UNIVERSIDAD AUTÓNOMA DE SAN LUIS POTOSÍ
FACULTADES DE CIENCIAS QUÍMICAS, INGENIERÍA Y MEDICINA
PROGRAMAS MULTIDISCIPLINARIOS DE POSGRADO EN CIENCIAS AMBIENTALES
AND
TH KÖLN - UNIVERSITY OF APPLIED SCIENCES
INSTITUTE FOR TECHNOLOGY AND RESOURCES MANAGEMENT IN THE TROPICS AND SUBTROPICS

SUSTAINABLE COFFEE ALTERNATIVES FOR THE RURAL COMMUNITY OF SAN FRANCISCO, MUNICIPALITY OF TAMAZUNCHALE SAN LUIS POTOSI, MEXICO.

THESIS TO OBTAIN THE DEGREE OF
MAESTRÍA EN CIENCIAS AMBIENTALES
DEGREE AWARDED BY UNIVERSIDAD AUTÓNOMA DE SAN LUIS POTOSÍ
AND
MASTER OF SCIENCE
NATURAL RESOURCES MANAGEMENT AND DEVELOPMENT
DEGREE AWARDED BY TH KÖLN – UNIVERSITY OF APPLIED SCIENCES

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SAN LUIS POTOSÍ, MÉXICO AUGUST, 2016

PROYECTO FINANCIADO CON EL APOYO DE:

CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA (CONACYT)

La Maestría en Ciencias Ambientales recibe apoyo a través del Programa Nacional de Posgrados (PNPC - CONACYT)

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To my dear family, my mom Rita, my father Gino and my best friend and sister, Gaby.

ACKNOWLEDGEMENTS

I would like to give my thanks to all those involved, one way or another, in this study. Due to the nature of my research, I had the great opportunity to meet many people, learn from them and have a broader understanding of the wonderful but controversial world of coffee.

I start my thanks to all the coffee farmers that are struggling to build a decent future for them and their families. Thanks for sharing your experience.

I would like to give a special thanks to Doña Narcisa and her husband for opening their doors and prepare for me food during the field trip. Thank to Don Valentin, for offering his home. Thank to Don Nasario for all the logistic support. Thanks to Don Luis and the whole group of El Consejo del Café. Thanks to all the farmers of the FCSASF Society to participate in the questionnaires and interviews. Thank to Julio, my faithful friend on this trip. Thank to Julieta Vazquez a wonderful person and barista. In Germany, I would like to say thanks to Anna Kiemen for the support provided.

Moving to the South of Mexico, in Veracruz, I would like to acknowledge Jaquelina and Cristina for having me and introducing me to the OCOZACA Cooperative. Thanks to Mister Felipe Melchor for all the knowledge shared. I would like to say thanks to Marcos, a young farmer an example of what hard work and determination can achieve. Thanks to the whole group of OCOZACA, including farmers interviewed; thanks for sharing their knowledge. I have to mention the Licona family from the Sustainable Coffee Farm “La Herradura”. It was not only an enriching experience in terms of knowledge but a very warm and friendly reception.

In Chiapas, I would like to say thanks to Don Calixto and his partners. Their sensibility and desire to improve has been their key to achieve a successful production models. Thanks for sharing your experiences.

I would like to thank my family here in Mexico, which are my friends of the ENREM –PMPCA-ITT group and many others that I met throughout the path. Thanks to Clarita, Andre, Hugo, Eyleen, Laura, Edson, Meli, Martin, Nadine, Rebecca, Herman, Jenny, Gus, Octavio, Erika, Nathalie, Miguel, and so many other amazing people. Thanks to my thesis committee and all its support. Thanks to all the staff of PMCPA and ITT, especially Sandra, Farah and Laura, who always were willing to help me.

The biggest thanks are for my family. They were my daily support. My sister Gaby, my mom and my father, the most important people in my life. Thank you!

…"*but life is beautiful*"

Flavio, a coffee farmer of San Francisco.

His life story changed me.

Abstract

Coffee, the second most important globally traded product in the world after oil, is a commodity produced mainly by small-scale farmers located in what is called the coffee belt. Its production has been associated with unfair conditions and low profitability for the producers, which also had to deal with other difficulties such as the climate change, lack of resources and high level of marginalization. Under this context, many sustainable alternatives have been developed in order to overcome this situation. However, each of them has addresses different strategies, missions and visions.

The present study has been focused on a small-scale farmers organization called *La Flor de la Sierra Alta de San Francisco* (FCSASF), located in the Municipality of Tamazunchale, Mexico in order to analyze the viability of different types of sustainable alternatives taking by reference other cases located in San Luis Potosí (Participatory Organic Certification), Veracruz and Chiapas (Fairtrade, Specialty Coffee and diversified models). For that, the coffee production system and the inherent subsystems of farmers involved in the FCSASF Society were described and characterized in order to understand the operation of it through a systemic approach. Here the strengths, weaknesses, opportunities and threats were identified in order to analyze the viability of these sustainable alternatives.

It was found that the FCSASF Society and its members depend exclusive on the coffee production as their unique source of income. This dependence has created a vulnerable system and less resilient in front of external changes. As a result, drops in the coffee prices or changes in the environmental conditions put in risk the operation of this organization, and therefore, the farmers' life. Additionally, it was identified that the weak status of the organization and the mishandling of farms has caused that the profitability of this activity do not reaches the values of the basic basket set for Mexico. Under this concept, it is vital to improve these two elements that are associated with other factors such as the low quality of coffee, lack of traceability and low production volumes. The general recommendation is that the FCSASF Society should diversify their systems based on their own resources. This might means move into other activities such as other commercial crops (such as plantain), do workshops for different stakeholders, rent their facilities for commercial and/or educational purposes, among many others. This also includes the development of a market oriented alternative that is more suitable for their conditions. In this case it is recommended the Specialty coffee. However, all this mechanisms should be developed parallel with strategies that strengthen the organization in terms of participation, confidence and sense of belonging and improving the agricultural practices in the farm as well as the coffee processing.

Key words: Coffee, sustainability, small-scale farmers, alternatives, San Francisco

Resumen

El café, descrito como el segundo producto más importante después del petróleo que es comercializado a nivel mundial, es un alimento producido principalmente por pequeños agricultores ubicados en lo que se llama el cinturón café. Su producción se ha asociado con condiciones abusivas y baja rentabilidad para los productores, que también tienen que lidiar con otras dificultades como el cambio climático, la falta de recursos, el alto nivel de marginación, entre otros. Bajo esta premisa, muchas alternativas sostenibles se han desarrollado con el fin de superar esta situación. Sin embargo, cada uno de ellas ha sido desenada con bajo estrategias, misiones y visiones distintas.

El presente estudio se ha centrado en una organización de agricultores a pequeña escala que se llama La Flor de la Sierra Alta de San Francisco, localizada en Municipio de Tamazunchale, México, con el fin de analizar la viabilidad de los diferentes tipos de alternativas sostenibles tomando como referencia a casos éxitos ubicados en San Luis Potosí (Certificación Orgánica participativa), Veracruz y Chiapas (Fairtrade y de Cafés de especialidad y modelos diversificados). Para ello, se describió el sistema de producción de café y los subsistemas inherentes de los agricultores que participan en la Sociedad FCSASF a fin de comprender el funcionamiento del mismo a través de un enfoque sistémico. Seguidamente, se identificaron las fortalezas, debilidades, oportunidades y amenazas con el fin de analizar la viabilidad de estas alternativas sostenibles.

Se identificó que la Sociedad FCSASF y sus miembros dependen exclusivamente de la producción de café como su única fuente de ingreso. Esta dependencia ha creado un sistema muy vulnerable y menos resiliente frente a los cambios externos. Como resultado, cualquier problema en los precios del café o cualquier cambio en las condiciones ambientales ponen en peligro el funcionamiento de esta organización, y por lo tanto, la estabilidad de los agricultores. Además, se identificó que el débil estatus de organización y el mal manejo de las parcelas, ha resultado en ganancias por debajo de lo que corresponde a los valores designados en la canasta básica establecida en México. Bajo este concepto, es vital mejorar estos dos elementos que están asociados con otros factores tales como la baja calidad del café, la falta de trazabilidad y bajos volúmenes de producción. La recomendación general es que la Sociedad FCSASF debe diversificar sus sistemas sobre la base de sus propios recursos. Esto significa poder moverse hacia otras actividades, tales como otros cultivos comerciales (tales como el plátano), hacer talleres para diferentes grupos de interés, alquilar sus instalaciones para fines comerciales y/ o educativos, entre muchos otros. Esto también incluye el desarrollo de una alternativa orientada al mercado que pueda ser implementada bajo el contexto de la organización. En este caso se recomienda el café de especialidad. Sin embargo, todos estos mecanismos deben desarrollarse en paralelo con estrategias que fortalezcan la organización en cuanto a la participación, la confianza y el sentido de pertenencia de sus miembros y la mejora de las prácticas agrícolas en la granja así como también el procesamiento del café.

Palabras claves: Café, sustentabilidad, pequeños productores, alternativas, San Francisco.

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ABBREVIATIONS

AFN: African Fairtrade Network
CCT: Coffee Council of Tamazunchale
CERTIMEX: Mexican Certification Product and Ecological Processes (From the Spanich: Certificadora Mexicana de Productos y Procesos Ecológicos)
CICADES: Centro internacional de capacitación en cafeticultura y desarrollo sustentable
CLAC: Coordinadora Latinoamericana y del Caribe de Comercio Justo
CNPO: known in Spanish as Consejo Nacional de Producción orgánica, translated in English as National Council of Organic Production.
EFTA: European Fair Trade Association
FLO: Fairtrade International
GAP: Good Agricultural Practices
GCP: Good Cultivation Practices
IC: International Certification
IAC: International Coffee Agreement
ICO: International Coffee Organization
INMECAFÉ: Mexican Institute of Coffee (Instituto Mexicano del Café)
IFAT: International Fair Trade Association
IFOAM: Federation of Organic Agriculture
FCSASF: La Flor de Café de la Sierra Alta de San Francisco
MCC: Mexican Coffee Council
NAP: Network of Asian Producers
NC: National Certification
NCPO: National Council of Organic Production
NEWS: Network of European Word Shops
OPL: The Organic Product Law
PGS: Participatory Guarantee Systems
POC: Participatory Organic Certification
REDAC: known in Spanish as Red Mexicana de Tianguis y Mercados Orgánicos, translated as "The Mexican Network of local Organic Markets"
REO: Rural Economic Organization
RPS: Rural Production Society Known in Spanish as Sociedad Productora Rural.
SAN: Sustainable Agriculture Network
SAGARPA: Known in Spanish as Secretaría de Agricultura Aanadería Desarrollo Rural Pesca y Alimentación, translated as Secretariat of Agriculture, Livestock and Rural Development, Fisheries and Food
SCAA: Specialty Coffee Association of America
USDA: United State Department of Agriculture
WFTO: World Fair Trade Organization

GLOSSARY

Beneficio: the area where farmers processed the ripe coffee cherries. In Spanish it is defined as profit (Zeppuca Coffee)

Caffeine: it is a white crystalline alkaloid with similar theophylline, theobromine and uric acid structure, slightly soluble in water, with a bitter taste and aroma.

Chapeo: Spanish word to define the action to clear land of weed.

Cherry coffee: it is the ripe fruit of the coffee.

Decaffeinated coffee: Coffee which has been extracted caffeine.

Defects: it refers to those non-processed grains or any grain that suffered damages and subproducs of the coffee processing mentioned in the following list:

Imperfection or strange matter	Description
Black bean	A grain that has suffered a change in its composition, developing a black color, caused by pest and diseases, bad processing or climatological phenomena (freeze).
Big stick	A stick greater than 2 cm and less than 7 cm.
Medium stick	A stick about 1.5 cm 1 cm to 2 cm long
Small stick	A stick less than 1 cm.
Small beans	Those beans that crosses a sieve No. 12 (4.75mm).
Big stone	Stone passing through the sieve No. 20 (8mm) and it's retained in a sieve No. 18 (7mm)
Medium Stone	Stone passing through a sieve No.18 (7mm) retained in a sieve No.12 (4.75 mm).
Small Stone	Stone passing through a sieve No. 12 (4.75 mm).
Low density particles	Grains with lower density than the normal.
Parchment	Refers to a grain that retained its endocarp despite having gone through a wet process.
Peaberry	A particular grain characterized by a cylindrical shape resulting from the atrophy of one of the two seeds.
Elephant bean	A grain larger than the regular size of any given variety, due to the higher growth of one grain relative to the other.
Animal material	Any particle derived from animals such as: dead insects, fragments or rest of insects, feces and animal urine.
Grain bitten or broken	Coffee beans processed by the wet process that have been cut or bruised during the pulping process, classification process or hulling process, leaving whitish, brown or blackish spots.
Immature grain	Immature coffee beans, often with a wrinkled surface.
Sour	Coffee bean with a waxy translucent appearance usually is yellowish green to dark reddish brown.

Foreign matter: all materials other than coffee.

Green coffee: grain obtained from the fruit of the genus *Coffe*a, which is hulling, with caffeine and ready for roasting. Commonly known as: raw coffee, gold coffee, unwashed coffee or natural coffee.

Ground coffee: product obtained through the milling of roasted coffee.

Parchment coffee: product obtained from the wet process consisting of coffee beans wrapped in the endocarp

Polished coffee: green coffee which the silver film has been removed by a mechanical operation to give a luster and a better appearance.
Roasted coffee: Product obtained by roasting green coffee

CHAPTER I. INTRODUCTION

1.1 PROBLEM STATEMENT

Coffee is considered the second most important globally traded product in the world after oil (FAO, 2015). Its demand has been increasing and the consumption average annual rate has grown by 1.9% in the last 50 years (ICO, 2014). This worldwide consumed commodity is produced mainly by small-scale farmers in developing countries in what is called the coffee belt, with Brazil being the first producing and exporting country, Vietnam the second one, Colombia occupies the third place and Indonesia the fourth. In the list, Mexico occupies the 9th place among the producing countries and the 10th place among the exporting countries. Finally, coffee is exported mainly into the European Union, USA and Japan (ICO, 2015), mostly as green coffee (International Trade Centre, 2011).

In Mexico, the coffee production is leaded by the states of Chiapas, Veracruz, Puebla and Oaxaca and in the 8th place comes San Luis Potosi (SAGARPA, 2014). Since 1795, when coffee was introduced in Mexico for the first time, smallholder farmers have adopted this crop as a way of living. Unlike other countries such as Brazil, where coffee is produced in large private farms under unshaded monoculture systems submitted to high levels of inputs, in Mexico, between 60% and 80% of the coffee is produced under traditional systems (traditional/commercial polyculture and shade monoculture) in plots less than 5 ha, of which 60% belongs to "*ejidos*"[1] (Bartra *et al*., 2003; Moguel & Toledo, 2007).

Due to the low environmental impact, these traditional systems are highly valuable, and from an ecological perspective, the most important effects are (Guhl, 2008; Moguel & Toledo1996): moderation of temperature ranges, reduction of insolation and winds, reduction of soil erosion,

[1] *Ejido* is a terms used to define what was considered one of the main result of the Mexican Revolution in 1910. It refers to the land given to a population stemming from a legal process for its exploitation. Formally, it was defined in the Second Conference of Agrarian Reform celebrated in FAO, Italy as: "a society of common interest made up of Mexican farmers with an initial share capital represented by land, forests and water that the state will deliver freely. The property is impassible, indefeasible and imprescriptible subject to exploitation in the manner prescribed in the law"… "and is aimed at the exploitation and integral advantage of natural and human resources through the personal work of its partners for their own benefits" (FAO, 1979).

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circulation of nutrients from deepest soil horizonts, protection of watersheds, among many others.

Despite all the benefits mentioned above, for many small-scale farmers the coffee production represents an inconsistent economic income that depends on many external factors. In fact, the scenario behind a single cup of coffee is surrounded by environmental, economic and social difficulties. The most recently coffee crisis took place in 1989 when the International Coffee Agreement (ICA)[2] stopped their activities affecting mainly small-scale coffee farmers. Even though a new International Coffee Agreement was established in 1994, it was decided that coffee prices would no longer be regulated by this entity and it will depend directly on the free market (Portillo, 1993).

In the state of San Luis Potosi, the coffee production dates back to the year 1850, it means 100 years after it was introduced in Veracruz (Per101). The produccion of this crop is handled mainly by indigenous groups from the Tenek and/or Nahuatl ethnicity located in the Municipality of Xilitla, Tamazunchale, Aquismon and Matlapa (in this order of relevance in terms of production), where the edaphoclimatic conditions are appropriate for coffee plantation (SIAP, 2014a). Here, the living condition of the coffee farmers is not different from the majority of the coffee farmers in the World. A high degree of marginalization, precarious living conditions, lack of infrastructure, among other shortcomings characterized the zone (Per101). Compare to other producing states in Mexico with quite similar environmental conditions, San Luis Potosi produces only 0.3% of the coffee in Mexico, compared to 43.4% produced in Chiapas (SIAP, 2014a).

In the Municipality of Tamanzunchale it has been identified that the main constrains faced by the farmers are the following: the no renewal of coffee plantations, lack of seedbeds and nurseries and poor organization (Castillo-Ponce et al., 2011). The high degree of marginalization (CONAPO, 2010) and all the limitations and constrains inherent of the coffee production systems, makes it difficult for small-scale farmers in communities such as San Francisco, located in the Municipality of Tamazunchale depend on coffee as their unique source of income.

Under this context, the need of pursuing sustainable coffee production models to ensure the continuity of coffee in the market has become the main approach of different proposals. Looking for possible solutions to the coffee crisis and its effects on small-scale farmers' livelihood, many

[2] The international organization chaired by coffee consumer and producing countries that negotiate the annual quotes of exportation between different countries and the floor price of the product, among other regulations.

international organizations have created certification programs in which certain standards of production, processing and/or distributions need to be accomplished in order to address a more lucrative market and, therefore, support sustainable production systems. This type of model could lead to a better payment through an extra price by promoting a pro-environmental agenda (Parvathi & Waibel, 2013). Eco-friendly coffees, Fairtrade, certified organic, Smithsonian Bird Friendly, Utz Certified, among many others, are considered more sustainable options that promote an environmentally friendly production model and the improvement of the social and economic situation of farmers (Koekoek, 2003).

Studies suggest that these models has brought important benefits for Latin American coffee producers by receiving a higher income for their product, at least in a short-term (Kilian *et al*., 2006). Similarly, many indigenous families have perceived economic and social benefits by adapting their traditional production techniques to an organic model (Maldonado-Sosa et al., 1995). Mexico also started to promote different alternatives to keep the coffee production as a viable and strong economic activity after the fall of coffee prices between 1998 – 2004, represented by the production and marketing of organic and Fairtrade coffee (Escamilla et al., 2005).

Although the third party certifications have been wordwide accepted due to their high degree of liability and objectivity, for many small-scale farmers it is not always an accessible option (Nelson et al., 2015). In some cases, the highly competitive market, the lack of economic resources and knowledge in the topic are the main reasons for smallholders to not participate in such programs (Parvathi & Waibel, 2013). It means that small coffee farmers have to find new strategies to improve their economic income without harming the environment on which they depend on and reduce their situation of vulnerability. Under this context, emerged the Participatory Guarantee System (PGS), a more accesible certification to small-scale farmers located mainly in the Global South (Nelson et al., 2015). The PGS has been supported by the International Federation of Organic Agriculture (IFOAM) as an important alternavite for small-scale farmers (IFOAM, 2007). Therefore, considering that the majority of coffee producers in Mexico manage traditional systems where the usage of chemicals is minor (Moguel & Toledo, 1996), the conversion to a sustainable model with a higher remuneration system seems to be a good alternative, especially when the prices are not favorable in the conventional coffee market.

On the other hand, recent studies have questioned whether sustainable coffee certification will be the definite answer to achieve sustainable systems or not and the real impact of this model in the life quality of small-scale farmers (Bacon, et al.,2008). Tracy Ging, Director of sustainability of *S&D Coffee* had claimed that the investment cost and the level of quality that farmrs need to achieve to get to higher-value markets sometimes do not correspont to the benefits percieved by them. She also mentioned that for some small-scale farmers, coffee could be consider as a side activity, remmembering that "as much as we think so, coffee is not at the center of the universe" (Ging, 2014).

Under this logic, other alternatives have emerged. The diversification of the crop systems as a way of improving small-scale farmers' living standards, especially in terms of food security (Caswell & Méndez, 2012). In fact, in 2009, the declaration of the recent World Summit of Food Security emphasized the importance of promoting a sustainable agriculture model recognizing the invaluable contribution of biodiversity for food security and ecosystems functioning. This way, farmers rely not only on coffee as their unique source of income, but also on other products and/or activities (FAO, 2010).

Taking into account the previous scenarios, the present study attempts to assess the current coffee situation of the community of San Francisco, focused on a Rural Productive Society (RPS) called "La Flor de Café de la Sierra Alta de San Francisco" (FCSASF) located in the Municipality of Tamazunchale and analyze the viability of sustainable coffee alternatives that could lead to benefits in economic, social and environmental terms for the coffee farmers belonging to this productive unit.

1.2 JUSTIFICATION

Coffee is an important economic activity in Mexico that represents 1.9% of the products in the agro-industry in Mexico. Additionally, this is the main organic product that the country produces followed by aromatic herbs, vegetables, cocoa, grapes and others (SAGARPA, 2014). Smallholder farmers are the main responsible for the coffee production in the country and have a leading role in this massive industry, which results quite contradictory compared to the benefits they perceive from their job (Moguel & Toledo, 1996). This has been the driving force to create sustainable alternatives that fulfill the economic, social and environmental dimensions of coffee production (Barrett, 2008; Nelson et al., 2010).

Mexico manages almost 90% of their coffee production under agroforestry systems, contributing to the conservation of the biodiversity and the protection of ecosystem services (Moguel &

Toledo, 2007). This represents an advantage when sustainable alternatives want to be implemented; advantages that have been managed in a very interesting way by organization located in Chiapas, where there is a major participation in differentiated markets.

Because the Municipality of Tamazunchale have the ideal environmental conditions for coffee growing, and the farmers manage low-input systems (Castillo-Ponce et al., 2011), this study presents alternatives for small-scale farmers that could lead to better performance in the coffee activity.

The community of San Francisco located in the Municipality of Tamazunchale has been choosing as the study area due the following factors:

- Problems with coffee production yields (SIAP, 2014).
- Adequate altitude for Arabica coffee production.
- The relation established with the members of the community in previous research studies.

In order to focus the analysis, the Rural Productive Society (RPS) "La Flor de Café de la Sierra Alta de San Francisco" (FCSASF) was chosen to do the research study. This was a determining factor to conduct the research, since the organization is one of the most important requirements to achieve better coffee production systems.

In the present study, the sustainable alternative models were taken from successful study cases in San Luis Potosí, Veracruz and Chiapas, emphasizing the importance of alternatives that can be developed under the context and reality of San Francisco and not generic alternatives that do not meet the real needs of the farmers.

1.3 RESEARCH QUESTIONS

- What are the main threats and opportunities of the coffee production in the FCSASF Society?
- What are the internal and external elements that define the coffee production systems in the FCSASF Society?
- How these elements affect directly or indirectly the coffee system?
- What are the inherent subsystems of the coffee productive system?
- What is the interaction among these subsystems?
- Which are the critical points of the coffee production and processing?
- What are the most suitable alternatives for the coffee producers to achieve more sustainable systems?
- Are the conditions given to develop a sustainable production model?

1.4 OBJECTIVE

1.4.1 GENERAL OBJECTIVE

Analyze the viability of sustainable coffee alternatives in the rural communities of San Francisco in the municipality of Tamazunchale, San Luis Potosi, Mexico.

