is formed by 6 producers. Then, analyzing the interpretation parameters the more related variables of social dimension are grouped closer between them, it could be interpreted as more relatives among them. Those variables are: disagree about gender equality, undecided about community decisions, slightly and very long distance to the market.

Participants, from cluster 1, have the perception of inequality in several indicators. They consider, apart from being part of the project, they are not achieving a good life quality and it is explained in the perception of sustainability. In this case, they consider having an average level of species produced into the chacra and irrigation and agricultural equipment, the main factor evaluated for agricultural technology innovation. Regarding sustainability, they are also presented a Low-income Access and low conservation practices. Imai, Cheng, & Gaiha (2017) found that projects whose goals are the agricultural growth tends to reduce inequality or accelerate inequality reduction, promoting overall economic growth and reducing poverty. Those goals could not be evidenced in the producer's perception they consider they need more training and generating new paths for market access to promote their products.

On the other hand, the producers from cluster 1 consider they have a good level of technology adoption; however, they present indicators as Farm-household dimension: they present income that is closer to the line of poverty, and low-income access regarding off-farm activities and negotiation of product's prices. Social dimension: no social capital, difficult access to chacra. Spatial dimension: low conservation practices. Rehman et al. (2016) emphasized that agriculture is important for the reduction of poverty, in developing countries, the poor rely on agriculture for employment and have limited skills to enter into the non-agricultural sector. Those limited skills could be evidenced by the development of the project.

This cluster is prevalent closer to the center, then, it represents a higher frequency in perception. It is important to mention that the number of species varies from 3 to 7 per chacra. Men's perception is most frequent in this cluster, that is the reason why Men metric is closer to the variables.

Cluster 2

It is formed by 2 producers. In this cluster, the variables are more disperse, however, it presents a higher relation between social and farm-household dimension analyzed through technology adoption. This cluster, even though is more represented by women, has a better perception of equality among the project participants. They consider the project is supporting their economic incomes and they are happier with the entrepreneurship presented.

It is explained by the social dimension with the metrics: agree about gender equality, agree about community decisions, short distance to the market, access to chacra easy, and social capital presented. According to The World Bank (2017) women own fewer assets and land that men, and less access to inputs, even when they are in equal opportunities, equal access to land an input is not resulting in equal returns for women.

In the chacras project, women consider not to have a good level of technology adoption but contrarily, they present indicators as Farm household: High-income access having a minimum wage as a reference and, Spatial: they present best conservation practices. The project is reaching some main constraints widely diffused, i.e. it is needed for women to have better yields improve rural access to training and information, produce knowledge and link women to agricultural value chains (The World Bank, 2017). Extension workers need to promote conservative ideas and stay close to the status quo, to find a delicate balance where they can not provoke resistant in farmers, helping to promote the women's participation in agriculture. (Mudege, Mdege, Abidin, & Bhatasara, 2017)

This cluster is far from the center, so it represents a lower frequency in the producer’s perception. In this cluster, they have the highest number of species in chacra that are 5 and 9 per chacra per producer.

Other Metrics: Outliers

Besides the two clusters of metrics, it has been identified other metrics that are not easily included in any cluster. These metrics are either more isolated or distinguish themselves by not considering some of the more prevalent elements. Members with better income in

cooperatives usually tend to provoke a lack of trust. To succeed in the long term, the chacras project participant needs to rely on a mechanism to create a sense of shared fate.

CONCLUSION

The hypothesis presented cannot be confirmed in this study. It sustained that producers with a higher number of species and with agricultural innovation adoption are not a key factor for having a better level of equality among producers belonging to the Chacras project.

The first cluster is the more representative from the analysis, and they have a high perception of inequality analyzing the chacras project. However, the second cluster, represented mostly by female producers, identified with the highest level of species in chacras and no technology adoption, have a perception of being more empowered and equality presence among producers. Regarding indicators, this cluster presents the highest level of income access and best conservation practices that cluster 1.

Even when cluster 2 has a higher number of species, productivity must be also value as a metric. According to FAO, (2009), Gender inequality also has detrimental effects on productivity: research shows that if women had the same access to productive resources as men, yields on their fields would increase by 20–30%. This statement could be validated in our study.

Jones *et al.* (2017) indicates that it is imperative to improve women's access to community and productive services, for improving production practices. In the chacras project, it is evident that more women feel empowered, self-confidence, and its perception is having a voice and agency, and the ability to claim rights. But it is necessary for the whole community and producers could have the same level of empowerment and self-confidence.

The Chacra Project promotes equitable access to productive resources such as species and land use. Nevertheless, it must be accompanied by training programs as basic financial, management and market access, technical advisors in production activities and extension programs. It is imperative to address limitations in producer’s skills, education levels in the off-farm and agricultural sectors.

Finally, environmental issues must not be apart from the farm production system. From the theoretical perspective of socio-ecological systems, social factors should not be separated

from environmental factors in matters of adaptation. Environmental changes often trigger responses and adaptations at the local level (Ashkenazy et al., 2018; Higgins, Dibden, & Cocklin, 2008; Pokorny, Johnson, Medina, & Hoch, 2012). Then, analyzing those changes is a challenge when the chacras project takes off.

Limitations

The main limitation of this research is that one community is not representative of all the chacras producers in Ecuador. However, we argue that our study has a high internal validity due to the ethnographic approach, corroborating the information through direct observations and producers' interview. Thus, our study supports a deep vision of inequalities and serving as a first step to document this reality in rural communities.

Another important limitation was the access to financial resources, then this study collects the information using a convenience sample of nine participants' interviews. Furthermore, our approach reflects the pros and cons of people's perception of the program, we intended the sample is somehow closer to the producers' reality.

Further research

This study had some constraints like time and funding to continue exploring the sample. We highly recommend analyzing the model with a larger sample and data collected in order to verify if the model varies, and the inequality keeps. Then, it is also imperative to explore the relationship between chacra production activities and its support to food security and mitigation of malnutrition, as part of the sustainability of the Chacras project in Pastaza.

Future research in social protection programs or policies in agriculture could prevent or mitigate the impacts of shocks through social insurance schemes and/or support productivity. More investing in productive activities is also necessary, then credit and financial services need to be further analyzed.

We encourage further studies about the promotion of social programs or public policies to empower individuals and households as a mechanism to remove discriminatory barriers and incentive linkages with complementary services. To increase productivity, more research and extension programs to promote skills and knowledge in the rural producers and peasants must be carried in the agricultural sector.

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