1.4.2 SPECIFIC OBJECTIVES

- To analyze the coffee production system and inherent sub-systems in the community of San Francisco, located in the Municipality of Tamazunchale, San Luis Potosi, Mexico.
- Identify the weaknesses and opportunities of traditional coffee production in the community of San Francisco located in the Municipality of Tamazunchale, San Luis Potosi, Mexico.
- To assess the viability of sustainable coffee alternatives based on endemic experiences in Mexico that could be carried out in the community of San Francisco located in the Municipality of Tamazunchale, San Luis Potosi, Mexico.

CHAPTER II STATE OF ART

2.1 SUSTAINABLE AGRICULTURE

The term sustainable development appears officially for the first time in 1987 in the World Commission on Environment and Development (Brundtland Commission), expressing the existing relationship between humanity and nature and recognizing the dependency of humans on the environment to meet their basic needs, and not the other way around. In this first approach, **Sustainable Development** was defined as "development which meets the needs of current generation without compromising the ability of future generations to meet their own needs" (WCED, 1987); a definition that has been broadly used, modified and adapted to different approaches.

As in many other fields, the term sustainability has been applied to agriculture in order to introduce a more holistic approach. Agriculture is considered one of the most important anthropogenic activities that have contributed to the transgression of some of the natural boundaries by affecting the climate, the biodiversity and trigger changes in the global nitrogen cycle (Rockström, et al., 2009). As a response of these problems, a sustainable agriculture model has been proposed in order to guarantee food in the current and future generations. According to FAO, sustainable agriculture is defined as "the management and conservation of the natural resource base, and the orientation of technological change in such a manner as to ensure the attainment of continued satisfaction of human needs of present and future generations. Sustainable agriculture conserves land, water, and plant and animal genetic resources, and is environmentally non-degrading, technically appropriate, economically viable and socially acceptable" (FAO, 1988).

Under this context, FAO has defined five principles that should meet any crop, livestock, forestry, aquaculture and/or fishery activity to be considered sustainable (FAO, 2014). These principles are summarized in the table 1:

Table 1. Key elements of sustainability in food and agriculture according to FAO.

Principles of sustainable agriculture				
Principle	**Key word**	**Description**	**Examples of key policies and practices in crops and Forestry system**	**Examples of key policies and practices in coffee production**
1. Improving efficiency in the use of resources is crucial to sustainable agriculture	Efficiency	Water, fertilizers, labor, energy, among other elements should be used efficiently. This principle encourage to get the "right mix" of technology and management used in order to reflects the value of natural resources and the real cost of environmental impact.	**1.** Genetically diverse portfolio of varieties **2.** Conservation agriculture. **3.** Judicious use of organic and inorganic fertilizers, improved soil moisture management. **4.** Improved water productivity, precision irrigation. **5.** Integrated pest management (IPM). **6**. Sustainable management of natural and planted forests **7.** Forest area increase and slowing deforestation. **8.** Tree improvement to support productivity and resilience.	**1**. Promote growth of the tree by cutting unproductive stems. **2**. Maintain healthy and fertilize soils using the sediment of fish ponds as compost. **3**. Having a fish pond also improves food security. **4**. Save water through the use of more precise techniques for irrigation.
2. Sustainability requires direct action to conserve, protect and enhance natural resources	Conservation	Conservation is a key factor to be considered in order to reduce the depletion and degradation rate of natural resources. In this context, strategies for conservation and protection will be necessary to avoid the degradation of ecosystems that constituted the means of livelihood for many producers.	**1.** Use better practices for biodiversity, such as in-situ and ex-situ conservation of plant genetic resources. **2.** Use better practices for soil: land rehabilitation **3.** Use better practices for water management: deficit irrigation, preventing water pollution **4.** Set policies, laws, incentives, and enforcement to promote the above. **5.** Conserve biodiversity and forest genetic resources. **6**. Restore and rehabilitate degraded landscapes. **7**. Enhance the role of forests in soil protection and conservation. **8.** Use reduced impact harvesting techniques	**1.** Cover the soil with grass (mulching). **2.** Avoid overuse of fertilizers, it could pollute water and deplete soils. **3.** Dig trenches to protect the top soil from being washed away.

3. Agriculture that fails to protect and improve rural livelihoods, equity and social well-beings is unsustainable	Equity and social well-being	This principle presents the necessity of assuring equitable and secure access to natural resources in order to produce food and increase economic income also encourages the necessity of policies that ensure the reduction of tradeoff between the social and environmental objectives.	**1.** Increase/protect farmers' access to resources, e.g. through equitable land and water tenure systems. **2.** Increase farmers' access to markets through capacity-building, credit, infrastructure **3.** Increase rural job opportunities e.g. in small and medium enterprises sustainability and related activities **4.** Improve rural nutrition: production of more and affordable nutritious and diverse foods, including fruits & vegetables. **5.** Improve forest tenure rights and access to forest resources. **7.** Promote the development of small and medium-scale enterprises	1. Promote the organization among coffee producers
4. Enhanced resilience of people, communities and ecosystems is key to sustainable agriculture	Resilience	In the context of sustainable food and agriculture, resilience "*is the capacity of agro-ecosystems, farming communities, households or individuals to maintain or enhance system productivity by preventing, mitigating or coping with risks, adapting to change, and recovering from shocks*". Strategies that enhanced resilience should be consider a priority in order to achieve a sustainable system.	**1.** Generalize risk assessment/management and communication **2.** Prepare for/adapt to climate change **3.** Respond to market volatility, e.g.: encouraging flexibility in production systems, and savings **4.** Contingency planning for droughts, floods, and pest outbreaks; development; social safety nets **5.** Increase resilience of ecosystems to biotic and abiotic hazards including climate change phenomena, pests and diseases. **6.** Prevent the transmission of pathogens to other countries through international trade. **7.** Integrate risk prevention and management into sustainable land-use planning	**1.** Considering integrating other agricultural activities, for example: planting fruit trees as shade for the coffee trees, to earn more money and improve food security. **2.** Protect biodiversity in your plantation (more shading and more biodiversity will lead to greater resilience)

5. Sustainable food and agriculture requires responsible and effective governance mechanisms	Governance	In order to achieve a sustainable system, institutional framework will be needed. A sustainable agenda should be followed by policies that determine and assure accountability, equity, transparency and the rule of law.	**1.** Increase effective participation **2.** Encourage formation of associations **3.** Increase frequency and content of consultations among stakeholders **4.** Develop decentralized capacity **5.** Develop personnel and institutional capacity **6.** Support good governance of rural areas **7.** Decentralize decision-making and empower local communities to promote participatory forestry **8.** Develop financial incentive packages to support private investment and enable equitable distribution of benefits	**1**. Implementation of policies by the government that facilitate the application of the four principles

Source: Own creation with data obtained from FAO, 2014.

To summarize the principles that define a sustainable agriculture, key elements have been identified from the FAO's principles definition: EFFICIENCY, CONSERVATION, EQUITY AND SOCIAL WELL-BEING, RESILIENCE AND GOVERNANCE. Under this approach, FAO's sustainable agriculture definition is presented as a dynamic process instead of a merely a result. In this context, a sustainable system should also meet the main elements of food security: availability, access, utilization and stability. Additionally, the definition of sustainable agriculture should consider equally important the environment, integrity, health, economy and the life quality of the people involved in any step of the chain (Asami, 2003). As a practical example, in the table 1 the principles were contextualized in the coffee production systems as well, showing some sustainable coffee production practices that could be done in order to achieve more sustainable systems.

However, it is also evidenced that the definition leads to a very broad interpretation. In fact, there is not a unique and strict definition of what sustainable agriculture means and how can be achieved. As a result, the term sustainability has led to dualities and erroneous interpretations widely criticized (Hopwood et al.,2005).

2.2 SUSTAINABLE COFFEE

As happens with the concept of sustainable development, at the moment, there is not a unique definition for sustainable coffee. Even though some elements are shared between the existing definitions, each of them responds to different logics, visions and methods. Nevertheless, some objectives can be similar: preservation of the natural resources and social equity and economic viability (Altieri & Nicholls, 2005).

The coffee consumption as a stimulating beverage in Europe started to grow at the beginning of the XVII century, when coffee was introduced by the turkish people. This product, originally from Ethiopia, expanded rapidly throughout the main cities in Europe. Around the 17th century, the seeds were transported to the countries colonized by the Dutch in East India, specifically Ceylon and Java, where it was stablished large coffee plantations. Since that moment, coffee producction was plagued by abuses, making this the motivation and starting point for the first Fair Trade Certifictation system called Max Havellar that was launched as an alternative to support small-scale farmers (See figure 1) (Guhl, 2008).

As it is summarized in the Figure 1, the certification systems started to emerge in the mid-20th century, as an alternative for the model proposed in the green revolution. Before that, in the 1960s and 1970s, agriculture was focussed on solving the problem of feeding rapidly the population through the implementation of a higly dependent external input model. Despite the increases of yields, the green revolution created many problems in the population in terms of equity, environmental degradation and unsustainable productive systems (Conway, G.R & Barbie, E.B, 1990). As a response, alternative model are focused on reducing and/or eliminating the use of agrochemicals and implementation of other source of nutrientes to increase soil fertility such as manure, sewage sludge, legumes, among others. Rotation of crops and integration of livestock are other practices promoted by this new alternatives (Altieri M. , 2000).

In Mexico, the first certification system was established in the state of Chiapas, in la Finca Irlanda. Nevertheless, coffee production in Mexico has been characterized to be a low impact activity in terms of environmental damages (Moguel & Toledo, 1999), way before that the certification models were created.

Worldwide		Mexico
Fair Trade Organizations (**FTO**) started in Europe. The Dutch division of Oxfam opened a shops selling goods from developing regions.	1960	
	1967	The international agency *Demeter International* certified for the first time the coffee unit "Finca Irlanda" in Chiapas.
The oldest **Participatory Guarantee System** (PGS) that has been registered is Nature et Progrés in France		
In France, the International Federation of Organic Agriculture Movement (**IFOAM**) started to be established.	1972	
In the Netherlands, the **first Fair Trade certification** system called **Max Havellaar** was launched by farmers and activists as a third-party recognition and a label of Fair Trade products, specially for coffee.	1988	
The **World Fair Trade Organization** (WFTO), established as first global Fair Trade network	1989	
The United States Department of Agriculture (USDA) standardize and regulate the term "organic" through the development of **national standards for agricultural products produced organically.**	1990	
Rainforest Alliance certification was stablished	1991	
The Sustainable Agriculture Network (SAN) was stablished to promote the development of good practice standards, certification and the training of rural producers		
	1996	**The first local organic market** was established in Guadalajara.
The Foundation of **UTZ certification**	1997	The Foundation of the National Organization Certification body **CERTIMEX**
The USDA implemented the **national organic standards**	2002	
	2003	Three additional **local organic markets were opened** in Chapingo, Xalapa and Oaxaca city
The terminology **and conceptual framework for PGS** was established in the first International Workshop on Alternative Certification" in Brazil.	2004	**REDAC** (known in Spanish as Red Mexicana de Tianguis y Mercados Orgánicos, translated as "The Mexican Network of local Organic Markets" was the first civil association established in Chapingo before PGS, formed by these four markets

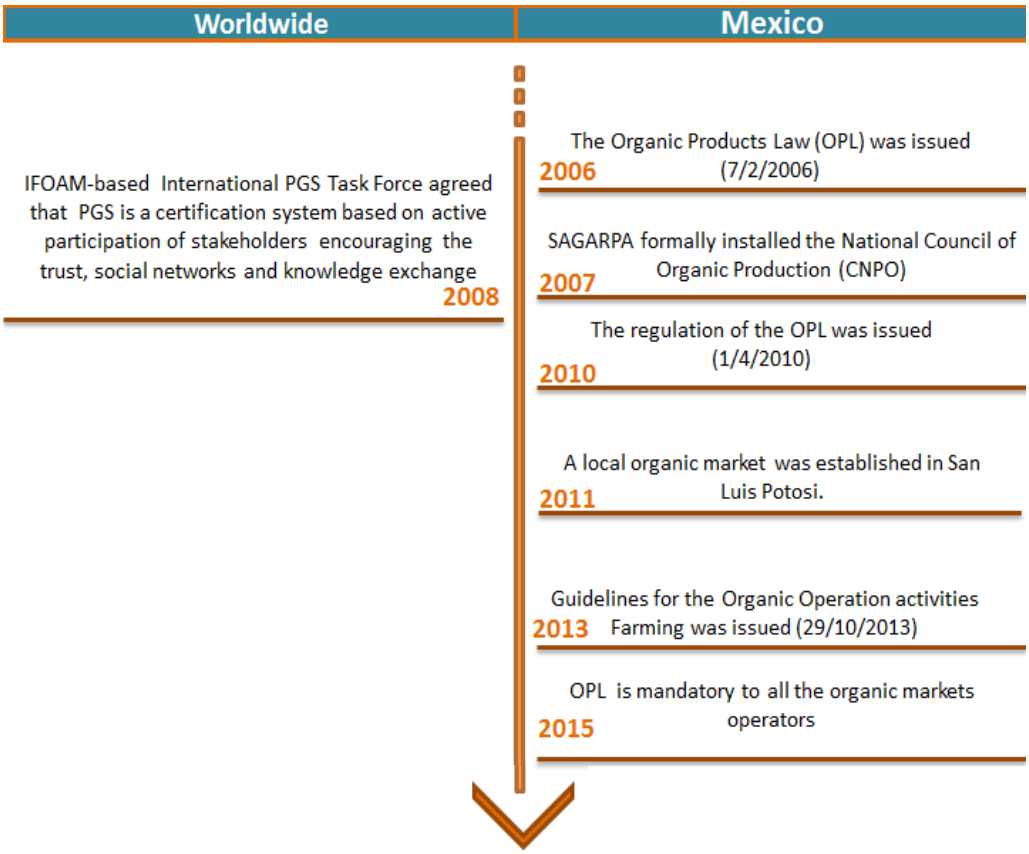

Figure 1. Historical timeline of the main certification systems in the agriculture field.

Source: Own creation with data obtain from: CNPO, 2010; Nelson *et al.*, 2015; IFOAM, 2016.

In a market oriented definition, sustainable coffee refers to a type of coffee produced under certain standards stablished by a certifying entity that fulfill the balance between the environmental, social and economic factors. In this case, the certified coffee fills a market niche and a premium price is delivered to those producers who comply strictly with the requirements (Giovannucci, 2003). This type of sustainable coffee is mainly held by a third-party certification, that is an independent organization in charge of inspecting the compliance of specific standards of the manufacturing process, which is finally represented with a label (NSF, 2016). These systems are based on national and international standards and policies which offer a degree of objectivity and trust among consumers and access to a more lucrative market niche (Nelson et al., 2010). In the coffee field, five well- stablished NGO- Based certifications are recognized. Each of them respond to different approaches and have been created under specific missions, visions and standarts. For example, Organic and The Smithsonian Bird Friendly certifications have a clear environmental mission. In the first model, chemical intensive farming practices are forbidden, while the shade/Bird friendly certification encourages the conservation of trees to preserve

migratory birds. The Rainforest Alliance and UTZ have a dual social-enviromental mission, protecting people and the environment by implementing better farm management. On the other hand, Fairtrade have a clear social mission, promoting justice and development for small-scale farmers by reducing trade difficulties (Raynolds, et al., 2007 & Kline, 2009).

Since 1970-1980, the third party certification has been the most common process to guarantee the correct implementation of certain standards leaving behind the peer review model of certification held previously (Nelson et al.,2015). However, many constrains have been identified and as a respond to this, other options have emerged such as the PGS. As the third party certifications, PGS are based on national regulations to provide a reliable organic production system, however it is presented with a different focus. PGS is adapted to the local context, small-scale productions and local markets where administrative and logistics procedures are simplified to maintain low costs. Additionally, the system is characterized by the participation of all the stakeholders involved, resulting in a more transparent process (Fonseca et al., 2008).

As it has been evidenced, the focus point of each of this sustainable certified models is different and it's summarized in the figure 2.

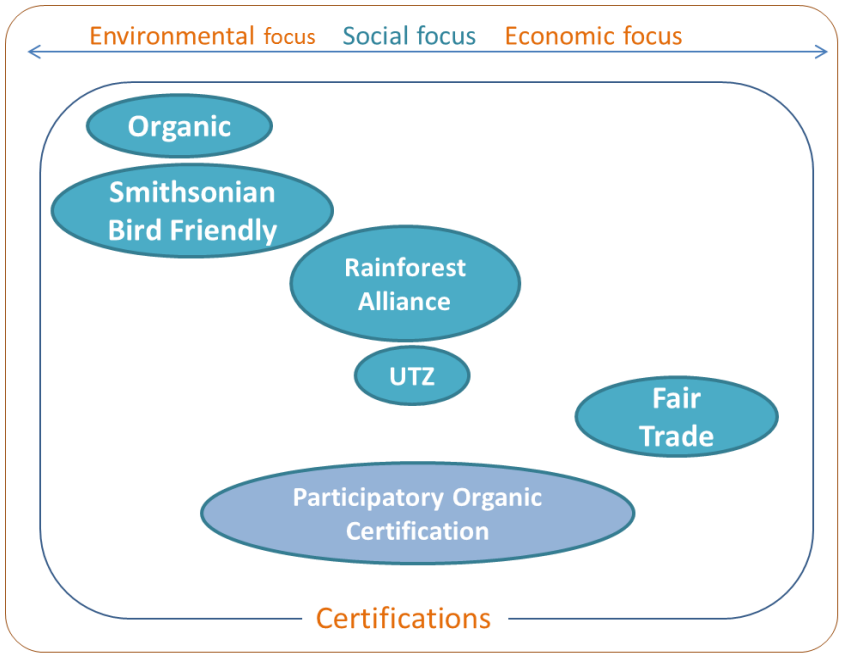

Figure 2. Classification of the main coffee certification programs according to their focus.

Source: Own creation based on data obtained from: Raynolds et al., 2007; Kline, 2009.

Besides these models, other non-certified coffees have been defined as sustainable. In fact, different perspectives have emerged and sustainable coffee not necessarily means a coffee that has been certified by a third party institution or by a participatory certification. According to Goodrich (2015) [3] "Innovation and sustainability are linked as key drivers for our future". Under this logic, the term sustainability in the coffee industry is focused principally on the reuse of materials throughout the life cycle and the use of sustainable materials. This approach is based on the circular economy[4], a new vision where materials are used wisely, toxic elements are eliminated and more elements are recovered to be reused (NCAU, 2015). Despite the fact that environmental issues are considered in this approach with a clearly technical focus, other important component of sustainability such as the social component are been overlooked.

Highly concerned with the management of modern agriculture, agroecologists are seeking to change the logic behind this production model in order to reconsider the ecological processes that have been substituted and modified in intensified agro systems. In this case, "the agroecological approach seeks the diversification and revitalization of medium size and small farms and the reshaping of the entire agricultural policy and food system in ways that are economically viable to farmers and consumers" (Altieri & Nicholls, 2005). In this context, the crop diversification is a key element that brings resilience to the system, food security, diversification of sources of income and reduces the environmental degradation (Lin, 2011). Crop diversification is a common strategy used by many farmers, corresponding to "the practice of growing more than one crop to increase financial and biological stability" (Johnston& Cadet, 1995). This model attempts to return to the logic implemented in traditional farming systems that are characterized by a high vegetal diversity in form of polyculture. This strategy promoted the stability of the soil, diversifies the dietary of farmers and keeps the balance of the natural resources (Altieri & Nicholls, 2000). It is necessary to mention that agricultural diversification could take place in other dimensions besides crop diversification, such as: (1) a shift from farm to non-farm activities; (2) shift from less to more profitable crops (3) use resources in diverse but complementary activities (Vyas, 1996).

In the coffee field, diversification promotes the development of additional and/or alternative activities to reduce the dependency on coffee as the unique source of income (Osorio, 2002). Here, sustainable coffee systems are oriented more on providing food security and stability to

[3] Greenblue executive director for sustainable packaging coalition director.

[4] Circular economy is based on producing no waste and/or pollution by adapting designs, components, materials (Ellen Macarthur Foundation, 2015)

farmers in terms of preserving their environmental resources, supporting their families and reducing vulnerabilities instead of supplying a market niche.

For the purpose of this study, sustainable coffee is defined considering the definition presented by Moguel & Soto Pinto, 2002; Osorio, 2002 and FAO, 2014 as a process of production, processing and marketing of coffee that is environmentally friendly, economically viable, promotes human development and accomplished quality standards. This type of coffee should exalt the role of coffee farmers and their irreplaceable function in this activity, by providing fair production conditions and tangible benefits for them and their families. The figure 3 summarized the key elements to be considered in sustainable coffee.

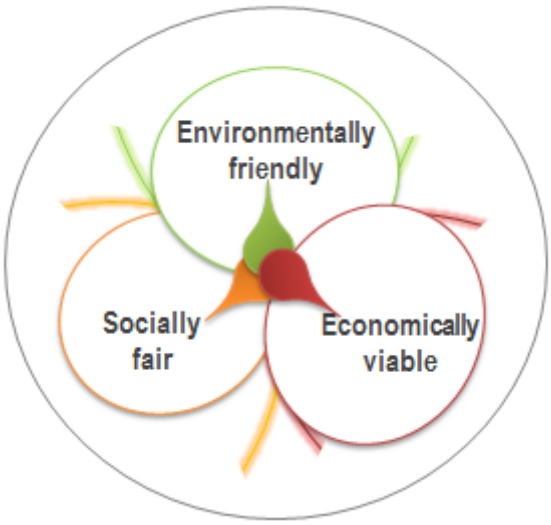

Figure 3.Graphic representation of the Sustainable Coffee Definition.

In the definition, **socially fair** means that the coffee production satisfies the basic needs of the farmers, promotes participation and the process of decision making is transparent. It is **environmentally friendly** because it conserves the natural resources, with special emphasis in the soil, as well as promotes the conservation of biodiversity and **economically viable** because it is profitable, and the economic risks are lower because it is diversified and produces coffee that accomplishes quality parameters (FAO, 2014) (SAI, 2009) (Altieri & Nicholls, 2005).

2.2.3 CERTIFICATIONS MODELS

The implementation of certification programs in the coffee industry seems to be the most common approach to achieve sustainable models (Giovannucci, 2003). Under this statement, in the present study two different certifications were presents as possible alternatives: Fairtrade and Organic Participatory Certification.

2.2.3.1 Fairtrade

To start defining what Fairtrade is, it is necessary to recognize the differences between two terms: Fair Trade (FT) and Fairtrade (no abbreviation). The first one corresponds to a term used to describe a trading system, which is based on certain values such as: transparency, respect, equity in international trade and dialogue within parties. It was officially define by the FINE[5] group in 1999 as "a trading partnership based on dialogue, transparency and respect, which seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions and securing the rights of marginalized producers and workers, especially in the South. Fair Trade organizations (backed by consumers) are engaged actively in supporting producers, awareness raising and in campaigning for changes in the rules and practice of conventional international trade" (Boto & La Peccerella, 2008). On the other hand, the term Fairtrade is use to define a brand by Fairtrade International (FLO) that follows the Fair Trade principles (WFTO, 2011). The Fairtrade International (FLO) is the headquarters of many local organizations responsible of standardize the parameters of the Fair Trade worldwide and being the main representative in international scenarios. In each producing continent, farmers are represented by different organizations; for example, in Africa by African Fairtrade Network (AFN), in Latin American and Caribbean by La Coordinadora Latin-American y del Caribe de Comercio Justo (CLAC) and Asia by the Network of Asian Producers (NAP).

Fairtrade works through a *minimum price guaranteed* which works as a lifesaver when the price of the coffee market collapses. Currently the coffee price stablished by Fairtrade is 140 cents$/pound for Arabica washed coffee and 135 cents$/pound Arabica no-washed coffee. In case when the price of the New York Stock Exchange is higher than 135-140 cent/pound, Fairtrade follows these prices (CLAC, 2010). This represents an important help for farmers in cases when the coffee price drops as happened in 2000 and 2005, when coffee hold a price of 50 cent$/pound less than the

[5] FINE is an informal network that involves the Fairtrade Labelling Organizations International (FLO), the International Federation for Alternative Trade (IFAT), the Network of European Word Shops (NEWS) and the European Fair Trade Association (EFTA).

cost of production. Fairtrade Organic Certified products receive an extra price of 30 cents $/pound. Additionally an extra premium is added to the coffee price that must be invested in social and economic development in the communities and/or organizations (FLO, 2011).

The International Fair Trade Association (IFAT)[6] has defined 10 principles that must be fully met in order to achieve a Fair trade. The 10 principles are presented in the table 2.

Table 2. 10 Principle of Fair Trade.

Principle	Description
Principle One: Creating opportunities for economically disadvantaged producers	Reduce poverty through fair trade forms, supporting small producers, whether they are independent or organized in co-operatives or associations. Enable them to economic self-sufficiency and ownership
Principle Two: Transparency and Accountability	Encourage the transparency and participation within employees, members and producers in its decision-making processes.
Principle Three: Fair Trading Practices	
Principle Four: Payment of a Fair Price	The price designated has been mutually aggred and it provides a fair payment for producers by a minimun price. Fair Trade organizations encourage the capacity building as require to producers in order to enable them to set a fair price.
Principle Five: Ensuring no Child Labour and Forced Labour	The Fair trade organizations ensure that forced labor in its workforce or members do not exist. The participation of children in the production for Fair Trade products is monitored and does not affect children's well-being, security, education and need of play. The organizations are subject to the UN Convention of the Rights of the Child, and national/local law on the employment of children.
Principle Six: Commitment to Nondiscrimination, Gender Equality and Women's Economic Empowerment and Freedom of Association	The Fair Trade organization does not discriminate in hiring, remuneration, access to training, promotion, termination or retirement based on race, caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation, HIV/Aids status or age. Additionally, the organization recognized full employment rights for women and the rights of all employment to participate in a trade union of their choice.
Principle Seven: Ensuring good working conditions	Based on national and local laws and ILO conventions on health and safety, the organization provides a safe and healthy working environment. Fair Trade organizations know the health and safety conditions of the producers they work with.
Principle Eight: Providing Capacity Building	The capacity and skills building whithin employees and members of the organization is strongly encouraged. The main objective is to support vulnerable producers and their organizations.
Principle Nine: Promoting Fair Trade	The Fair Trade organizations raises awarness of the importance of fair trade and business conditions for producers. As well as providing costumers with all the required information about the

[6] The global network of Fair Trade Organizations constituted by 300 members in 70 countries (Boto & La Peccerella, 2008)

	product they are bying (producers organization, members, the product) using always honest advertising.
Principle Ten: Respect for the Environment	Fair Trade organizations encourage the efficient use of material and sustainable techniques, the use of tecnology to minimize the gas emisions. Reduce the environmental impacts by using organic and/or low pesticide, minimise the impact of their water stream.

Source: Information obtained from WFTO , 2013. (WFTO, 2013)

2.2.3.2 Participaroty Guarantee System - Participatory Organic Certification.

Since 1970-1980, the third party certification has been the most common process to guarantee the correct implementation of certain standards leaving behind the peer review model of certification held previously. However, constrains have been identified and model such as PGS have emerged. As the third party certifications, national regulations are used by PGS to provide a reliable organic production system, however it is presented with a different focus. PGS are adapted to the local context, small-scale productions and local markets where administrative and logistics procedures are simplified to maintain low costs. Additionally the system is characterized by the participation of all the stakeholders involved, resulting in more transparent process (Fonseca et al., 2008). This model is presented as a more viable alternative for small scale producers, by adapting a more viable system based on the following six elements described by IFOAM[7]:

Table 3. Key elements of the Participatory Guarantee System proposed by IFOAM.

	Key elements
Shared vision	It is fundamental to have a shared vision between farmers and consumers.
Participatory	The certification is based on participatory principles where the interests of the producers and consumers are considered. The participation of the members in the establishment of the organic principles and rules assures the credibility among the community involved.
Transparency	All the members involved must be aware of the mechanisms, the general process and decisions making. All this information must be reported in a written document available to all the interested parties.
Trust-integrity based approach	Trust is a key element, based on the fact that farmers will carried out fully the organic certification system and ensure the integrity of their activities.
Learning Process	A PGS goes beyond the certifications process and look also to provided tools and knowledge among farmers, consultants and consumers.
Horizontality	The power is shared by all the stakeholders involved in the process of participatory certification and verification of the organic quality standard avoiding the complete control by a small group of people.

Source: Obtain and modified from (IFOAM, 2007).

[7] IFOAM – is the International Federation of Organic Agriculture Movements. The global umbrella organization for the organic farming movement.

PGS is a participatory system leaded since 2004 by Brazil with the Ecovida network as the main representative of the movement and expanded throughout different countries. In Mexico, the PGS, known as the Participatory Organic Certification (POC), a model based on organic local production and consumption is promoted by the Mexican Network of Local Organic Markets; a civil association in charge of promoting local production initiative under organic standards constituted by a committee of different stakeholders such as producers, consumers, agronomists, students, volunteer among many others (Nelson et al., 2015).

This model has been legally accredited and validated in the Mexican Organic Law (OPL) in the Article 24 that declares:

"Participatory organic certification of family production and/or organized small producers for that purpose will be promoted, for which th Secretariat with the Council's opinion will issue the sufficient arrangements for its regulation, in order that those products maintain compliance with this Law and provisions may be marketed as organic in the domestic market"

Taking in cosiderenation that this two certification models were cosidered as possible alternatives of certification for the study case, here is presented a comparative table that shows what are the amin differences.

Table 4. Comparative table of the two certification models

Certification/Verification	Fair Trade	Participatory Organic Certification
Responsible organism	FLO, which represents many Fair Trade organizations.	REDAC
Mission	Connect disadvantaged producers and consumers, promoting fair trade conditions and train farmers to fight poverty, strengthen its position and take more control over their lives.	Ensuring organic quality and healthy local production, through a collective process between small scale producers, consumers and other stakeholders.
Market Focus	International Market	Local Market
Main focus	The establishment of fair trade conditions ans a minimum price and a social premium aimed to develop the community.	Local consumption and direct trade of organic products between small-scale producers and consumers with a fair price based on cost of production.

Inspection and Accreditation	Annual inspection by a Fair Trade inspector.	Accompanying visits which are less extensive than those documented in an agency. In case the clients do not meet the standard, it receives information and recommendations.
Communication and Promotion	One of the strongest efforts by the organization is to provide its customers with information about Fairtrade by campaigns, media, among other.	The legal basis has been published in 2013 in the Official Diary of Federation. SAGARPA has a extensions program that promotes this certification
Traceability Chain of Custody	Physical traceability at each state of production and processing	The producer most keeps record of their activities in a work diary.
Addresses all Actors in the Chain	Yes, all the members should be registered with Fairtrade.	Yes, all the members should be registered with POC
Price Differential to Farmers	Minimum price	Based on production costs
Some limits for admission	Farmers should be organized democratically to get a Fairtrade organization.	Periods of conversion, lack of participation of people.
Type of participation	Collective	Individual/collective
Environmental issues management		
Ecosystem conservation	√	√
Waste Management	√	√
Soil Management	√	√
Water Management	√	√
Production and Commercialization Regulations		
Use of fertilizes and GMO	Some chemicals are allowed. GMO are forbidden	Chemical products and GMO are forbidden
Commercialization and trade specification	Farmers receive a guaranteed price known as a Fairtrade Minimum Price (FMP). They manage long term contracts and credit advances.	Trade most be performed directly by the producers. Price definition is based on cost of production.
Labor policy		
Discrimination	√	√
Child labor	√	√
Collective organization	√	√
Labor justice	√	√

Fair wages	√	√
Forced labor	√	√
Dissemination of relevant information	x	√
Health		
Health of workers	x	Not considered
Labor health	√	Not considered
Education		
Training in productive area	√	√
Education in no-productive areas	x	x
Social aspect regulations		
Social development	√	√
Democracy	√	√
Transparency and participation	√	√

Source: Own elaboration with data obtained from (Raynolds et al., 2007; Kline, 2009, Nelson et al, 2010).

2.3. COFFEE PRODUCION SYSTEM.

2.3.1 COFFEE DEFINITION

According to the Mexican Law (NMX-F-586-SCFI-2008, 2008), the term coffee refers to the fruit and the seeds of the *Coffea* genus plant, as well as the cultivated species and the products of these fruits and seeds intended for human consumption. This includes: cherry coffee, parchment coffee, green coffee, polished coffee, decaffeinated coffee, roasted coffee, extract of coffee, soluble coffee, drinkable coffee (See the definition in the glossary).

The Scientific classification is:

Table 5. Scientific classification for Coffee

Kingdom:	**Plantae**
Class	Equisetopsida
Order:	Gentianales
Family:	Rubiaceae
Subfamily:	Ixoroideae
Tribe:	Coffeeae
Genus:	Coffea
Species:	*C. arabica, canophera*

Source: (Berthaud, 1985)

Currently there is an estimate of 124 species of *Coffea*, but only two are the main commercial species: *Coffea arabica* and *Coffea canophera* (commonly known as Robusta), representing the 99% of the world's production. These plants, originally from Ethiopia and West Africa, have differences in their botanic and chemical properties (Moldvaer, 2015). Arabica has generally better taste qualities that are affected by multiple factors including growing and processing. The term Mild Arabicas and Colombia Arabicas refers to coffee produced by the wet method and unwashed Arabicas by the dry method. Each producing country belongs to a one of these classifications: Colombian Mild Arabicas, Other Mild Arabicas, Brazilian Natural Arabicas, Robustas. Mexican coffee belongs to the Other Milds Arabicas (ICO, 1994)

On the other hand, Robusta exhibits higher yields and pest resistance. Despite the fact Robusta is not recognized for its taste, it is highly used for blends. This plant grows better in drier weather compared to Arabica (AMECAFÉ, 2012).

2.3.2.1 Classification of coffee according to the altitude:

Coffee can be classified by the altitude where it is produced. According to the Mexican Law (NMX-F-551-SCF1-2008, 2009)**,** coffee is classified in this manner:

Strictly High (> 1200 m.a.l.s)

High (>900 to 1200 m.a.l.s)

Extra Premium Washed (800 to 900 m.a.l.s)

Good washed (250 a 600 m.a.l.s)

Each of these have a sensory profile defined in the law.

2.3.2.2 Classification according to the coffee process method

Coffee can be also classified depending on the way it is processed. According to the Mexican Law (NMX-F-551-SCF1-2008, 2009), coffee is classified this manner:

Natural: refers to Arabica coffee beans derived from the dry process, from which dried cherries are obtained. (Known in Spanish as Bola or Chibola and after been hulled, it is shelled, it is called green coffee)

Semi-washed coffee: it refers to coffee where the dry mucilage remains attached to parchment.

Washed coffee: the method is applied where the mucilage is removed by the wet process.

Soft Coffee: it refers to a washed Arabica coffee.

Wasted Robusta: Robusta coffee obtained in the wet process.

Natural Robusta: Robusta coffee that comes from the dry coffee process.

2.3.2.3 Climatic and physical conditions of growing

Coffea is considered one of the most sensitive agricultural commodities that grow under specific conditions. Arabica and Robusta require different climatic conditions (Moldvaer, 2015) (See table 6). In terms of **temperature**, when it drops less than 10 °C, the leaves stop growing and the plant suffers from chlorosis. The **Altitude** is an important factor that determinates the density of the bean, oil content, pH and acidity, organoleptic acidity and bitterness (Buenaventura-Serrano & Castaño-Castrillón, 2002). **Annual values of rain** can affect the growth and/or productivity of the plant. High precipitation could saturate the soil and therefore affect the roots system development, producing damages on the plant physiology and spreading diseases. On the contrary, water deficits can cause damages in the productivity of the plant by promoting defoliation and cellular death. **Relative humidity** (RH) is an important factor affecting coffee plants efficiency. Higher than 85% of RH promotes fungi diseases, while low RH induces drying of the plant cell (Buenaventura-Serrano & Castaño-Castrillón, 2002; Cenicafé, 2002).

Table 6. Climatic conditions for Coffee growing

	Robusta	Arabica
Temperature	20 to 30 °C	15 to 25 °C
Altitude	0-900 m.a.l.s	900-2000 m.al.s
Annual values of rain	2000-3000 mm	1500-2500 mm

Source: (Moldvaer, 2015)

2.3.2 CULTIVATION, HARVESTING AND PROCESSING OF COFFEE

2.3.2.1 Cultivation

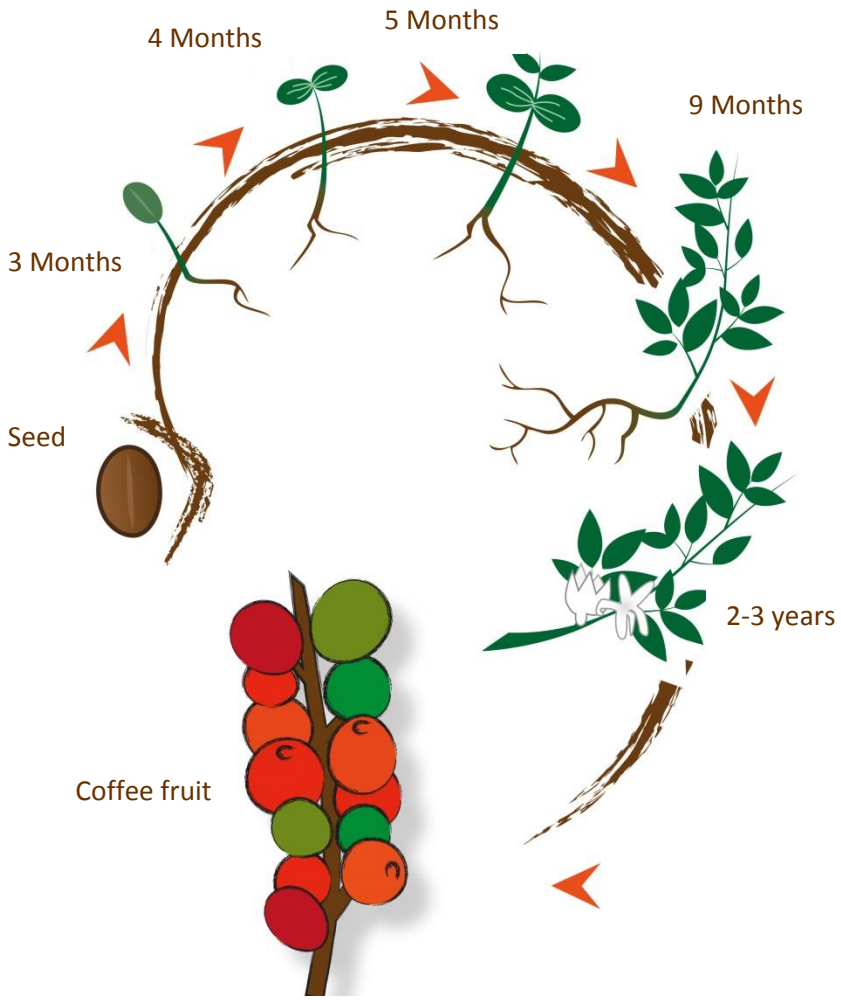

Figure 4. Coffee biological cycle

Source: Own elaboration with information obtained from Moldvaer, 2015.

Arabica coffee is planted by seeds selected from the mother tree (parchment). Coffee seedlings grow in nursery beds or poly bags and are planted in the field when they reach between 20-40 cm in 9 months. Once the coffee is planted, it takes two to three years to produce fruits. Once it is planted in the field, approximately 6-8 weeks after being fertilized, the ovaries develop into drupes in a period of 15 weeks after flowering. The cherries ripen in the branch until they are harvested (See Fig. 4). Arabica trees blossoms following a rainfall period, growing in places with marked seasons of rain (Moldvaer, 2015).

2.3.2.2 Harvesting and processing

The processing of coffee started in the harvesting time, which varies depending on the region. Ripe cherries can be harvested manually or using a harvesting machine. In Mexico, the coffee harvesting is manual, called picking. The cherries are colleted one by one by farmers and/or external workers. Some countries harvest once a year and other biannual (Moldvaer, 2015). In Mexico, 80% of the coffee is harvested annually, between December and March (SIAP, 2014a), specifically in the dry season when the cherries are mature. The idea is to selectively pick ripe cherries and leave the unripe cherries for later harvest. A healthy coffee tree could produce from 1-5 kg of cherries, when it is well treated. Before 24 hours, cherries must be processed in order to preserve the quality of the fruit. Farmers can process the cherry either using their machinery (when it is available) or take it to a "***beneficio***"[8]. (Moldvaer, 2015)

Two main processes are been identified, and despite their own singularities, its common goal is to produce green coffee by a dry process or a wet process. During the coffee process, the main layers of the bean (called grain once it's processed) are removed (See figure 5).

- **Dry Method.** Once the cherry is harvested, it goes to the drying process either by the combine effect of sunlight and aeration or drying machine to obtain what is called the dried coffee cherry. Subsequently, the hulling process removes the entire dried husk to obtain green coffee and finally the beans are classify by shape, size, mass and color and, sometimes, the grains receive a polishing treatment to remove the silver film.
- **Wet Method.** The wet process is a more complex treatment that produces better quality grains. It begins when the cherries are washed in tanks and subsequently sent to the pulping machine to remove the pericarp leaving the mucilage. The mucilage is removed through a fermentation process to finally obtain parchment coffee, after being dried to obtain 12% of moisture (Moldvaer, 2015).

Here the most important steps of the wet process:

a. **Fermentation process**: the grains are poured in tanks to induce the digestion of the mesocarp attached to the parchment by aerobic and anaerobic bacteria allowing its removal by washing.

[8] A ***beneficio*** is a Spanish word that means profit or benefits and in the coffee area it refers to a local or space where farmers bring their ripe cherries for processing.

b. **Washing:** technical operation with water used to remove all the rest of mesocarp and mucilage.

c. **Hulling:** the mechanical process to remove the parchment layer (hulk) from the wet processed coffee.

d. **Polishing:** mechanical operation used to remove the silver film (epidermis of the bean) in green coffee.

e. **Classification**: technological operation used to remove foreign matter (See glossary), fragments of coffee and defective beans from green coffee and to separate healthy coffee beans according to their shape, size and weight.

f. **Toasting, Roasting:** correspond to the heat treatment that produces fundamental physical and chemical changes in the structure and composition of green coffee, developing the characteristic aroma and flavor of roasted coffee.

g. **Milling**: mechanical operation used to fragment the roasted coffee beans, which results in ground coffee

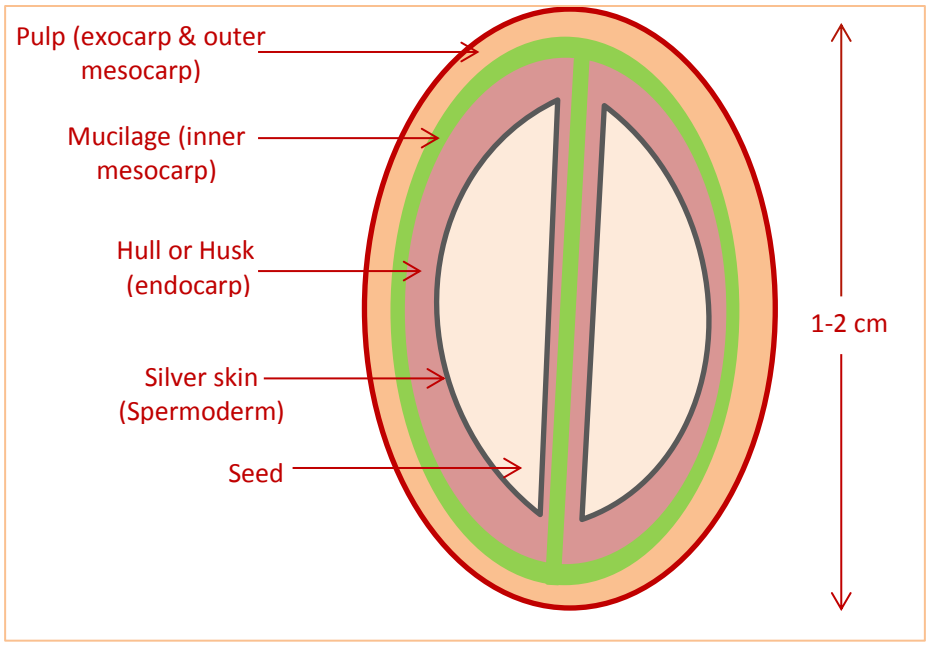

Figure 5. Parts of the coffee fruit (undried)

Part of the coffee fruit (undried), according to the Mexican law (NMX-F-551-SCF1-2008, 2009)

Cherry coffee: Fresh and complete fruit of the coffee tree.

Pulp: part of the cherry composed by the pericarp (exterior skin) and outer part of mesocarp. It is remove through the coffee pulping process and fermentation process.

Mucilage: correspond to the inner mesocarp.

Parchment (Hull or Husk): corresponding to the endocarp of the fruit.

Spermoderm: also refer to the silver skin of the seeds.

Parts of the coffee fruit (dried) according to the Mexican law (NMX-F-551-SCF1-2008, 2009)

Dried coffee cherry: dried fruit of the coffee tree that still have the pericarp and two or one grain.

It is known locally as: *bola* or *capulín*.

Shell: external cover (pericarp) of the dried coffee fruit.

Parchment bean: coffee bean covered totally of partially in its own endocarp.

Dry Parchment: dry endocarp of the coffee fruit, with acceptable range of humidity

Spermoderm: skin that cover the coffee bean; dry cover of the seed.

Coffee bean: commercial term for dry seeds of the coffee plant.

CHAPTER III: METHODOLOGY

3.1 RESEARCH DESIGN

The research study was conducted in three general phases described in the following figure:

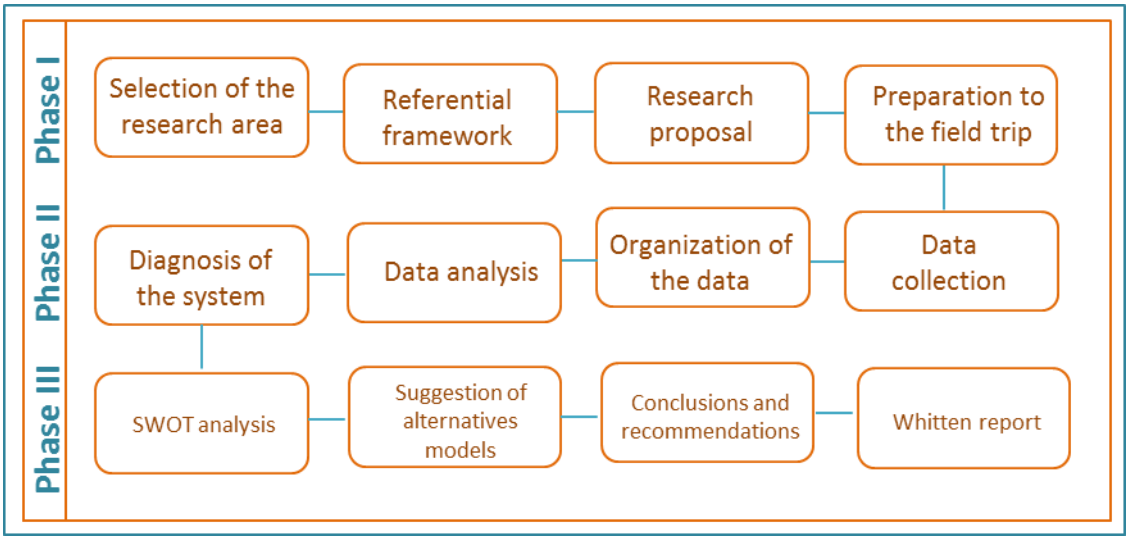

Figure 6. Research diagram
Source: Elaborated by the Author

Phase I started in July 2015 when the first approach with the community was done in association with The Coffee Council of Tamazunchale (CCT) (from the Spanish: "*El Consejo del Café, Tamazunchale*"), which was a strategic institution aimed to get in contact with the farmers of the Municipality and other important stakeholders. In this phase, the study area was chosen. Phase II took place between March and April, 2016, when the data was collected during the field trip in San Luis Potosí, Veracruz and Chiapas in order to have the necessary information to do the diagnosis and the alternative models assessment.

In the third phase, the strengths and weaknesses of the systems were identified in order to propose possible changes and adaptations of the system considering the regional models visited in the state of Chiapas, Veracruz and including San Luis Potosi. Finally conclusions and recommendations were given.

3.2 METHODS

The methodology for this research study was divided into four phases:

3.2.1 PHASE I. INITIAL DIAGNOSIS.

The main objective of a farming diagnosis is to identify clue elements that determine farmers' decisions and the *modus operandi* in a certain region (Apollin & Eberhart, 1999). To achieve this, in this first phase, the coffee production system and the inherent subsystems were described and characterized in order to understand the operation of it through a systemic approach. This type of methodology is based on the analysis of the whole system considering the interrelations between the elements that constitute it. In contrast to an analytic approach where the elements are characterized in a descriptive way, the systematic approach seeks to relate all the elements of the system in order to understand the complexity of it.

The methodology implemented was based on the methodological guide: "Analysis and diagnosis of the production systems in rural areas" by Frédéric Apollin and Christophe Eberhart, 1999. As the methodological guide proposes, the system should be characterized considering all the elements in a hierarchy as it is explained in the figure 7: from the general (for example the international context) to the more specific level (farmers' organization system). The study sought to understand the reality of each level and the way they are interconnected and how this influenced the coffee production system.

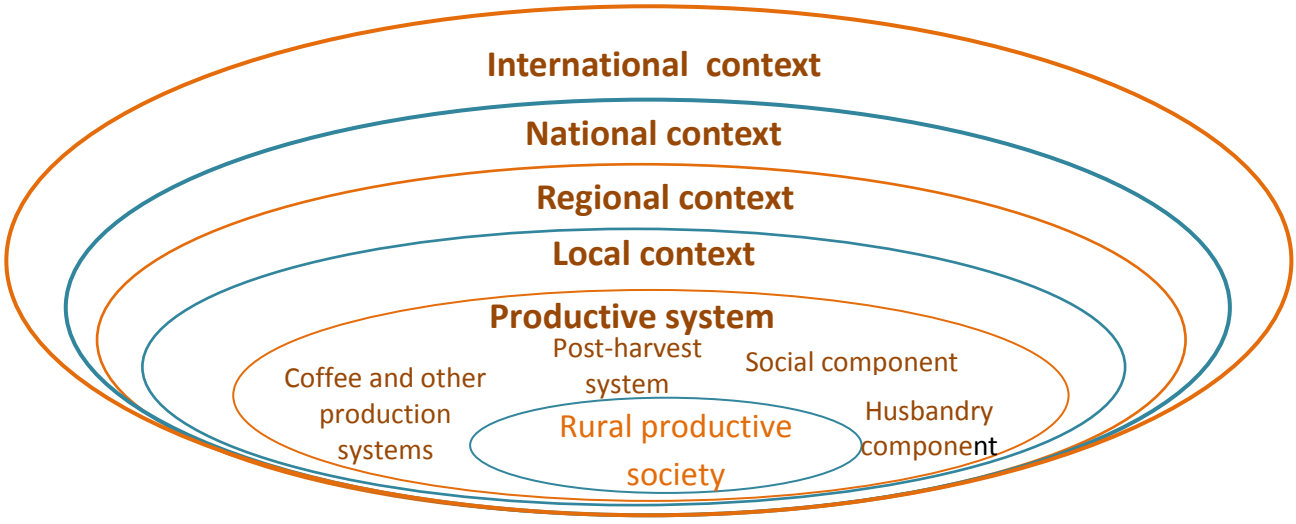

Figure 7.Diagram of the different levels of study of an agrarian diagnostic

Source: Own creation based on Apollin & Eberhart, 1999 and own analysis.

3.2.1.1 International context

In this domain, the main features on the international context that affect the coffee production systems are identified. This section is focused on the elements that fix the coffee prices, the elasticity of the demand and current coffee market status.

3.2.1.2 National, regional and local context

The national and regional analysis considers the following: coffee production in the Municipality, institutions that support small-scale farmers in Mexico. Additionally this dimension includes a general definition of the geographical and environmental condition of the area of the Municipality of Tamazunchale, making emphasis in the community of San Francisco.

3.2.1.3 Productive system

With the purpose to comprehend the coffee production in the community of San Francisco focused on a rural productive society, it is necessary to analyze the whole context. The isolate study of the crop coffee systems is not satisfactory to understand the logic of the decision making, the practices used by the farmers and many other factors that finally define the productive system. Considering the previous, the productive system will be divided into five sub-systems:

3.2.1.4.1 Coffee productive system: it is defined as the management of parcels dedicated mainly to coffee production. It is relevant the analysis of traditional practices used by small-scale farmers. The assessment will include the following:

- Environmental Conditions
- Pest management
- Use of pesticide and other hazardous chemicals products
- Soil management
- Water management
- Waste management
- Biodiversity – Coffee varieties.
- Instruments of production
- Exploited land (farmland, the conditions of access to irrigation water, plantations, terraces, creation of a humus layer, ode of land tenure of the different exploited lands, extension of the land).
- Working modalities of exchange
- Work calendar

- Other crop systems

3.2.1.4.2 Postharvest system: it includes:

- The coffee processing assessment, the use of wet and/or dry processing, techniques, instruments and periods of harvesting, among others.
- The general description of organoleptic characteristics of the coffee produced by the RPS, by the Barista Julieta Vázquez Rivera.
- The coffee prices managed and description of the main markets.

3.2.1.4.3 Non-agricultural activities: it is defined as all the alternative activities besides coffee production that the farmers develop in order to improve their economic stability. This includes: small business, handcrafts, jobs in the city, laborer and household. The following information was gathered:

- Type of activity and members of the family involved.
- Destiny of the income generated and management of the money within the family members.
- Competition problems with the agricultural activity.

3.2.1.4.4 Husbandry System: it includes any breeding activity developed by the farmers.

3.2.1.4.5 Social component: it defines the social component of the system and its structure. For that, a wide household socioeconomic survey was done, based on the following information: age, sex and origin, level of education; the family member that participate in the productive process, home and land ownership, workforce.

3.2.1.4 Rural Productive Society.

The study was focused on a Rural Production Society (RPS) called "La Flor de Café de la Sierra Alta de San Francisco" (FCSASF) located in the community of San Francisco, Tamazunchale. In total, 13 members of this society, included the legal representative, were interviewed in order to have a general understanding of the current status of the Society, the coffee production and the post-harvesting.

3.2.1.4.1 Organizational level.

The current organizational status of the FCSASF Society was assessed using the diagnostic tool called "*Self-diagnosis guide for Economic Organizations*" by SAGARPA (2008). Through the implementation of this instrument, it is possible to have a broad understanding of the

organizational level status of any Rural Economic Organization (REO) and identify areas of improvement. The method consists on the implementation of a self-diagnosis instrument (Annex A) that identified the strengths, weaknesses and shortcomings in the following levels:

- **Institutional level**: (institutional life and government)

Objective: determine the development level of the organization according to the compliance of the legal framework of the society and the organic structure.

- **Administrative level**: (Material resources, human capital and controls)

Objective: verify the efficiency of the organization in terms of the use of human and material resources and implementation of internal controls.

- **Financial level**: (profitability and investment management)

Objective: identify the profitability and solvency of the organization in terms of its operation, planning and control.

- **Business level**: (Business plan and projection)

Objective: verify whether the REO counts whit a business plan or other instruments that allows them to achieve their commercialization goals, as well as promoting their competitive participation in the market.

- **Operational level**: (Membership services and development)

Objective: identify the actions that the organization takes to offer a better service to their memberships, considering that they are its reason for existing.

3.2.2 PHASE II. SUSTAINABILITY ANALYSIS OF THE COFFE FARM SYSTEMS.

In order to measure how sustainable a farm is, indicators have been developed. One of the most important is the index proposed by Altieri and Nicholls, 2002. This methodology assesses the sustainability of agricultural systems based on the soil quality and the health state of the crop. However, this approach does not include the social dimension, a fundamental element to be considered in the definition of sustainability. In the year of 2015, Marquez & Julca presented an index to assess the sustainability in the specific case of coffee farms. The methodology is divided into three main categories: social, economic and environmental. It is integrated by sub indicators that have been deliberately selected based on the components that a sustainable farm must meet. This index is an adoption of other methodologies proposed by Sarandon, 2006.

In the current study, the sustainability of the productive system of a group of 13 farmer members of the FCSASF Society was assessed by using this index. The index is classified in three dimensions:

economic, social and environmental. Each of them is divided into indicators and sub indicators. The variables used to assess each dimension received a value between 0 (less sustainable) and 4 (more sustainable), a scale recommended by the Authors. It is important to mention that some variables were adapted to the study context (Refer to Annex B to see the detailed information of each indicator).

3.2.2.1 Dimension

3.2.2.1.1 Analysis of the economic dimension

This dimension is composed by the following indicators:

a) Farm profitability:

- *Productivity*
- *Physical quality of the coffee*

b) Net monthly income

c) Economic risks:

- *Sale diversification*
- *Dependency on external supplies*

Economic indicator (EcI):

$$EcI = \frac{2(\frac{a1 + a2}{2}) + b + (c1 + c2)/2}{4}$$

3.2.2.1.2 ***Analysis of the environmental dimension***

This dimension is composed by the following indicators:

a) Soil conservation:

- *Vegetable cover management.*
- *Crops diversification*:

b) Erosion risk:

- *Vegetation cover:*
- *Soil conservation:*

c) **Biodiversity management:**

- *Vegetable diversity.*
- *Conservation areas*

Environmental indicator (EnI)

$$\mathrm{EnI} = \frac{\frac{(a1 + a2)}{2} + \frac{(b1 + 2b2)}{3} + \frac{(c1 + c2)}{2}}{3}$$

3.2.2.1.3 Analysis of the social dimension

This dimension is composed by the following indicators:

a) Satisfactions of basics needs

- Access to education
- Access to health and coverage health
- Services

b) Social integration:

c) Technical knowledge and ecological awareness

Social indicator (SI)

$$SI = \frac{2\left(\frac{(\mathrm{a1} + \mathrm{a2} + \mathrm{a3})}{3}\right) + b + c}{4}$$

3.2.2.1.4 General sustainability index (GSI)

To assess the sustainability of the coffee farms, social, environmental and economic variables were considered. For that, the three dimensions receive the same value. A sustainable farm should get a GSI index higher than 2, and none of the three dimensions most have a score lower than 2.

General sustainability index (GSI) equation:

$$GSI = \frac{(\mathrm{EcI} + \mathrm{EnI} + SI)}{3}$$

3.2.3 PHASE III. IDENTIFICATION OF THE CRITICAL POINTS

Once the system has been described, the main critical points were identified through the application of a SWOT analysis (Strength, Weaknesses, Opportunities and Threats), using the methodology presents by Ramírez- Rojas, 2002.

The strengths and weaknesses are related to the internal factors of the systems. In this case, it is related to the FCSASF Society which includes the coffee production and processing. Opportunities and Threats are external factors over which the organization has no control.

Strengths: refers to those elements and/or factors that are under its control, maintains a high level of performance, generating advantages or benefits in the present and probably in the future.

Weaknesses: It means a deficiency or lack; something of what the organization has low levels of performance and therefore is vulnerable. This could represent a potential obstacle.

Opportunities: These are external circumstances that are potentially favorable for the organization.

Threats: These are external factors that results in adverse circumstances that threaten the achievement of the organization's goals.

In this phase, the tipping points affecting the whole systems were identified in order to present suitable alternatives considering this diagnosis.

3.2.4 PHASE IV. PROPOSAL OF COFFEE SUSTAINABLE ALTERNATIVES

After the system was diagnosed and the strengths, threats, opportunities and weaknesses have been identified, the viability of different alternatives scenarios has been presented.

The alternative considered are based on different successful cases in which small-scale farmers in Mexico have developed more sustainable systems. Three alternatives were considered and the viability of implementation was assessed based on the diagnosis.

- Certification models and alterative markets: In this case, only two models of certifications were considered*: Fairtrade* and *Participatory Organic Certification*.

In order to evaluate the viability of these models in the study area, the questionnaires in the diagnosis phase included the information required in each certification model standard.

In the case of Fairtrade certification, the following guideline was used:

- Fairtrade Standard for Coffee for Small Producer Organizations. Version 2011 and the Fairtrade Standard for small-scale farmers. Version 2011.

In the case of the POC, the following guidelines were used:

- Initial inspection questionnaire for participatory organic agricultural production units, *(Cuestionario inicial para inspección participativa orgánica de unidades de producción agrícolas*)
- Technical guidelines for organic farming operation. Mexican Network of Organic Markets Tianguis and AC. version 2010. (*Lineamientos técnicos para la operación orgánica agropecuaria. Red Mexicana de Tianguis y Mercados Orgánicos AC. Version 2010*) (Gómez-Cruz et al., 2010).

Beside the standards verification, independent and organized farmers in Mexico holding this type of certifications were visited in order to gather information regarding the benefits of each the program, perception of farmers, *modus operandi*, among other relevant data. For that, two strategic visits were done: one in the Municipality of Aquismon, San Luis Potosi to interview farmers with a POC; the second one took place in the OCOZACA Cooperative located in the community of Zacamitla, Ixhuatlan del café Municipality, Veracruz, a cooperative that has a Fairtrade certification. In the first case, it was interviewed an independent farmer, while in the second case a total of 7 farmers out of 24 farmer that constitute the organization were interviewed as well as one of the coordinators of the cooperative.

- Diversified systems: coffee systems with a diversified management of activities were analyzed in two different study cases: one in the Municipality of Oxchuc, Chiapas, in the MUKEMAL Cooperative, and the other one in the Finca Sustentable de café "La Herradura" (Sustainable coffee farm "La Herradura") located in the city of Xalapa, Veracruz. The first model corresponds to a system managed by a group of small-scale farmers while the other corresponds to a private initiative managed by a single family. In both, the level of management and the practices that farmer used in order to have a more sustainable model were identified.

- Specialty coffee: this alternative was not considered at the beginning of the study.

However, during the field trip it was recognized that smallholders are moving into this market niche in order to improve their socioeconomic situation. The information was assessed in the Sustainable coffee farm "La Herradura" located in the city of Xalapa, Veracruz, since they are Specialty Coffee producers.

3.3 SAMPLING:

3.3.1 SELECTION OF THE STUDY AREA

The focus area was the RPS "La flor de la Montana Alta de San Francisco" (FCSASF), a society formed by 133 farmer members of the community of San Francisco. This specific society was chosen as the study area since it was an already established organization, a requirement that represents an advantage for coffee farmers. In addition, the pre-established relationships with stakeholders of the community as well as the favorable climatic conditions for coffee production were determinants factors in this decision.

The decision was also consulted with experts of the CCT and members of the cooperative, who willingly agreed to cooperate. The final number of farmers interviewed was 13.

3.3.2 SELECTION OF THE STAKEHOLDERS

To understand the whole context of the unit of study, strategic stakeholders were identified, with the help of the CCT and with students that have had previously conducted research in the coffee field in the same community. During the first visit in 2015, main actors were identified, with whom it was agreed to carry out the interviews and questionnaires.

For the phase III, different sustainable alternatives were analyzed. The contacts with these different groups of producers were done through networking and contacts provided by the thesis committee. For this purpose, the groups where previously contacted by email and/or phone in other to have their approval and to set an appointment for the visits.

The table 7 presents the sampling of stakeholders considered for this research study and the information obtained from them:

Table 7.Stakeholders selected for the sampling

Sample	Location	Type of data	Methodology implemented
Farmers in the cooperative FCSASF N=13	San Francisco SLP. Mexico	Technical socioeconomic.	Questionnaires, observation, free conservations.
Independent farmers N=2	San Francisco SLP. Mexico	Technical socioeconomic	Questionnaires, observation, free conservation
President of the FCSASF Cooperative N=1	San Francisco SLP. Mexico	Organizational	Questionnaires, interview, implementation of a diagnostic tool.
Public Institution Technical staff			Interviews and

N=2 **Coordination staff** N=1	San Francisco SLP. Mexico	Technical and organizational	questionnaires.
Commercial coffee store (middleman) N=1	San Francisco SLP. Mexico	Commercial sector	Interviews and questionnaires
Coordinator of of POC N=1	San Luis Potosi	Technical, POC expert	Interviews and questionnaires
Farmer with POC	San Luis Potosi, Aquismon	Technical POC	Questionnaires
Representative of the OCOZACA Cooperative N=1	Veracruz Zacamitla, Municipio de Ixhuatlan del café	Organizational	Interview and free conversation
Farmers of the OCOZACA Cooperative N=7	Veracruz Zacamitla, Municipio de Ixhuatlan del café	Technical Fairtrade	Questionnaires, observation, free conservation
Coordinator of CLAC in Latin-American N=1	Veracruz Zacamitla, Municipio de Ixhuatlan del café	Technical, Fairtrade expert	Interview
Coordinador of Finca La Herradura N=1	Veracruz Xalapa	Technical, Diversify systems and Specialty coffee	Questionnaires, observation, free conservation
Representative of the MUKEMAL Cooperative N=3	Chiapas Oxchuc	Technical, Diversify systems	Questionnaires, observation, free conservation

Source: Own creation based on the requirement established in the methodology.

The samples were taken according to: people interested in participating in the study; mobility; time and accessibility to the farmers' home (many of them live in remote places separated one from each other). In the case of the FCSASF Society, many of the members are advance in years, therefore it was difficult for them to participate in the study. Additionaly, some data wasn't possible to gather since many of the farmers didn't manage the information on time. In that case, secundary sources were used to obtain the data. However, in general terms, all the stakeholders were open to participate and willing to cooperate with the research.

3.3.3 TOOLS AND INSTRUMENTS

The required data was gathered through different strategies presented below:

Secondary data: scientific papers, database, international organization, national and international reports and statistics databases were consulted in order to describe the international, national and regional context.

Observation: many of the qualitative data require for the study was gathered through notes taken on the field in order to understand the general characteristics of the current situation. Workshop and free conversations were important scenarios to understand some elements that are not reflected in the questionnaires.

Semi-structure interviews: this type of tool was used mainly with professional stakeholders and coordinators in order to address a specific topic, leaving space for the interviewee to provide extra information about the topic discussed. This type of tool gave reliable and comparable qualitative data.

Questionnaires: the questionnaires were implemented mainly to gather technical information and socioeconomic data of the farmers in order to comprehend their context and the way coffee has been cultivated, harvested and processed.

It is important to mention that despite the fact that a participatory activity with the FCSASF Society was previously organized, it was not possible to be accomplished. The efforts to convoke members were not successful. Therefore, the information was collected individually through the interviews.

Refer to Annex C for detailed information of the forms.

CHAPTER IV. DIAGNOSIS OF THE COFFEE SYSTEM IN THE FCSASF SOCIETY, COMMUNITY OF SAN FRANCISCO.

4.1 COFFEE IN THE INTERNATIONAL CONTEXT

4.1.1 COFFEE PRODUCTION AND CONSUMPTION

Coffee is produced in areas with specific climatic conditions of temperature, altitude, rain and RH in what is called the Coffee Belt: an imaginary line along the globe in the Equatorial zone located between latitudes 25 degrees North and 30 degrees South, which includes countries in Africa, South America, Central America and Asia (See fig. 8). The World total production is defined by three types of coffee: Soft, Arabica –Brazil and Robusta. Due to their quality, soft coffee is the most sought in the Market (Giovannucci, 2003).

Figure 8. Main coffee producers in the World

Source: Figure obtained from Taringa.net, modified by the Author. Data obtained from ICO,2015.

Typically, coffee has been produced in countries located in the South part of the World and exported to the North, mainly to USA, the European Union and Japan. Currently Brazil is leading the coffee production with volumes that double the second producer, which is Vietnam. In the list,

Mexico occupies the 9th place, with volumes similar to Guatemala and Peru (See Table 8), but the 4TH in organic coffee production (0.7 million of hectares) (FiBL and IFOAM, 2014).

Arabica coffee, the main coffee exported in the World, represents 63% (71.14 million bags) of the total exportation, against the 37% of Robusta coffee (41,26 million bags) (ICO, 2016). Since 2011, coffee consumption in the World has increased in 2.0%, and despite the fact the pattern of consumption is still leaded by the countries located in the North, data obtained in the last 5 years show that coffee consumption has been increasing in producing countries as well (ICO, 2015).

Table 8. Total coffee production of the 10 main exporting countries

Year	Coffee produced 2014	Coffee produced 2015	% Change 2014-2015	% coffee exported 2014-2015
Country				
Brazil	45639	43235	-5.30%	50.1%
Vietnam	26500	27500	3.80%	48%
Colombia	13333	13500	1.30%	51%
Indonesia	11418	12317	7.90%	32.2%
Ethiopia	6625	6400	-3.40%	19.3%
India	5450	5833	7.00%	44.8%
Honduras	5400	5750	6.50%	53.4%
Guatemala	3328	3400	2.20%	40.1%
Mexico	3591	3900	8.60%	35.6%
Peru	2883	3200	11%	34.03%

(In thousand 60kg bags)
Source: Own elaboration with data obtained from (ICO, 2015).

4.1.2 COFFEE MARKET

Coffee is the second most important commodity in the Word, representing an economic activity developed by approximately 25 million of farmers in the World, where 70% of this important product is produced by small-scale families (Brown et al., 2001). The prices of this product is regulated at international levels by four markets: the New York “C” contract market, for Arabica coffee; the London Robusta Coffee future, for Robusta; the coffee market of the Paris Stock Exchange and Future market commodity exchange in Sao Paolo. Due to the volume managed, the two first markets set the standard of the coffee international traders.

In general terms, coffee has a relatively rigid demand. This is a type of demand that is not very sensitive to price changes. However, in extreme cases where coffee prices have changed

dramatically, this has resulted in changes in the demand patterns as well. For example, in 1926-39 a dropped of 35% of the coffee prices, boosted the *per capita* consumption in 20%. Nevertheless, it was an isolated event that do not represents the really of the coffee demand (Hunter, 1959). In general terms, the demand is relatively rigid in front of possible prices fluctuations.

On the other hand, the volatility of prices is one of the main concerns in the coffee industry, especially for small-scale coffee producers which are the last in the supply chain to perceive benefits from this commodity.

As it is shown in the Fig. 9, coffee prices have an unpredictable behavior compare to other commodities such as Tea.

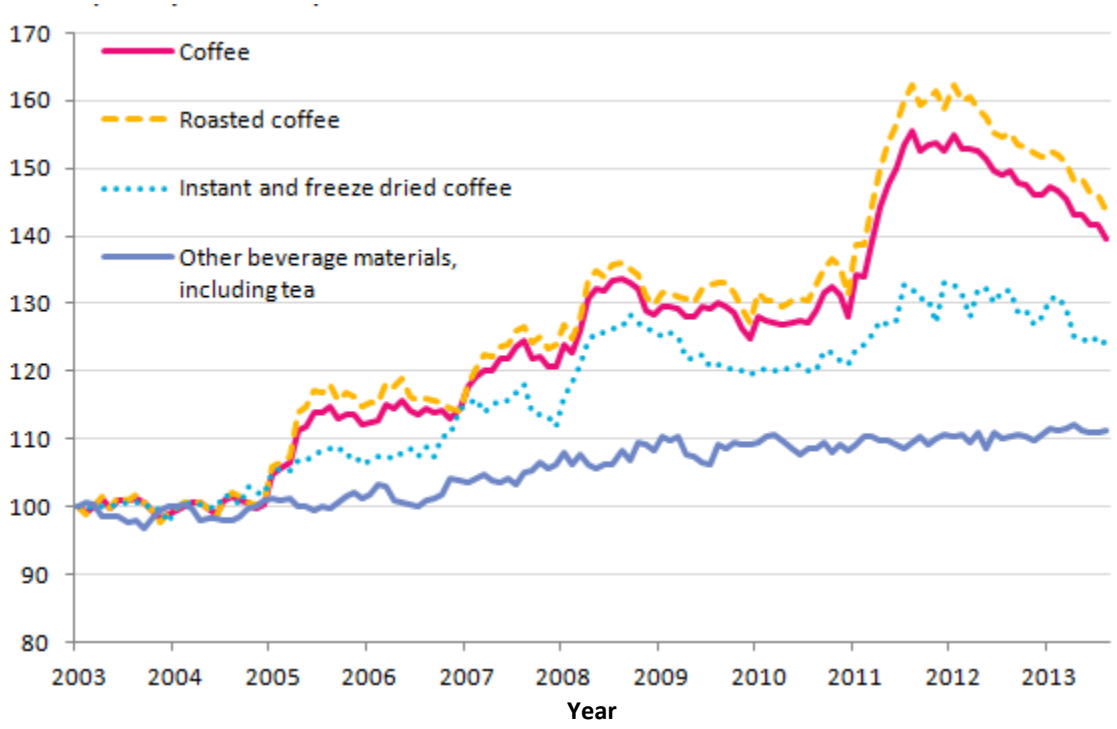

Figure 9. Consumer Price Indexes for coffee and tea, not seasonally adjusted.
Source: (Bureau od Labor Statistics, 2013)

The year of 2003 was considered a devastating year for the coffee industry due to the overproduction of the grain and the collapse of the prices, reaching values of US $ 0.54/pound. As an immediate response, farmers abandoned their plots to migrate to other places or simply stopped cleaning and fertilizing their coffee plots. However, the year 2004 begins with rising coffee prices as a response to the reduction of coffee production in Brazil. From that period of time, coffee prices have tended to rise due to the following aspects:

- Speculation of the investment funds

- Less estimated production in Brazil due to climate changes and substitution of coffee plots for soy.
- Increases in consumption
- Scarcity of Arabic coffees and abundance of Robusta (Ramirez, 2006).

In the year 2015, it was thought that coffee prices would continue to grow due to the coming droughts and the leaf rust attack in Central America, Peru and Mexico. However, the unexpected rains in Brazil improved the coffee production and the devaluation of the Real (the Brazilian currency), against the dollar has encouraged Brazil to export part of their inventories accumulated in the 2012-13 and 2013-14 cycles. As a result, there is a tendency to low prices (Callejas, 2015)(See figure 10).

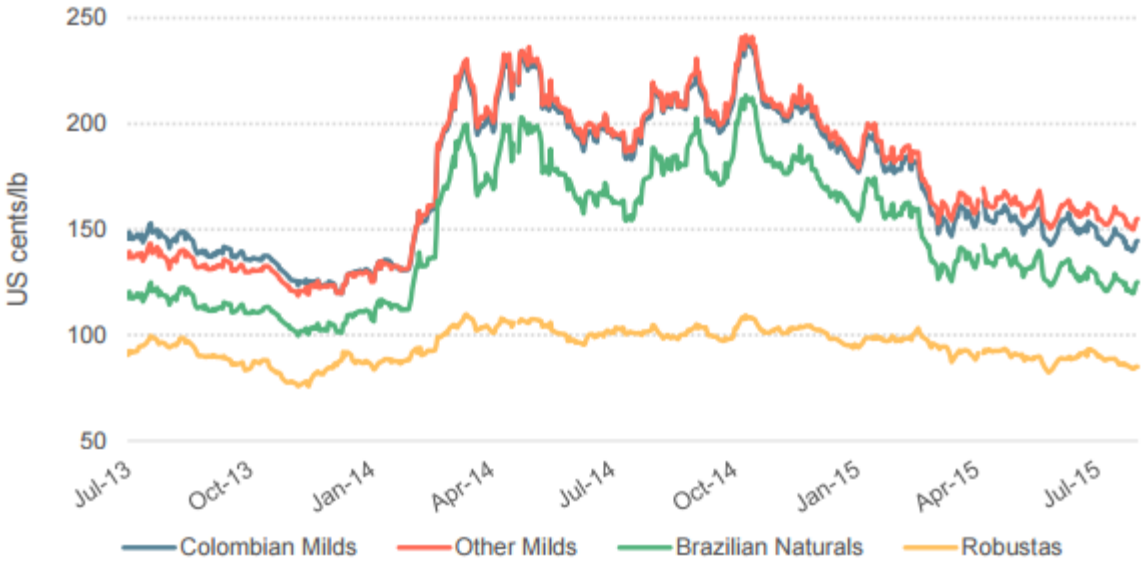

Figure 10. ICO group indicator daily prices of coffee
Source: (ICO, 2015a)

As a result of all those unexpected changes, more frequent after the ICA closed, the volatility of coffee prices has been always an issue for small-scale farmers, who have to deal also with other factors such as environmental changes (Gay et al.,2006), lack of infrastructure and unfair marketing conditions (Pérez-Akaki, 2015; Perales Moreno & Vázquez Mata, 2010).

It is expected that coffee prices are tended to decrease as many other agricultural commodities due to the implementation of new technologies and cost reduction. As a result, the specialization

of the market is becoming a tangible option in order to abandon the market of commodities (non-differentiated) and enter to a more lucrative market (SAGARPA and FAO, 2006).

4.1.1 SUSTAINABILITY IN THE INTERNATIONAL CONTEXT

Coffee production has changed throughout the years and the tendency is to simplify the crop systems. The traditional management of coffee has been abandoned in many countries and substituted by modern management represented by unshaded coffee systems with high inputs, wherein the use of synthetic agrochemicals is a key element to assure high levels of productivity (Guhl, 2008).

Studies have suggested that since 1900, countries such as Colombia, El Salvador, Guatemala, Nicaragua and Costa Rica have reduced their traditional coffee systems (Jha, et al., 2014) giving space to intensified unshaded coffee (Guhl , 2008). However, Mexico is one of the countries that still reports higher percentage of shade coffee managed mainly by small-scale farmers (Moguel & Toledo, 1995). In fact, unshaded coffee in Mexico represents only 5-17% of the total coffee production in the country. Here, small-scale farmers work mainly in rustic or polyculture systems, with little or no use of agrochemical and technology, producing what is called organic passive or natural coffee[9] (Bartra, et al., 2002).

The decision of keeping traditional systems or going towards intensified unshaded systems depends on certain factors that Jah and colleagues (2014) have reviewed in their research study. According to them, the way coffee is produced in a nation is influenced by: the cultural origin; resistance to diseases (mainly to the coffee leaf rust); higher yield purposes; socioeconomic condition of group members and market trends.

The current trend of changing traditional shade systems to highly productive systems such as unshaded coffee raises concern about the environmental impact in terms of biodiversity loss and reduction on ecosystem services (Guhl, 2008). This situation has motivated many conservation

[9] The main difference between “natural” and “organic” lies in the compliance or not of standards that can be verified and recognized internationally. The term organic is used to identify a certified product that follows verified standards, while natural food do not have legal recognition, therefore there are not requirements to be proofed (IFOAM, 2016)

initiatives to start encouraging shade coffee systems in producing countries. However, in order to be adopted by the farmers, economic goals such as premium prices are been established. As a result, conservation-oriented marketing strategy had emerged.

In addition to the environmental damage caused by intensive production models, the high volatility and repeated declining prices of coffee have triggered the development of differentiated markets and adoption of sustainability standards as a mechanism to overcome this situation. In fact, coffee is considered the commodity with more success among the agriculture products involved in the sustainability standards[10] and certifications field (Giovannucci, 2003). In just 20 years, sustainable coffee market has grown as a fully recognized business management tool as it is evidenced in Figure 11 that presents the coffee production under different certification models assessed in a period of 5 years. Here is evident that different certifications have had a better performance from 2011, such as 4C and UTZ, while others have declined such as C.A.F.E practices.

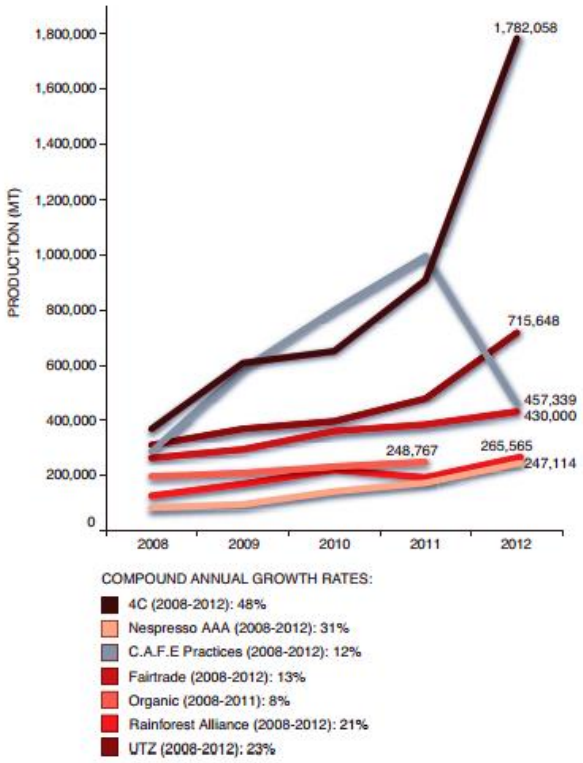

Figure 11. Standard- compliant coffee produced under different certification programs (2008-2012)

Source: (Potts *et al*., 2014)

[10] Even though Sustainability is a broad concept, the majority of the studies and reports refer to this as "certified coffees". However, as was mentioned in chapter II, the definition includes other approaches.

In the year 2012, 40% of the global coffee produced in the World was standard-compliant. It means a coffee that was produced voluntarily under any of the existing certification standards. In the same year, Latin America reached the first place, producing 77% of the sustainable coffee in the World. It is expected that within the next five year, sustainable coffee will reach 50% of the production (Potts et al.,2014). Summarizing, sustainable coffee is a growing business and one of the most successful agriculture products in the market, at least in terms of production and sales.

4.2 COFFEE IN THE NATIONAL, REGIONAL AND LOCAL CONTEXT

4.2.1 COFFEE PRODUCTION IN MEXICO

In Mexico, coffee is cultivated in priority areas for conservation (located in the slopes of the Gulf of Mexico and the Pacific, specifically in the Central and Southern part of the country) (Moguel & Toledo,1999) (See Fig. 12). This activity is developed in strategic ecosystems for conservation: 40% in high and medium forests (humid tropics) 23% in pine and oak forest, 21% in low deciduous forests and 15% in cloud forest (Bartra *et al*., 2003).

Figure 12. Coffee productive areas in Mexico

Table 9. Production data from the main coffee producing states in Mexico for the year 2014

Location	Planted areas	Harvested area	Production	Yield	PMR	Production value
	(Ha)	(Ha)	(Ton)	(Ton/Ha)	($/Ton)	(Thousands of pesos)
Chiapas	260,129.43	254,020.78	402,099.00	1.58	5,074.88	2,040,607.85
Veracruz	146,619.41	138,512.81	353,697.00	2.55	4,507.87	1,594,420.43
Oaxaca	142,117.15	138,422.62	129,781.00	0.94	3,835.43	497,767.15
Puebla	73,201.50	56,145.66	148,900.00	2.65	4,947.34	736,661.79
Guerrero	47,209.00	45,507.50	48,921.00	1.08	6,717.56	328,635.79
Hidalgo	25,500.00	24,749.00	35,229.00	1.42	4,136.78	145,734.50
Nayarit	17,739.03	17,739.03	24,634.00	1.39	6,731.58	165,831.99
San Luis Potosí	**17,006.43**	**16,420.43**	**13,052.00**	**0.8**	**2,273.65**	**29,675.63**
Jalisco	3,624.30	3,564.30	5,399.00	1.52	5,434.74	29,346.37
Colima	2,373.00	2,373.00	2,744.00	1.16	5,462.19	14,989.34
Tabasco	1,040.16	1,040.16	848	0.82	7,513.73	6,376.75
México	479.04	474.04	427	0.9	4,752.23	2,031.24
Querétaro	270	270	135	0.5	8,800.00	1,188.00
Morelos	52	52	94	1.81	4,047.06	381.64
Michoacán	16	16	60	3.75	5,000.00	300
Total	**737,376.45**	**699,307.33**	**1,166,025.82**	**1.67**	**4,797.45**	**5,593,948.47**

Source: Own creation with data obtain in SIAP, 2014b.

The main producing states are summarized in the table 9, been Chiapas, Veracruz and Oaxaca the first on the list. In terms of productivity, there is a notorious difference between the first coffee producing state, which is Chiapas and San Luis Potosí. While the first produces 41.4% of the total national production, San Luis Potosi only 0.3%. It is also notorious the differences in yield. In the state of Chiapas and Veracruz, yields are double and triple, respectively, compare to San Luis Potosi. During the field trip in the state of Chiapas and Veracruz, it was notorious that the whole community was organized around the coffee activity, and many of the economic activities are associated in one way or another with this product. In this sense, key elements might influence the differences of yield:

- Differences in the economic and technical support received by the government (Trader in Taman, Personal Conversation, 2016.04.20)
- Climatic and edaphologic conditions.

- Experience in the industry due to the difference of times since the coffee was developed in each state, which is almost 100 years of differences.
- Better management practices.

In the country, almost 90% of the coffee is produced under shade coffee systems by 280 thousand producers; of which 92% have parcels less than 5 ha and at least 65% belongs to an ethnic group. (Bartra *et al*., 2003). In ecological terms, **shade coffee** is defined as an agroforestry system where coffee is combined with a number of different shade trees that includes fruits, timber, leguminous and other species, providing ecological and economic benefits and ensuring the longevity of the farm (WOCAT, 2007). Based on the management of shade and non-shaded coffee systems and its vegetable complexity level, 5 classification categories have been proposed by Moguel & Toledo (1999); a classification that was developed in Mexico and nowadays is implemented worldwide (Guhl, 2008) (Fig. 13).

Rustic systems are a type of shade coffee crop where the plants growing beneath the forest canopy (understory) is removed, while the original canopy remains. This is considered the system with the lowest input in Mexico and it's located in isolated areas managed mainly by indigenous people (Moguel & Toledo, 1996).

Traditional Polyculture Systems are a type of shade coffee plantation with a most complex vegetables cover and structural elements. It is constituted by the original tree cover along with useful plant species resulting in a "coffee garden" (Moguel & Toledo , 1999). This is consider a more advance systems with a higher level of management.

Commercial polyculture System are characterized by the entire removal of the original forest canopy in order to introduce new species that can provide shade, add nitrogen (N) to the soil and/or add species with commercial value. One of the most common trees used in this kind of system is the *Inga* spp (locally known as Chalahuite, Vainilllo, Junicuile, among other names) (Moguel & Toledo, 1996). This kind of systems are found in the region of Coatepec in Veracruz, where different types of trees are introduce (pepper, cedro, Inga, Plantain) and in some cases chemical subtances are use to improve the yields (Moguel & Toledo, 1996).

In the case where the entire original canopy has been removed and substituted with a unique species (for example, *Inga* spp) we talk about a **Shade Monoculture System**. This type of system was introduced in Mexico by INMECAFÉ in the late seventies where high density of plants per Hectare and massive amount of fertilizers were used. Eventhough the yield increased in a

considerable way (from 7 to 15 quintal/ha), important negative consecuences appeared later on (Bernkopfova, 2014).

Finally comes the **Unshaded Monoculture System** where coffee is cultivated without shade (Moguel & Toledo, 1999), loosing its agro-foresty character.

It has been clearly evidenced that the difference between the systems lies on the vegetable complexity and the use of external inputs. According to previous studies, the highly complex systems provide certain benefits in terms of pollination, pest control, climate regulation that might be affected in more simplified systems (Jha et al., 2014).

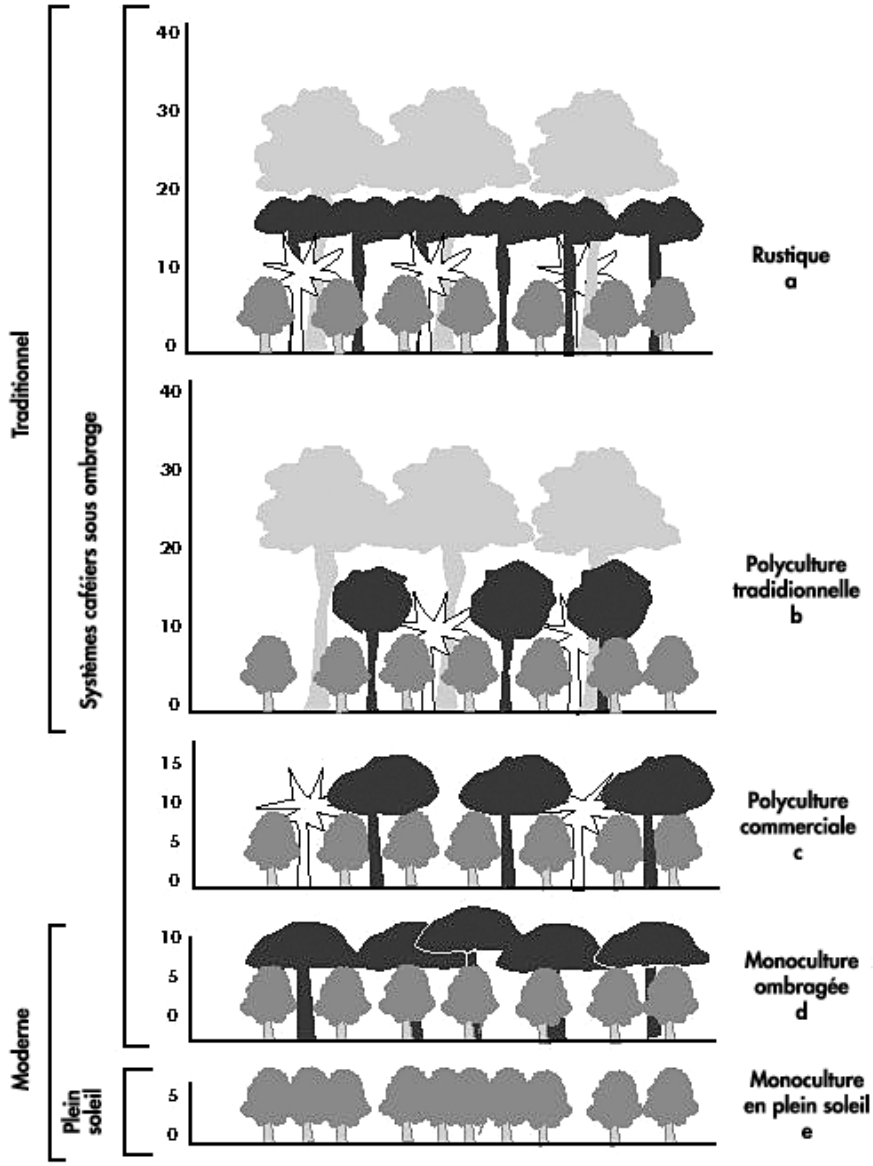

Figure 13. Representing the five major classes of systems coffee plantations in Central America
Source: Mexico (adapted from Moguel and Toledo, 1999).

4.2.2 COFFEE CRISIS IN MEXICO

The year 2016 is considered one of the worst years for coffee production in Mexico. With low coffee production in the cycle 2014-2015 (3 million of bags), which is expected to continue in the cycle 2015-2016 (around 2.4 million of bags), it is probable that the international demand will increased, mainly for low quality coffee. As result, green coffee production is being affected by the low prices in the international market. In combination with the leaf rust disease and the change in weather, coffee production in Mexico has been negatively affected (Barragan, 2016).

In general terms, the coffee industry in Mexico is threatened by:

- Inefficient processing practices
- Lack of knowledge of quality markets by producers
- Little knowledge of the foreign and domestic market management
- Low domestic consumption
- Lack of advertising campaigns to encourages the consumption of quality coffee (AMECAFÉ, 2012).

As a strategy to boost the coffee industry in the international market, the creation of a new INMECAFÉ was announced this year in the Latin American Conference of Coffee, 2016 (*La Cumbre Latinoamericana del Café* 2016). Here, in the Integral Care Plan Coffee (*Plan Integral de Atención al Café*") is established that coffee industry in Mexico will increased up to 4.5 million of bags (of 60kg) in the cycle 2018-2019 with a projection of 10 million of bags in 10 years (Imagen Agropecuaria, 2016).

4.2.3 COFFEE IN SAN LUIS POTOSI

4.2.3.1 General information of the state

Location and size: The state of San Luis Potosi is located in the central part of the country surrounded by 9 states: in the North are the states of Coahuila and Nuevo León; on the northeast, Tamaulipas; on the east, Veracruz; on the south, Hidalgo, Querétaro, and Guanajuato; on the southwest, Jalisco; and on the west, Zacatecas. The state covers an area of 62,849 Km^2

Population: San Luis Potosi counts with a population of 2.410.414 inhabitants (SEDESOL, 2014). 64% urban and 36% rural. From the total, 18.000 people are involved in the coffee production in the state.

Climate conditions: The average annual temperature in the state is 21 ° C, the average minimum temperature is 8.4 ° C presented in January and the average high is around 32 ° C in the months of May. Most rainfall occurs during the summer months from June to September, and the average rainfall is 950 mm/year. In 71% of the territory predominates the dry and semi-dry climate, mainly

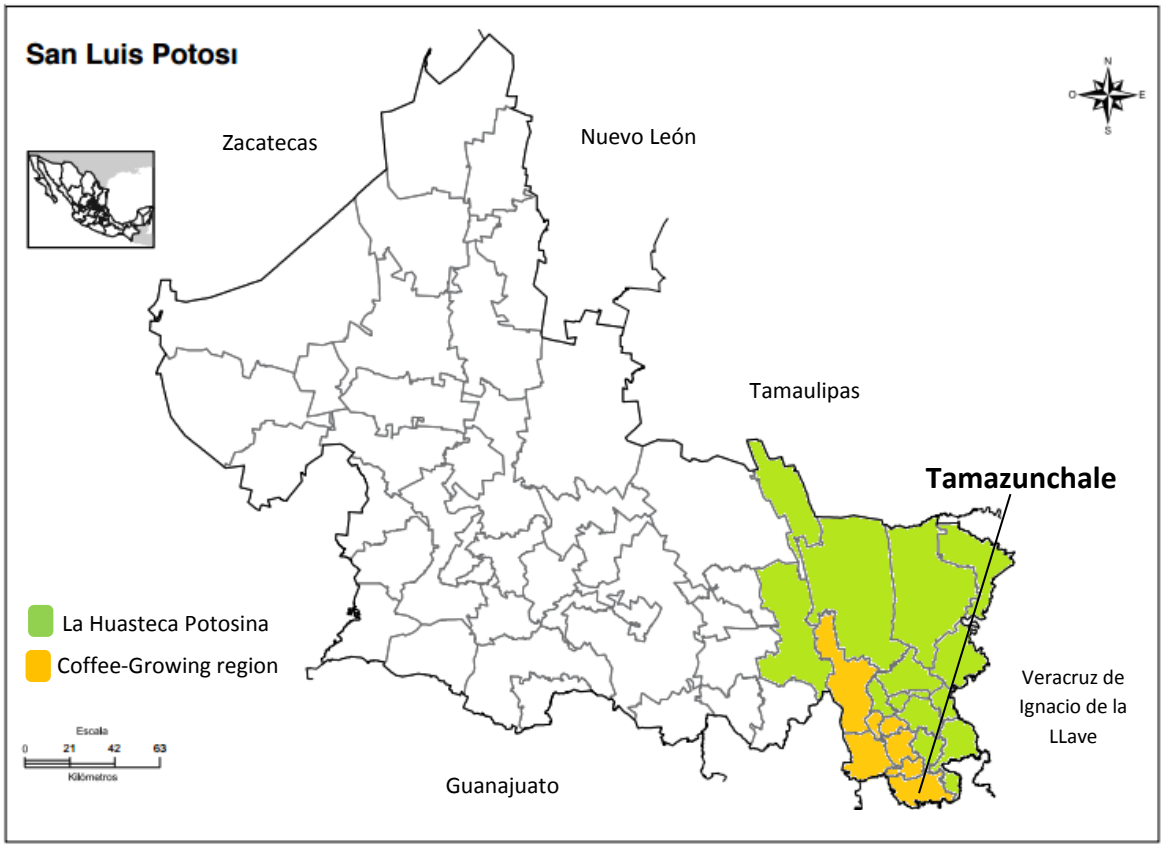

Figure 14. Coffee-growing region of San Luis Potosí
Source: Image modified from (INEGI, 2010).

located in the region known as El Salado while 15% is represented by the warm humid climate, located on the east side of the Sierra Madre Oriental, where the coffee activity takes place. 2.5% is very dry climate located in the "Mesa Central" and 1.5% is temperate humid and is located on the plains that lie between the mountains.

Social condition. In average, the state presents a high level of marginalization including all the coffee producing municipalities (SEDESOL, 2014).

4.2.2.2. Coffee production in the state.

Coffee was introduced in Veracruz, Mexico in 1795 and in 1850 reaches the mountains of San Luis Potosí. Here the first Arabica coffee was planted in the Municipality of Xilitla, that was managed

usually by indigenous communities belonging to the Nahuatl and Tenex ethnicity (Perales Moreno & Vázquez Mata, 2010). From that moment, the coffee-growing region was established in la Huasteca Potosina (See Figure 14). Nowadays, the main coffee producing municipalities are: Xilitla (representing 31% of the total production in the State), Aquismon (30%), Tamazunchale (26%), Coxcatlan (24%), Matlapa (6%), Huehuetlan (1.6%) and Axtla de Terrazas (0,7%) (SIAP, 2014b). The coffee region is located between 100 m.a.l.s and 1400 m.a.l.s of altitude.

In the area, coffee yields are considerably low (0.53 ton/ha) (See table 10) compared to national levels (See table 9).

Table 10. Production of coffee in San Luis Potosi (2014)

State	Distrit	Municipality	Planted area (Ha)	Harvested area (Ha)	Production (Ton)	Yields (Ton/Ha)	PMR ($/Ton)	Production value (Thousand Pesos)
San Luis Potosi	Ciudad Valles	Aquismon	4,898.00	4,842.00	3,922.02	0.81	2,223.01	8,718.69
		Axtla de Terrazas	187.12	187.12	92	0.49	1,937.39	178.24
		Ciudad Valles	132	132	69.96	0.53	1,948.07	136.29
		Coxcatlan	371	371	319.06	0.86	2,164.32	690.55
		Huehuetlan	332.36	332.36	218	0.66	1,872.89	408.29
		Matlapa	1,224.18	1,129.18	895	0.79	2,358.10	2,110.50
		Tamazunchale	**4,045.26**	**3,860.26**	**3,405.00**	**0.88**	**2,180.79**	**7,425.59**
		Tancanhuitz	36	36	30.96	0.86	2,085.69	64.57
		Xilitla	**5,780.51**	**5,530.51**	**4,100.00**	**0.74**	**2,425.10**	**9,942.91**
		Total	17,006.43	16,420.43	13,052.00	0.79	2,273.65	29,675.63

Source: SIAP, 2014b

San Luis Potosi offers only conventional coffee; specialty coffee and sustainable agriculture initiatives are scarce. However, previous diagnosis suggest that the state of San Luis Potosi has the sufficient potential to develop organic coffee, gourmet coffee as well as other non-conventional types of coffee, only if the social, economic and environmental context is established to do so. The study identified the main problems presented in the coffee-growing area, using the Factor of Regional Importance (FRI) (See table 8). They concluded that the high marginalization level of the area is a fundamental component to be considered if sustainable alternative would be implemented (Castillo-Ponce, *et al*.,2011).

Table 11. Priority problems for the state of San Luis Potosi in the coffee sector.

Problems	Priority	Problems	Priority
Lack of technical assistance	1	Renovation	6
Old coffee trees	2	Pests and diseases in coffee trees	7
Lack of organization among farmers	3	Lack of management	8
Climate changes (frosts and droughts)	4	Pest of the *Inga* sp tree	9
Soil erosion	5	Lack of nurseries seedbeds	10

Source: Own elaboration with data obtained from (Castillo-Ponce *et al*., 2011)

4.2.2.3 Local context - Municipality of Tamazunchale

4.2.2.3.1. General information of the Municipality

Tamazunchale is located in the southeastern part of the state, in the Huasteca Potosina located in longitude 98°47'29'' O and latitude 21°15'46'' N (SEGOB, 2010). Its boundaries are: north, Matlapa and Tampacán; east, San Martin Chalchicuautla; south and west, the state of Hidalgo (See Figure 14). Due to its location, Tamazunchale presents uneven reliefs, from mountain (foothills of the Sierra Madre Oriental) to plains. The climate is predominantly semi warm and humid with abundant rainfall in summer. The annual average temperature is 25.50 °C with maximum of 44 °C and minimum of 11 ° C. The annual rainfall is 2168.3 mm.

The locality of San Francisco has 1045 inhabitant (2010) presenting a high level of marginalization and degree of poverty (SEDESOL, 2014).

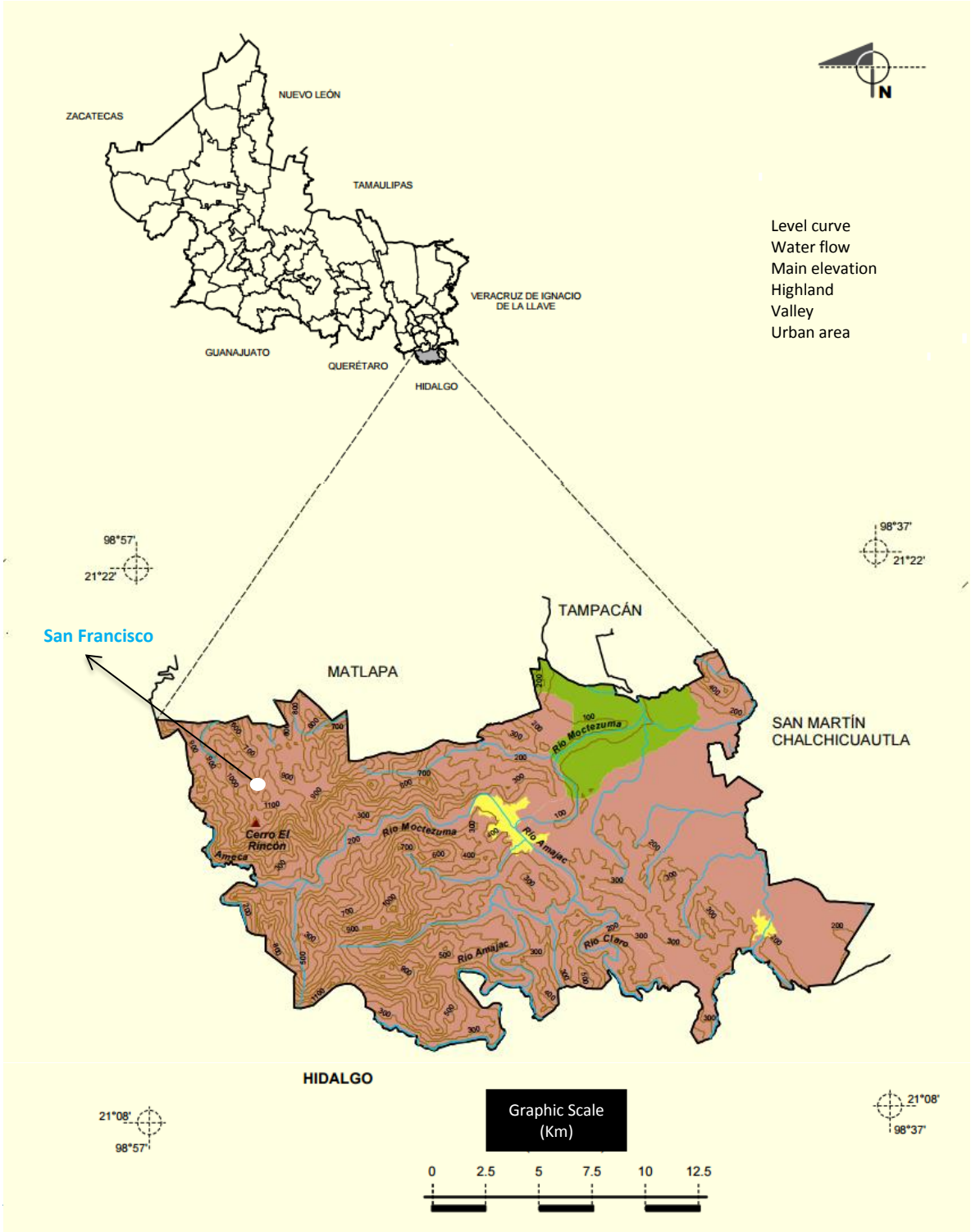

Figure 15. Geographic representation of the Municipality of Tamazunchale

Source:
NEGI. *Marco Geoestadístico Municipal 2005, versión 3.1.*
INEGI. Información Topográfica Digital Escala 1:250 000, serie II.
INEGI. Continuo Nacional del Conjunto de Datos Geográficos de la Carta Fisiográfica 1:1 000 000 serie I.
INEGI-CONAGUA. 2007. Mapa de la Red Hidrográfica Digital de México escala 1:250 000. México.

A diagnostic study made in the municipality of Tamazunchale determined that 76% of the coffee plantations are located in good agro climatic conditions for Arabica production. The table 12 presents the climatic conditions in the specific area of San Francisco.

Table 12. Comparative table of climatic and physical characteristics.

	Robusta	Arabica	Conditions in the Municipality of San Francisco
Temperature	20 to 30 °C	15 to 25 °C	25.5 °C annual average*
Altitude	0-900 m.a.l.s	900-2000 m.al.s	Average between 618 and 1032 m.a.s.l**
Annual values of rain	2000-3000 mm	1500-2500 mm	2183 mm*

Source: Own creation with information obtained from: SIAP,2014; Moldvaer, 2015; Castillo-Ponce et al.,2011)

- Annual average temperature of the Municipality.

** Average of the communities where farmer of the organization have plots (Barrio Progreso, Buena Vista, Camarones, Cerro Grande, El Encimal, El Gavilán, Poxantla, San Francisco and Xinictle).

Considering the minimum and maximum altitude of San Francisco, two types of coffee can be potentially produced: High and extra Premium Washed, coffees that are highly valuable in the coffee market.

In Tamazunchale, the coffee area represents 12% of the regional area. As the rest of the Municipality, Tamazunchale presents a broad range of problems that affect directly the coffee production: climatic changes (mainly frost) and lack of application of phytosanitary campaigns to prevent and control pest problems and major diseases (Castillo-Ponce et al.,2011).

In the municipality lives the majority of coffee producers in the state distributed in 11 communities, however, Xilitla occupies the main area occupied by coffee plantation (See table 13).

Table 13. Information of coffee production in San Luis Potosi. Mexico

Municipality	Locality	Producers	Farms	Area (m^2)
Aquismon	64	3914	5620	2978.01
Axtla de Terrazas	8	274	328	187.12
Coxcatlán	19	453	535	246.02
Huehuetlán	19	622	708	332.36
Matlapa	25	1503	1979	1129.18
San Martín	1	1	1	0,24
Tamazunchale	11	6080	8706	3860.51
Xilitla	80	5201	10184	5530.51
Total	327	18048	28061	14263.7

Source: Information obtained by El Consejo del Café. Tamazucnhale, 2016.

4.2.2 INSTITUTIONS AND PUBLIC POLICIES IN COFFEE – FROM THE NATIONAL TO THE LOCAL CONTEXT

From 1957, INEMACAFÉ was the entity responsible for the development and transfer of technology and technical assistant of the coffee sector in order to increased yields and profitability in the Mexican land. Its actions were focused on controlling the intern prices, soil, pest and diseases management, becoming that way a multiple-functional organism in the coffee field in Mexico. In this context, INMECAFÉ organized farmers, provide them with equipment and cash advances, which at the end of the 1973 result in a significant increase of the coffee production in Mexico (SAGARPA and FAO, 2006). However, in 1993 INMECAFÉ was abolished apparently due to their low financial status and administrative transparency; as a result, the Mexican Coffee Council (MCC) was established. To overcome this situation, some farmers accelerated the process of organization that started some years ago, as was the case of the "Coordinadora Nacional de Organizadores Cafetaleras" (CNOC) an independent national farmworker organization that in their beginning gathered 60 mil producers of 30 regional organizations willing to help each other through sharing experiences, promoting economic development with collective capitalization and raise level of social welfare (Paré, 1990). It is notorious that during the data collection phase, many farmers claim how different is the coffee production nowadays compared to the past when INMECAFÉ was still functioning, especially in terms of technical support and prices control.

However, one negative aspect of this period of time was the fact that INMECAFÉ monopolized the national production. Therefore, there was a decline in the coffee quality and high quality samples were sent to the byers but batch of low quality. This action was highly penalized in the international market and as a result, Mexican coffee is still affected. Nowadays there is still a monopoly leaded by AMSA (Agroindustrias Unidas de Mexico), however, Mexican coffee has been improved the quality and used better varieties with an important development in specialty coffees in the area of Veracruz, Aromatics Nayarit, among others (Coello-Manuel, 2012).

The MCC was formed by 12 coffee producing states, by the heads of the Departments of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), Finance and Public Credit (SHCP), Economy (SE) and Social Development, that continued many of the responsibilities leaded by INMECAFÉ except the price control. Nowadays each state member has their own *Coffee council* in charge of addressing the governmental funds and develop programs in order to support

coffee farmers. Some states manage also regional councils as happens in the Municipality of Tamazunchale.

At present, there is a Productive Incentive program leaded by the MCC in which a technology package will be provided to coffee farmers according to the number of hectares. This is a modification to the previous productive Incentive program that functions until this year. In the previous program, farmers were given 1300 pesos (Mexican currency) annually, with the condition to sell their coffee in specific commercial establishments under an established price. The same amount of money was given to all the farmers regardless of the volumes of coffee produced. As a result, many farmers simply stopped investing in their plot (Staff of Mexican Council Coffee In Tamazunchale, Personal Communication, 22.05.2016). Some of the farmers interviewed were not even aware that this year the 1300 pesos will be substituted with a technology package; and those aware of the change claimed that they have enough instrument to work, and what they really need is money to pay workers. It is evident there is a conflict between the policies and programs and the farmers' needs.

According to technical staff of the CCT, these programs seem to have some limitation in term of execution: "*the problem is not the lack of programs but their low acceptability by farmers"* (Staff of Mexican Council Coffee In Tamazunchale, Personal Communication, 2016. 04.22). On the other hand, many farmers complained that the technical supports provided by national institutions are not suitable for their needs. For example, last year farmers were provided with heavy pumps that they couldn't carry on the slopes of their parcels. Apparently, the implementation of new technologies has not been completely accepted by many farmers in San Francisco, since many programs do not meet the farmers' need. Additionally, it is a fact that there is a high dependence of farmers with government programs; to the point that often take refuge in the lack of programs and financial assistance as the reason for their current situation.

4.3 THE RURAL PRODUCTIVE SOCIETY (RPS). "LA FLOR DE CAFÉ DE LA SIERRA ALTA DE SAN FRANCISCO" (FCSASF)

4.3.1 GENERAL DESCRIPTION OF THE ORGANIZATION

Among the 6080 coffee producers in the whole Municipality of Tamazunchale, only 25% of them belong to an organization (Hernandez-Ramirez, M.A, Personal Communication, 2016.04.22). The Rural Productive Society (RPS) called "La Flor de Café de la Sierra Alta de San Francisco" (FCSASF) is one of the few rural productive organization in the Municipality. The RPS is a legal type of organization established in the Article 27 of the Mexican Constitution and the Articles 108, 109 and 112 of the Land Law of the country. Among its main objectives are (INAES , 2013) :

- Produce, process, market and distribute services in an associated form.
- Acquire and manage financing, insurance, supplies, machinery, equipment, among others.
- Receive goods and services, as well as private and public support to develop productive projects and social investments.
- Negotiate operation with similar organizations and/or public and private organizations.
- Establish civil or commercial contracts with different purposes: financial, commercial, technological and other services.

The FCSASF Society was established in the year 2000 by coffee farmers of the community of San Francisco, Municipality of Tamazunchale, San Luis Potosi. Currently, the RPS is formed by members of San Francisco and neighboring communities. The organization is managed by internal authorities were at least 60% of the members are older than 60 years old. Since its foundation, its main purpose was to be a coffee processing organization, where members bring their coffee to be processed through the dry and/or wet method, and finally be roasted, grinded and sold under the commercial name of Café Corca (Annex D).

The FCSASF society counts with the physical facilities for the wet and dry processing, as well as a total equipped laboratory of entomopathogenic fungi (Annex E).

4.3.1.1 Organizational Status

The FCSASF Society was assessed in 5 different levels in order to have a general understanding of their level of organization, administration, operation, commercial activity and finances. The results are presented in the Figure 16.

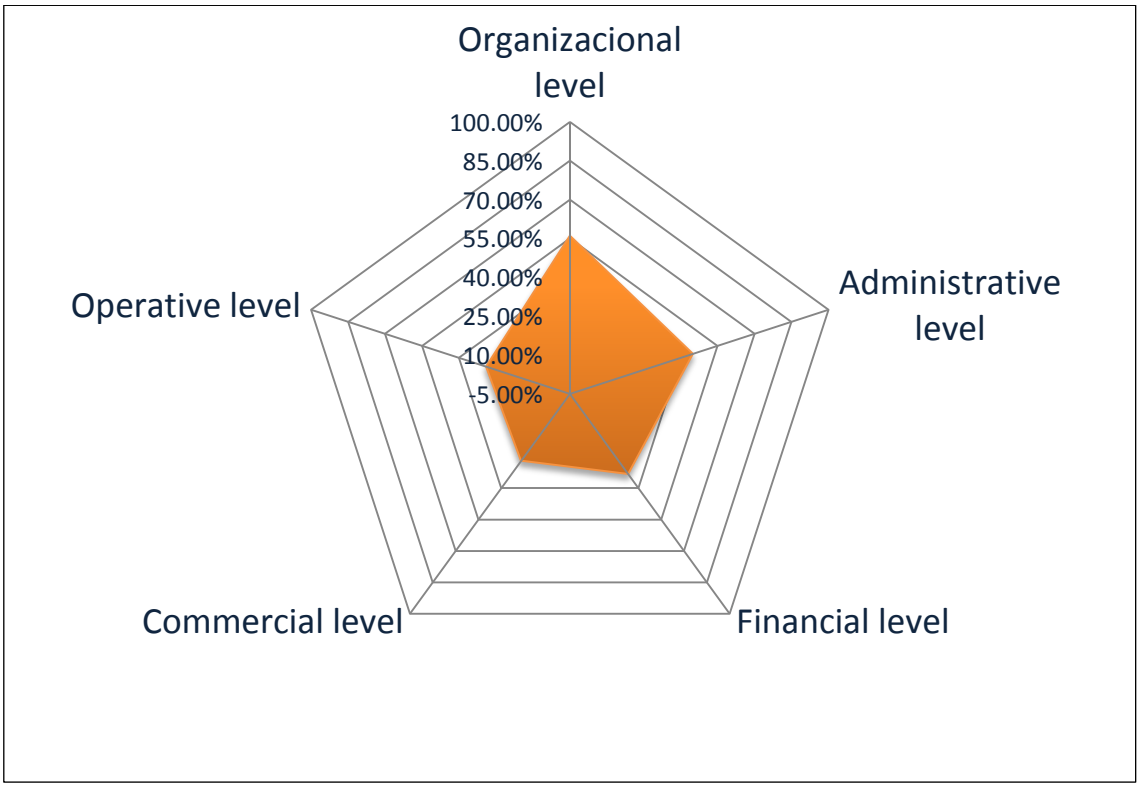

Figure 16. Status of internal processes of the RPS "La Flor de Café de la Sierra Alta de San Francisco”.

Source: Data obtained in the self-diagnosis instrument (SAGARPA, 2008) filled out by the legal representative of the FCSASF Society, Mr. Nasario López Rubio.

At the organizational level, the FCSASF Society accomplished successfully with 56% of the requirement established in the diagnosis instrument (Annex A). According to the diagnosis, the governmental and internal structures status has been clearly set since the 2000, as well as their vision, mission and values. The Society has a legal representative, Mr. Nasario López Rubio, a supervisory board and a support team. However, some legal official procedures are still not fully settled, such as the book of records, certification of contribution, among others formalities. The diagnosis tool revealed that the FCSASF Society has no affiliation with other institutions, Universities and/or NGOs. Furthermore, it was notorious that the Society hasn’t held elections of their representatives members in the corresponding periods established in the statute of the Society. As a result, Mr. Nasario López Rubio, has been the legal representative for more than the legal period.

At the administrative level, only 45% of the requirements presented in the tool are accomplished. Internal controls are the weakest part of the administration dimension. The tool shows that there

are no mechanisms to assess the satisfaction level of customer and members of the organization. In terms of material resources, the FCSASF Society does not count with essential assets such as transport vehicles, computer equipment, as well as internet access and a Web page.

The financial level reaches only 33%. Currently there is no monetary income registered in the annual budget but there are only expenses corresponding to fixes costs. The Society does not manage insurance or hedge funds. Subsidies or supports are only received by governmental institutions, but not by banks, providers or other partners. This type of help is only received after an extensive bureaucratic process is carried out. Currently, the FCSASF Society receives a technological package by a governmental program (consisting of: 1 motor pump, tubes, nylon, tanks for washing and fermentation, pulping machine per farmer); under the same project, it was approved money and material to construct a nursery for coffee plants for the whole municipality.

Commercial and operative axis receive the lowest score (27.00% and 29.00%, respectively), since the *Beneficio* and the laboratory are not working at its full capacity. In this sense, the activities in the laboratory are completely stopped. The responsible for the operation of the laboratory was involved in problems of corruption, and since then, the activities have ceased. Currently, the roasting and grinding process are the main activities developed in the organization. In some cases, the grinding and roasting machines are rented to farmers not members of the *Beneficio* as a way to cover basic costs. Farmers are processing their coffee at home and bring it to be roasted in the *Beneficio* or just sell the green coffee (this procedure is explained in detail later on).

The main reason of this cease of activities is attributed to the low production of coffee in the last decade. Many factors have influenced the low productivity in San Francisco. Since 2010, frost caused the loss of 10% of the national coffee production coffee. In the second stage of the 2009-2010 cycle, the state of Veracruz and Chiapas lost 60% of it crops and other coffee producing states, such as San Luis Potosi were affected (Perez, 2010). Unlike many coffee farms located in Chiapas and Veracruz, the FCSASF society does not have an insurance policy that could cover such losses. Therefore, when this kind of situation occurs, farmers have no other way to recover their crops, but by using their own means, or just simply abandon the activity. 2013 was a year when coffee crops started to recover from the past frosts, however, in the period 2014 -2015, coffee plantations were devastated by the coffee leaf disease and the Coffee borer beetle, reaching very low yields (0.6 ton/ha in average). Due to all this constrains, farmers are processing their coffee

independently in their homes (technical details of the coffee processing are presented later on), because the volumes are not cost effective to do it in the *Beneficio*.

According to the self-diagnosis, the FCSASF Society got 197 points, which correspond to a "Under development" level (see Figure 17).

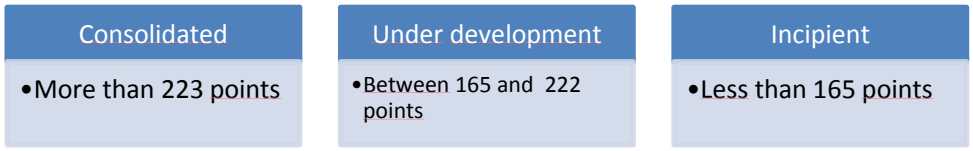

Figure 17. Score analysis of the "Self-diagnosis guide for Economic Organizations" by SAGARPA (2008).

This is an organization that has partially complied with its statutes; on the other hand, business plan has not been elaborated, none marketing plan or market research has been done. Basic assets are not available; making more complicated the process of transportation and communication. Additionally, it was notorious that some members of the organization were not aware of the current status of the organization, as well as the future plans. The irrevocable permanency of legal representatives (the case of Mr. Nasario Lopez Rubio) in the Society is not an advisable practice in terms of confidence and transparency.

Besides the self-diagnosis, members of the FCSASF Society were asked to mention what are the benefits of being part of an association. They respond that the main benefits consist on receiving equipment (for example pulping machine, material to construct drying beds), workshops and/or capacitation. However, some claim that the material provided is not suitable to be used. Other believes that the benefits are perceived only in years with high coffee production. Additionally, it was evidenced that the sense of belonging of the members of the organization is limited. Many of them perceive the organization as an instrument to receive help from the governmental programs, but not as an opportunity to gain independence from external subsidies.

As a result, the farmers are legally founded but the sense of belonging and team work seems to be one of their biggest constraints.

4.4. PRODUCTIVE SYSTEM

4.4.1 SOCIAL COMPONENT

Information obtained in the questionnaires of a group of 13 farmers gave a general landscape of the social component of the system, in this case, the FCSASA Society. In average, farmers have 65 years old and are married. More than 60% of the farmers have a basic level of education while a 40% of them have not gone to school or haven't finished the basic level. Farmers belonging to the Nahuatl ethnicity are the minority, while the rest does not belong to any indigenous ethnicity. Families are conformed by 4 members minimum and 10 maximum. Each member of the family has a well-defined role: Women are usually engaged in in the housework and the Milpa, while men are dedicated to the coffee production and other extra activities. All the producers interviewed claimed that at least one of their offspring is working somewhere else. The most common destinies are: Monterrey, Mexico city and the United States. In fact, migration is a common phenomenon in the coffee sector that triggers socioeconomic problems such as: abandon of coffee plantation, increase of work for the remaining family in the community and the hiring of workers and the replacement of coffee for monocultures (Nava -Tablada, 2012).

Many of the offspring are dedicated to work in construction and other activities, but it was also evidence that some of them have a profession. A number of farmer said that they receive some economic help from their sons, and only in isolated cases their sons are working in the coffee farm. Therefore, coffee crops are basically managed by the farmers, and their wife participates in times of harvesting.

The land is communal; it means a territory belonging to one or more communities managed by an assembly of commoners. It is divided into parcels used by commoners, with the legal right of usufruct, inheritance or exchange between members of the same community. However, it does not have the character of a private property. The members of the community have collective right to used independently properties of the community (Cámara de diputados, 2003; FAO, 2003).

4.4.2 PRODUCTIVE SYSTEMS

The sale of green coffee represents the main economic source of income for at least 80% of the farmers here interviewed. In average, coffee plots have an extension of 1.8 ha, located between 618 and 1032 m.a.s.l. The plant density is 1000 plant/ha in average, representing a low density compare to other National average (1500 plant/ha) (CRUO-UACh. INCA RURAL. AMECAFÉ.

SISTEMA PRODUCTO CAFÉ, 2011). Currently, farmers are dedicated to the conventional market producing mainly green coffee. In only one occasion, in 2004, the organization enters to an international certification program called Naturland[11] in order to export organic coffee. Even though they were supported by a government program with 50% of the total cost, one year after the implementation the Society quit the program due to impossibility to pay the certification and volume of the whole production (López-Rubio, Personal Communication, 2016.04.17). It was mentioned that one of the problems was to keep record of their production, practices and the general cost of the certification. This difficulty was also metioned by other farmers in Veracruz belonging to the Fairtrade certification. It was evidenced that when farmers were asked what was its perception of the International certification, none of them were absolutely clear about the term, as they have never participate in this program.This might be another sign of lack of participation and integration in the FCSASF Society.

The majority of the coffee farmers interviweed considered the climante change and lack of economic support the main difficulty to be faced by them in the coffee production. Lack of organization and other important factor such as low quality and problems with pest and diseases are less mentioned by farmers (See figure 18).

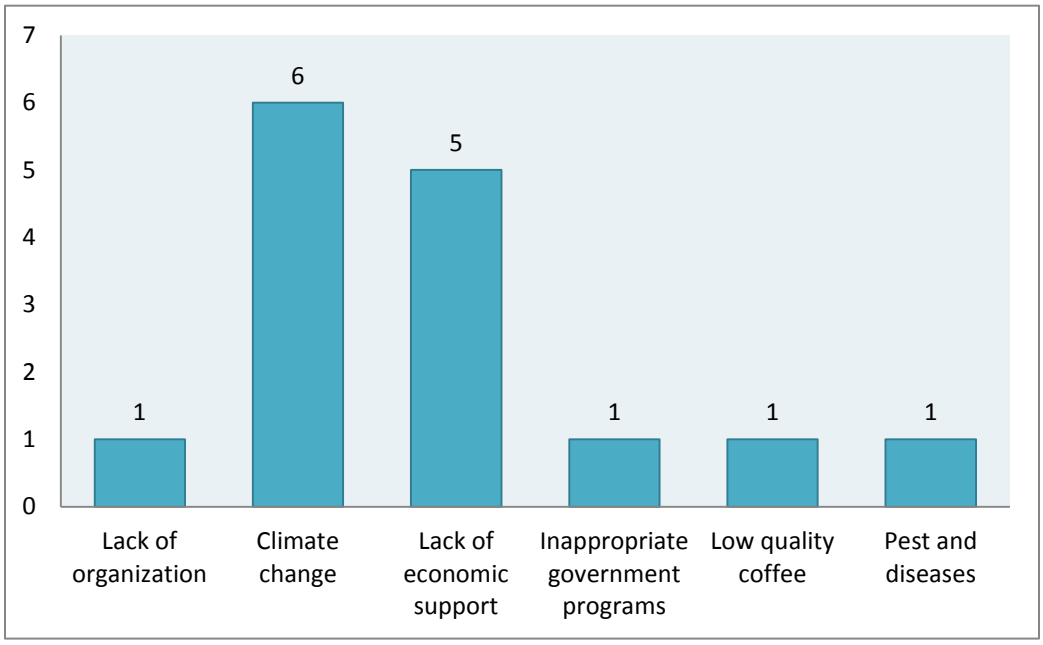

Figure 18. Perception of farmers regarding the major difficulty faced in the coffee
Source: Data obtained in the questionaties conducted with farmers of the FCSASF Society.

[11] An International organization dedicated to Fair Trade and Organic certifications.

Besides the coffee plantation, more than 83% of the farmers have a milpa, which in average has an extension of 1 ha. The term milpa comes from the Nahuatl (*mili*, planted plot, *pan*, above) and it is defined as a modified atmosphere where corn, beans and squash are the main crops planted. This millennial production system is mainly used to provide basic food for the farmers and their family (Biodiversidad Mexicana, ...). In the study case, farmers grow corn, beans and pumpkin in their milpas, and in lower level some reported to have quelites, tomatoes and some medicinal plants. This is a valuable traditional practice that helps farmer to have access to basic foods throughout the year. Despite the fact many farmers have abandoned this ancient mode of production, due to off farm employment opportunities, migration and other crop activities (Birol, Rayn, & M, 2007), farmers here interviewed dedicate most of their time to this activity, considering it a vital part of their livelihood.

Husbandry in low scale is a practice developed by 80 % of the farmers interviewed. Chicken is the most common animal since it does not represent a big investment and it is easy to feed. Only a minority of farmers breed pigs, which are used as a sort of saving accounts for the thin months. The animals are fed with corn from the milpa and/or leftovers and are breed for own consumption purposes and only a few for selling purposes.

In the study, it was found that for the majority of the farmers, coffee represents their main economic activity. In the interviewed group, only two out of 13 farmers are working in other economic activities: one farmer own a grocery stores in the community, and the other works in the public administration. As a result, their main source of income do not depend exclusively on coffee production. To overcome this situacion, some farmers are working as daily laborers in different activities. This has created other problems, such as the priorization of external activities before coffee plantations, despite the fact that coffee represents their main economic source of income. According to technicians of the CCT, "Producers are not dedicated exclusively to coffee. By having more crops or being focused on other activities, they not concentrate their time and energy in the coffee production. They are busy in the Milpa and leave the coffee in second place. As a result, many of the farmers do not assist on the workshops and activities that the CCT prepare for them"(Staff of CCT, personal communication, 2016.04.22).

The figure 19 summarized the main source of economic income of the group here assessed. This values were calculated considering the gross income obtained in each activity. Coffee activity, consist in selling green coffee, represents their main source of income for the majority of the producers. A minority of farmers perceive more benefits from the governmental program (1300

pesos/year) than the profit generated for the coffee activity. In average, farmers are obtaining 425 pesos/month for the coffee activity. Despite the fact the performace of each farmer in their parcels is determinative in the production and final yield, all the farmers interviewed percieve incomes less than 1000 pesos/ month for the coffee selling. This is an evidence of the low profitability of the coffee farmers that are involved in the FCSASF Society.

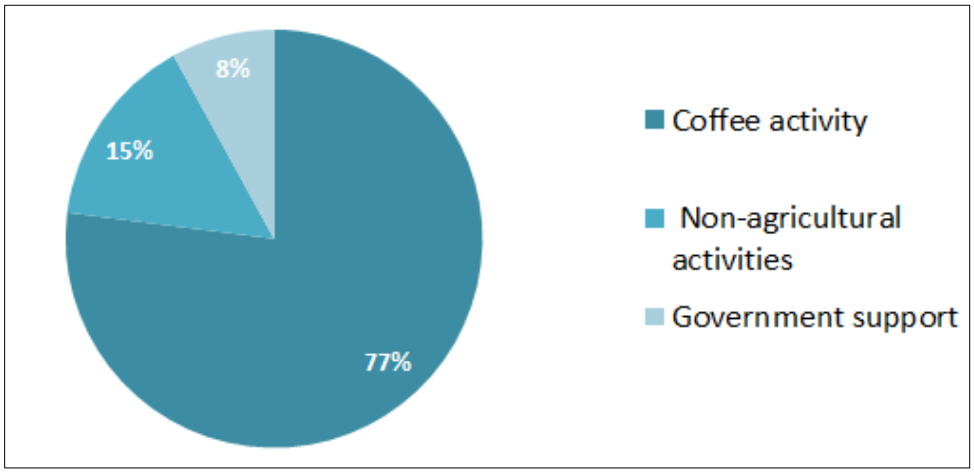

Figure 19. Main source of economic income of the group of farmers of the FCSASA

Source: Own elaboration with data obtained in the interviews.

The table 14 summarizes the calender of the main activities developed by farmers of the group of farmers of the FCSASF Society. Only two of them have a constant economic income throughout the year. The rest depend on the economic help provided by their offspring or by the government. This demonstrates that farmers do not have a diversified source of income, an the coffee activity is not a profitable economic activity.

Table 14.Calender of the main economic activities of the group of farmers of the FCSASA Society.

Calender													
System	**Activity**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Coffee	Harvest												
Milpa	Harvest												
Husbandry	Backyard animals												
Other activities*	Extra activities												
Thing months													

*reported only by 2 farmers.

Source of food or money

No income (Thin months)

Consequently, sudden changes in the market, unexpected frost or the leaf rust attacks put their welfare at risk. The red months are defined as the "thin months"; a period of time where coffee farmers confront the biggest food insecurity challenges (Fujisaka, 2007). This issue increases when farmers do not have develped other sources of income. Some of them claimed that in the period between July and August, they run out of money. This phenomenon is part of a cyclical pattern in the coffee production that occurs each year after the harvesting months. Studies revealed that coffee producing countries, such as Mexico, Nicaragua, Guatemala, among others, struggle to meet basic food needs at some point of the year (Fujisaka, 2007). Basically, smallholder coffee farmers have a single annual sale, and they are paid only one or two times per year. As a consequence, they have to face the problem of self-sufficiency and maintenance throughout the year with a unique economic income (Caswell & Méndez, 2012). In this scenario, the Milpa represents an advantage for them, since they can cover some basic food needs with this traditional crop.

4.4.2.1. Coffee production

Farmers of the FCSASF Society manage polyculture systems with different level of diversification. The specie *Inga* sp (commonly known as Chalauite in San Luis Potosi and Vainillo in other states, such as Veracruz) is the most common specie introduced in the system to provide shadow and nutrients. In this context, there are systems more orientated to simplified systems (using only Chalahuite) and those that manages more complex systems. These last ones are introduced to cover the following needs: shade, nutrition, food and wood. The table 15 shows the main species reported by these farmers.

Table 15. Introduced trees in polyculture coffee systems describe by farmers of the FCSASA Society

Specie	Family	Common name	Function
***Inga* sp.**	Fabaceae	Chalahuite, Vainillo	Shade, N fixation
Lysiloma divaricatum	Fabaceae	Palo blanco	N fixation
Eysenhardtia polystachya	Fabaceae	Palo azul	N fixation
***Melia azedarach* L.**	Meliaceae	Paraíso o pioche	Shade
***Macadamia* sp**	Proteaceae	Macadamia	Edible
Juglans regia	Juglandaceae	Nogal	Edible

Persea schiedeana	Lauraceae	Pagua, chinine	Edible
Musa sp	Musaceae	Platano manazao	Edible fruit
Ipomoea batatas	Convolvulaceae	Camote	Edible
Manihot esculenta	Euphorbiaceae	Yuca	Edible
***Citrus* sp**	Rutaceae	Mandarina	Edible

Source: Own elaboration with data obtained in the questionaries carried out with farmers of the FCSASF Society.

4.4.2.1.2 Management of the coffee parcels

4.4.2.1.2.1 Coffee varieties

Due to climate and physical conditions of the area, farmers in San Francisco grow mainly varieties of *Coffea arabica* described in the table 16.

Table 16. Farmers samples - Varieties of coffee used

Variety	Number of Producers	General description
Caturra (yellow and red)	7	Dwarf mutant variety of Bourbon (statured plant, 1.8mts), with short internodes. This variety is characterized by high productivity, but also high fertilization requirements and constant pruning. The grain result to be smaller that the typica grain.
Typica	6	Originally from Ethiopia. It is a low productive variety (tall plant 3.00-5.00 mets), non resistent to the coffee leaf rust but highly adapted to lands with low fertility. It produces high quality grains.
Bourbon	5	It is a variety from an island in the Indian Ocean, east of Madagascar, now known as Réunio. Its a medium size tree (3mts). It has more branches compare to typica and it is highly productive and produces smaller fruits than typica. .
Mundo Novo	2	It is a natural hibrid between typica and bourbon found in Brazil. A tall plant (3.00 mts) highly resistance to disease and highly production, with different matures periodes than other coffee varieties.
Pluma Hidalgo	2	It is a mutant from typica, a Mexican variety of great international recognition for its pungent aroma and distinguished flavor.

Source: Questionaries of farmers of the FCSASF Society and Coffee Research Institute, 2011; SCAA, 2011.

It is imporntat to mention that the FCSASF Society will be provided in the next month by a governmental program with two resistant varieties: Sarchimor and Costa Rica. These are highly resistance varieties that are planned to substitute the susceptible varieties (Typica, Caturra) of San Francisco.

The origin of the seeds is not very clear in some cases. Some farmers said that their seeds were given by technical staff coming from Veracruz. Many of them claimed that seeds provided by governmental programs sometimes do not work. As a consequence, producers lose their time in planting and after three years they have no profit. Others obtain their seeds from their own plots. Since farmers reported having stopped using chemicals 15 years ago, it is probable that seeds are natural (it means that hasn't been treated with chemical substances but do not have the legal recognition to be consider organic).

The farmers do not manage seedbeds, a fundamental activity that must be done to have high quality plants and availability of plants for the crop renewal. In fact, this is a problem diagnosed in the region (Castillo-Ponce, 2011). However, it is expected that this year the organization recieves the economic and techical support to develop a seedbed with a capacity of 200.000 plants.

4.4.2.1.2.2. Pest and disease management:

The individual questionaries reveled that 92% of the farmers have some problem with the following pest and or disease:

- The coffee berry borer (*Broca* in Spanish) (*Hypothenemus hampei*)
- The coffee leaf rust, (*Roya* in Spanish) (*Hemileia vastatrix*)
- American leaf spot of coffee (*Mycena citricolor*).

The incidence in the plots of coffee berry borers and the coffee leaf rust was reported in the same proportion by the farmers, while the American leaf spot of coffee was reported only by one farmer. It doesn't mean that the pest is not present, since in some cases controls and monitoring programs are not conducted properly.

***The coffee berry borer*:** is a beetle belonging to the Family Curculionidae. The female deposits its eggs in the endosperm of the coffee fruit, casing important economic losses (Silvestre, 2007). In San Luis Potosi, during the harvest period between 1995-1996 it was reported only 1% of plant with the coffee berry borer infestation, while in the rest of the country it was considered the main pest problem in coffee plantations (INMECAFÉ, 1998). However, from 2000 onwards, the % of infestation in San Luis Potosi have presented an inconsistent behavior, with rises and falls, reaching nowadays almost 100% of the coffee surface infested (Olvera- Vargas, 2010). The % of infestation of this pest is directly related with the economic situation of the farmer. In cases when coffee have higher prices, manual practices are done in the parcels, on the contrary, farmer do not invest in this kind of activities (Anacafé, 2013)

Even though some farmers claim that they are monitoring for the coffee borer, it has been reported that this application has been done incorrectly (Castillo-Ponce et al., 2011).

The leaf rust is a disease developed in a range of altitude between 600 and 1200 m.a.l.s by a fungus that attacks mainly the leaf of the trees, causing severe damages in the plant physiology and therefore, the productivity (INMECAFÉ, 1998). It attacks mainly the following varieties of Arabica: Caturra, Bourbon, typical, Pache, among others (Anacafé, 2013), being these the main varieties cultivated in San Francisco, except from the Pache. Additionally, this fungi develops in coffee plantations with poor fertilization of the soil, variation in the climatic condition as well as incorrect management of fungicides (Anacafé, 2013), all conditions that are presented in farms of the FCSASF Society here interviewed.

For the pest controls, farmers ensure that they carry out some traditional practices, such as shadow regulation, reported by 100% of the group. However, the frequency with which they do it depends directly on the money availability. Besides, tecnical staff of the CCT and own observation of the parcels revels that this practice is not completely develop by the farmers. On the field, it was observed that some of the plots have trees that exceed 8 meters high, making impossible for them the pruning. Basically because they do not have the machinery to do so. The borer traps are used only when resources are available.

4.4.2.1.2.3 Soil management

In coffee production, soil represents a decisive factor when we want to have healthy plants that are resistant to pests and diseases and a high quality bean. In fact, the majority of the sustainable indicators take into consideration soil management as the most important aspect to be assessed (Altieri & Nicholls, 2002). Under this context, it was relevant that none of the farmers fertilize their plants with some type of fertilizer (nor of organic neither inorganic fertilizer). The unique source of nutrients consists on the organic matter and nutrient recycle that is provide by the agroforestry system. Besides this, the fertilization is not favored by any other practice. The majority of farmers claim that 15 years ago they stopped using chemical fertilizers. According to technical staff (personal communication, 2016.04.11) from that moment, coffee yields have decreased in San Francisco, and farmers have complained having weak plants, problems with flowering and falling leaves. Additionally, the majority of the farmers are planting a highly demanding variety, Caturra (See table 13). As a result, farmers are having low productions and week plants that are susceptible to be attacked by diseases and pests.

Additionally, farmers haven't done any soil test. It means that they don't know the composition of their soils, and therefore, what type of fertilization they need to provide to their plants. Without this fundamental information, fertilization could only represent a waste of time and money and not necessarily a help.

4.4.2.1.2.4 Waste management

Inorganic waste is burned or it stays in the floor of the coffee plantations (annex F). There is no formal solid waste management system, and the garbage is not recollected by a municipal garbage collection system. As a response to this, the community of San Francisco organized themselves in local groups in order to collect once a week the garbage and then burn it. Farmers use the organic waste to fertilize the Milpa or it is just throw it away in the garden. It means that organic waste do not represent a problem compared to the inorganic waste. Some farmers reported to use inorganic waste for their traditional kitchen as a source of fuel.

4.4.2.1.2.5 Water management

The coffee system is not managed through irrigation and the only source of water is provided by the rain. In regular conditions this should be enough to cover the system. However, according to model projections of the rain patterns in Mexico (2000-2098) it is probable that the tendency over most of the mainland in Mexico is towards drier conditions (Gonzales et al., 2011). Given that, coffee trees are highly vulnerable to rain changes; these changes might impact the coffee production in the future.

4.4.3. HARVEST

The coffee is harvest once a year during the months of November, December and January. This activity is done by the farmer and its wife and sons in case there are still members of the family living there. More than 50% of the farmers hire workers (between 2 to 4) to help them in the harvesting and in the weeding activities. However, other group of farmers said that they don't have enough money to hire workers. Other important practice developed among farmers consists on helping each other with the harvesting activities in the plots. In this case, the worker (Peon in Spanish), which could be another farmer of the community or an external worker, receives a payment of 2 pesos/kilo of cherry harvested.

One of the problems perceived in this phase is the lack of a selective harvesting. Cherries at the peak of ripeness are harvested along with other less ripe. This happens when farmers do not want to do more than one collection, since this represents an investment of money and time. As a

result, coffee quality decreases significantly (refers to the point 4.4.4.2 Organoleptic description of the coffee Café Corca for more details of the coffee quality). However, when coffee is picked unripe, the farmer loses 27% of the harvest weight. It means that at the end they are losing.

After the coffee is harvested, sometimes it takes more than 24 hours to process the cherry, decreasing that way the quality of the grain as well. The harvesting is a critical phase in the coffee production, since the cherries can suffer from non-controlled fermentation (Moldvaer, 2015). Besides the unselective harvest of ripe and unripe cherries, farmers are picking cherries from different varieties and then processing the cherries together. As a result, high quality varieties are mixed with low quality varieties, limiting the possibility of setting a higher price for the product.

4.4.4 POSTHARVEST

4.4.4.1 Coffee processing

In periods of time when the coffee productions is low, farmers process the coffee in their homes, and then it is transported to the *Beneficio* to be roasted and milled. During the last four years this has been the *modus operandi*. More than the 60% of the farmers are processing coffee by the dry process since it is an easier practice that does not depend on expensive or sophisticated equipment. The final product obtained however, is from less quality (dried coffee cherries), since the fermentation does not take place.

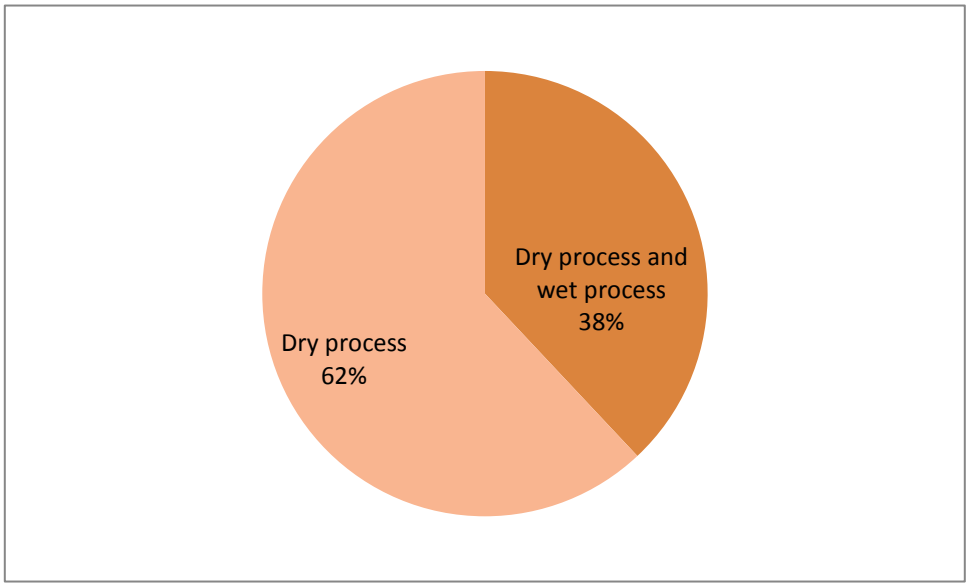

Figure 20. Type of coffee processing developed by the farmers in the FCSASF Society

Source: data obtained in the questionnaires carried out by farmers of the FCSASF Society.

Farmers have developed different strategies to dry the coffee: on concrete soils, directly on the floor and few are drying coffees on drying beds. The practice of drying direct on the soil can lead to contamination problems. However, in the last years, farmers are starting to do the wet process since the FCSASF Society has provided some of them with pulping machines. Besides the machinery, members of the organization have received capacitation to do the wet process at home as well.

In the case of the wet process, the washing and fermentation is done in plastic tanks with water that comes from a spring that supplies the community. The quality of water has never been tasted. Farmers use a manual disk pulping machinery. Therefore, additional source of energy are not used.

In the Beneficio, coffee is mainly processed by the wet method. Each year the activities is less common since the volume of coffee produced do not cover the cost of energy and workforce. However, in regular conditions, farmers bring their cherries to the *Beneficio*, it is processed and then sold. The details of the market are explained later on.

It was notorious that the hulk produced by the hulling process is not used as a source of organic matter. Instead it is discharge (Annex F). This represents a waste of a valuable source of nutrients for coffee plant.

4.4.4.2 Organoleptic and physical description of the coffee Café Corca

The coffee produced by the FCSASF Society is defined as washed coffee. According to the **NMX-F-551-SCFI-2008,** this is a type of coffee with high values of aroma, acidity, bitterness and flavor and none of the following defects must be present: phenolic, fermented, earth, mold.

To assess the general characteristics of the coffee produced in the FCSASF Society, a sample of 250 gr was taken to the barista Julieta Vázquez Rivera[12] to be analyzed in terms of presentation of the product and quality. The results are shown in the table 17.

[12] Barista from San Luis Potosi. Winner two times of the Mexican Barista Competition and the 16th place in the World Barista Championship in Seattle.

Table 17. General characteristics of the commercial coffee of RPS "La Flor de Café de la Sierra Alta de San Francisco"

Package	The package is closed with staples and it is not sealed. This type of packing allows coffee aroma loss and the entrance of moisture.
Aroma	The coffee issued a fermented* and a strong and stinker** aroma, suggesting that the grains were not in perfect conditions when they were processed, and also problems in the storage and fermentation process of the coffee. The roasting of the coffee is very high. Therefore, natural aromas are eliminated. Instead the coffee issues a burned aroma.
Color	The coffee has a strong dark and greasy color, suggesting that there was an over roasting process of the grain. This is define as an over roasted grain ***
Flavor	The coffee has a bitter and burned taste.
Size of the ground	Grain particles are very thick to be used to American coffee preparation.

* It is the taste of a coffee infusion resulting from an uncontrolled fermentation and goes sour and putrid.
** Coffee bean off an unpleasant odor and gives a taste in cup unpleasantly like, vinegary, fermented or rotten.
*** This is a bean with too much power, submitted to high temperature for a short time. They are characterized by a much darker external color and blotchy unequal. This grain do not develop properly taste, has charred tones and high acidity.

Source: Result of tasting and presentation analysis performed by the Barista Julieta Vázquez Rivera. May, 2016.

The result of this analysis shows that the coffee produced in the FCSASF Society has serious deficits in terms of quality and presentation.

This is a constraint not only to address differentiated markets that require a minimum of quality standards, but to address better markets in the local and regional area. Additionally, these results are an indirect proof of the deficiencies of the process of harvesting and processing determined in this study.

4.4.4.3 Market and prices

The marketing of coffee in the study case depend on the volume of coffee during the year. In good years, the market follows this pattern:

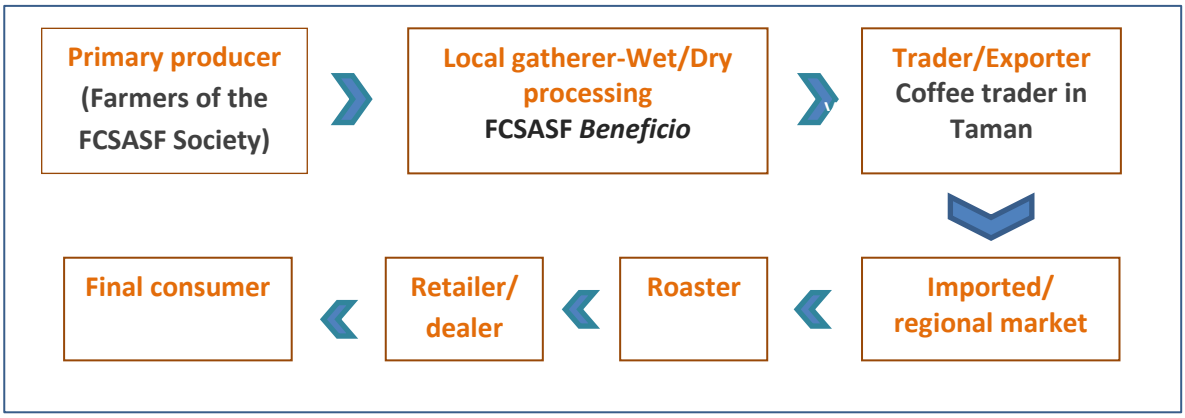

Figure 21. Marketing chain - High coffee volume (A)

Once the coffee is processed, it is traded in the coffee marketer located in the locality of Taman (around 35 km from San Francisco). They receive the coffee only from producers enrolled in the PROCAMPO program. For that, farmers have a code that must present every time they sale their coffee. The prices are standards, and annually each farmer receives 1300 pesos as an economic incentive for being part of this program.

Since 5 years ago, coffee of the Municipality is no longer imported and traders sell coffee from Veracruz, since the volumes in San Luis Potosi are not sufficient. That's the reason why the coffee is dominated by the local market.

Currently, the local market is the only market that supplies the FCSASF Society (Fig. 21). Since the production of the last years has declined, many farmers process their coffee in their houses and sell it directly (as green coffee) to middlemen or to the local trader in Taman. In cases of severe economic crisis farmers accept to sell their coffee at bargain prices that is paid immediately in cash. The transport from San Francisco to Taman represents a cost that some farmers are not willing to pay. In this case, local middleman (usually people of the community with trucks) transports the coffee to the commercial places (Fig. 20 – B.1).

In other cases, the same FCSASF Society roasts the coffee in the *Beneficio* and sells it to middlemen as roasted coffee (Fig. 20 B-2). This represents an advantage in terms of prices. The prices are established according the type of coffee sold. The current prices managed in the Municipality of Tamazunchale are summarized in the table 15.

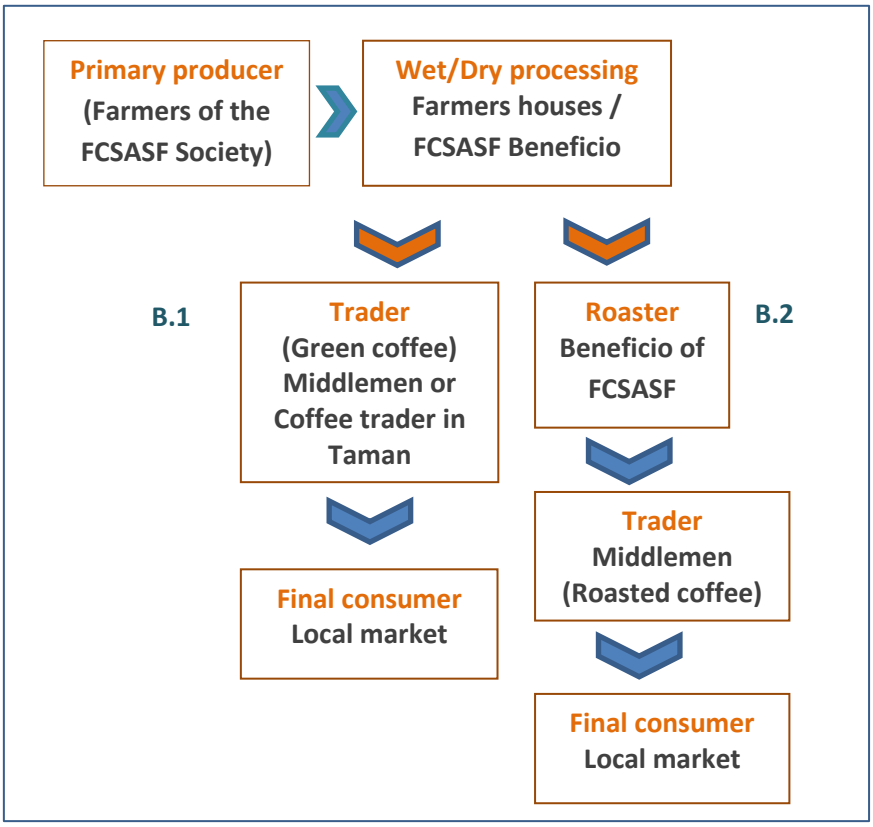

Figure 22. Marketing chain - Low coffee volume (B)

Table 18. Table of prices of coffee in San Francisco

Type of coffee	Price Mexican currency (pesos/kg)
Cherry	5
Green coffee	35-40
Parchment coffee	41-50
Roasted coffee	80-120

Source: data obtained from the questionnaires and interviews with specialists.

Few farmers sell the cherry. In fact, only one of the groups of farmers interviewed has sold the cherry coffee this year. The rest of the farmers are selling green coffee. Those farmers that are doing the wet process have the chance to sell parchment coffee, which has a higher value in the market.

It is important to mention that until recently (year 2000), San Francisco was pretty much isolated from the rest of the communities and the capital of the state. Before the roads were paved, the access to the markets was limited. This explains in part the inexperienced in the area. Farmers in San Francisco are recently dabbling in the market and all it means. This might also explain their lack of awareness in the certification and/or specialty coffee field.

4.5 SUSTAINABLILITY OF THE COFFEE FARMS

The sustainable index applied in the study was a version adapted from the model proposed by Marquez, 2015. Despite the fact it is an index developed specifically for coffee farms, it was not useful to determine the differences between each farm performance. In fact, in the present study, the index only gave a broad view of the current situation in the three dimensions assessed: economic, environmental and social, but it was not possible to determine the subtle differences between each farm (See Fig. 22).

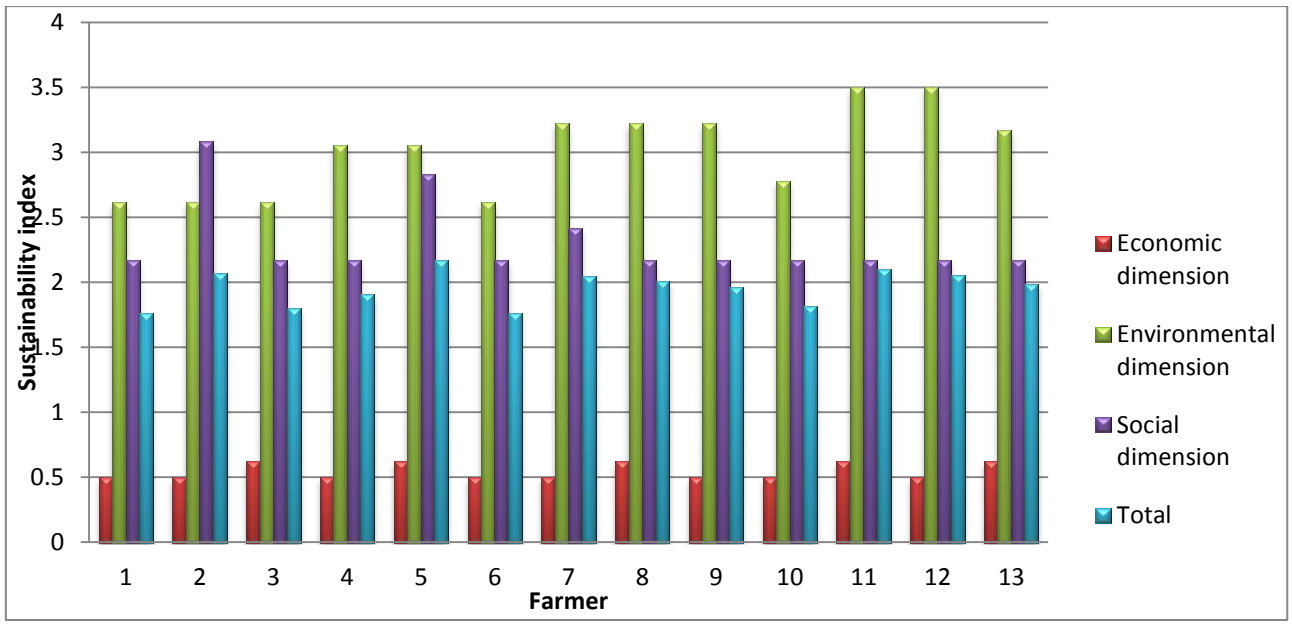

Figure 23. Sustainability index of coffee farms of the FCSASF Society producers.
Source: Data obtained from questionnaires made to the group of 13 farmers belonging to the FASASF Society.

Despite this, the index revealed important information about the current situation of the farms. The economic dimension seems to be the most problematic area. In a scale between 0 and 4, the average of farms obtained a score lower than 1 point. The majority of the variables assessed in the economic index in terms of economic profitability,

economic income and diversification of production, received the lowest score in each farm. In fact, some of the farms scored values significantly below the lowest value presented in the index (See annex B). Even though this might be a sensibility problem, some variables revealed that the farms do not cover some important basic needs. For example, the profits in the coffee activity do not cover the minimum value settled in the Mexican basic food basket, which correspond to 2890 pesos/month (156,14 U.S dollars 18/07/2016). This has been one of the triggering factors for young people to migrate. As a young man mentioned during the field trip in San Francisco, "In the U.S.A I can earn 130 $ in one day… when will I earn this amount of money here in the farm? [sic]) (Anonymous, Personal Conversation, 2016. 04.20).

The yields obtained in the farms (0.65 ton/ha in average) are lower than the yields reported in the Municipality (0.88 ton/ha) (SIAP, 2014b). Considering the fact that farmers usually don't roast and mill the grain (which represents an added value to their product) and sell green coffee instead, the profits obtained are very low (450 pesos/month in average).

The social dimension reached a similar score in each farm assessed. In this case, the access to basic services (such as education, clean water, access to electricity, to health, among others) and the level of participation in the organization was assessed. The locality of San Francisco has had important improvement in terms of access to basic services. In fact, from 2005 to 2010 there has been an improvement in the following aspects: houses without drainage (from 16.09% to 2.16%), houses without electricity (from5.19% to 2.16%) and houses without piped water (99, 56% to 98.19%). This data is proportional to the inhabitants in each year. (Unidad de Microrregiones, 2013). On the other hand, it was relevant that more than 80% of the samples are lower than 2.5 points, only two of them reached a higher score. In fact, this two correspond to farmers that have an active participation in the organization, a not common behavior in the FCSASF Society.

The environmental dimension receives the highest score. This was an expected result since the farms are managed under traditional techniques, and external inputs are not

usually implemented. The scores are located within 2.5 and 3.5 points. The differences in the score are based on the diversity of trees managed in the parcel. Farms in which Chalahuite tree *(Inga* sp) is the main and only shade tree received a lowest score compare to those more diversified farms. However, the management of coffee under agroforestry systems does not imply that agricultural practices are done correctly. In fact, low yields and problems with the quality might be associated with poor performance in the farms. As it was mentioned previously, some farmers do not apply a correct soil management that might lead to erosion problems, as well as the frequency of the pruning and shade regulation. This level of detail is not assessing by the sustainability index. That is why deeper questionnaires were developed in this study.

The sustainability index that summarizes the performance of each dimension in one final value reached an average value of 1.95 out of 4 points. Even though there are many important variables not considered in the index, this index shows the low performance in the economic and social dimension of the farm systems. In order to develop sustainable systems, each of the variables of sustainability must reach a better performance. According to this index, sustainable systems should have a score above 2 and each of the dimension cannot be lower than 2. In this case, the lowest score was registered by the economic dimension with 0.54 points, followed by the social dimension (2.30) and the highest was the environmental dimension (3.01). The total sustainable index obtained 1.95. As a result, the systems assessed cannot be considered sustainable, at least not under the variable considered in this sustainability index.

CHAPTER V. IDENTIFICATION OF THE CRITICAL POINTS

The identification of critical points is vital to define future strategies to be implemented in the pursuit of a more sustainable model. In the present study, the SWOT analysis was carried out to identify those elements, behaviors or practices that are benefiting or harming the system. In order to have a more detailed view of the components and how are affecting the study case, two SWOT analysis were carried out. The first correspond to the Society of farmers FCSASF and the other to the productive system.

5.1 SWOT ANALYSIS OF THE RPS FCSASF. THE SOCIETY– THE BENEFICIO

The RPS FCSASF includes two components: the society, as the legal entity (describe in the Chapter 4, section 4.3) and the *Beneficio* as place where the Dry and/or Wet process takes place. Here, both components were assessed.

STHRENGHTS	WEAKNESSES
The FCSASF Society - Is legally stablished. - Own a laboratory totally equipped and a *Beneficio*. - Own a commercial brand. - Vulnerable groups are included (women, indigenous). - The statutes are clearly defined. - Have experience with organic certification models. **The *Beneficio*** - It has a physical structure (for the dry and wet process). - It is totally equipped - There is space available to make compost. - It is located not far from the main street. - Can offer services to the community as a way to obtain profits.	**The FCSASF Society** - Lack of trust and participation among the members of the organization. - Failure to comply with the election periods for the Committee members. - Members have low awareness of the activities developed in the organization. - Limited commercial, financial and operative activity. - Low material resources (transport, internet, computer). - No affiliation with other institutions, Universities and/or NGOs. - Lack of mechanisms to assess the satisfaction of customers and/or members of the society. - The majority of the members are seniors and young people are not present in the organization. - Lack of insurance and/or hedge funds **The Beneficio** - Low activity. - Organic residues are not utilized - Inorganic waste is not properly managed - Equipment is old. - Do not keep records of production and/or sales.

OPPORTUNITIES

The FCSASF Society

- Many governmental supports are given only to farmers that are organized.
- Some sustainable coffee alternatives demand for farmer to be organized.
- Increased demand for coffee in the market.
- Opening of new markets, such as the Specialty market (demanded in San Luis Potosi).
- New alternatives for small scale coffee farmers are being developed in San Luis Potosi, such as the Organic Participatory Certification (OPC).
- Relatively rigid demand of coffee worldwide .

The *Beneficio*

- They have constant access to a source of water.
- No other *beneficio* is located in the zone.
- It counts with machinery to do the wet process.

THREATS

- **The FCSASF Society**

- Disconnection between governmental programs and the farmer's needs.
- Dependency on government programs to operate.
- Migration of young population to other cities or countries.
- Volatility of coffee prices
- Coffee prices depends on middlemen and are not cost based

The *Beneficio*

- Low coffee processing due to low production caused by environmental threats and problems with some agricultural practices.

5.2 SWOT ANALYSIS OF THE COFFEE PRODUCTIVE SYSTEMS. THE PRODUCTIVE SYSTEM - POST HARVESTING.

The productive system was assessed by a SWOT analysis. Additionally, the post harvesting and market are included in the analysis.

STHRENGHTS

The productive system

- Low environmental impact due to traditional management of the coffee plantation.
- High quality varieties used by farmers
- Farmers have a long trajectory in the coffee production.
- Farmers have an alternative source of food obtained in the Milpa and backyard animals.
- Farmers own their own parcels.

Coffee processing

- Farmers have a coping strategy to process the coffee in cases of low production.
- Many of the members are learning to do the wet process and are starting to be equipped with pulping machinery.
- The majority of farmers are drying the coffee properly.

Market

- Coffee varieties are highly demanded in the local, regional and international market.

WEAKNESSES

The productive system

- Lack of fertilization of the coffee trees
- Old coffee trees
- No renewal of coffee plantations
- Non selective harvesting of the cherries (in case of varieties and ripening stages).
- Incorrect pruning.
- Problems in shade regulation.
- Lack of seedbeds and nurseries
- Low quality coffee
- Lack of knowledge of quality markets by producers.
- Lack of management of the coffee plots
- Farmers are managed by eldery people.
- Low diversification of activities
- Use of vulnerable varieties of plants
- Lack of organic and inorganic waste management
- Lack of soil and quality water analysis.
- Low yields of production.

Coffee processing

- Hulk from the parchment coffee is not utilized for organic compost.
- Water is not reused.
- The quality water is unknown.
- Some farmers still dry the beans directly on the floor.
- Poor practices can harm the bean.

Market

- They have not done a market study to see their possibilities.
- The quality limits the potential market.
- They don’t own means of transportation to distribute their coffee.
- Low volumes make production be done independently; therefore there is not a traceability of the coffee produced under the commercial name.

OPPORTUNITIES

Productive system

- Good environmental and climatic conditions for Arabica coffee growing.
- National support is increasing through the reopening of INMECAFÉ and other initiatives that are looking to improve the production of Arabica coffee in Mexico.

Coffee processing

- Low cost practices can improve the quality of the coffee

Market

- Sustainable coffee is a growing business in the International level.
- San Luis Potosi offers only conventional coffee; specialty coffee and sustainable agriculture initiatives are scarce.
- Low national production of coffee has increase the demand.

THREATS

Productive system

- High infestation rate of Coffee leaf disease and the Coffee borer beetle.
- Young people are migrating to othe cities or countries due to lack of opportinities in the community, reducing the labor force of the family and the need to hire workers.

Coffee processing

- Low volumes of coffee due to external factor such as environmental problems limited the coffee processing in the Beneficio

Market

- Middlemen define the price of the coffee, and it is not based on cost or production.
- Coffee of the Municipality of Tamazunchale is not known as the coffee from Xilitla.
- Low domestic consumption
- Lack of advertising campaigns to encourages the consumption of quality

CHAPTER VI. PROPOSALS FOR SUSTAINABLE COFFEE ALTERNATIVES

6.1 VIABILITY OF ALTERNATIVES

In the present study, the viability of three different alternatives was assessed in order to propose which of them are more suitable for the FCSASF Society considering the results of the previous diagnosis.

6.1.1 VIABILITY OF CERTIFICATION PROGRAMS

Certifications are one of the main mechanisms implemented as a way to achieve sustainable systems (See section 2.2). Considering the fact that the FCSASF Society was already enrolled in an International Organic Certification program, other two models were assessed: Fairtrade and POC. In this case, it was verified the fulfillment of the standards by the FCSASF Society on each of the certification programs in order to assess the viability of the requirements. Additionally, the perception of farmers that are currently enrolled in these two certification programs was considered as part of the viability analysis in order to verify the compliance of sustainability principles proposed by each certification from a farmers' perspective.

6.1.1.1 Fairtrade

Alternative models in this emerging field such as Fairtrade have been widely accepted by many and criticized by other. The European Commission and EU members have recognized in many occasions the work of Fairtrade in reducing poverty and promoting sustainable development (Boto & La Peccerella, 2008). According to FTO, one of the main Fairtrade benefits is its role as a protective network in front of the drastic changes of coffee market, where farmers receive a price that covers their average costs of sustainable production in a sort of minimum price (Fair Trade International, 2014). On the other hand, some studies have shown that the main benefits of Fairtrade are non-economic but others such as the capacity building among members, empowerment of farmers, access to credit, the opportunity to develop better and new crops and pre-financing crops; all these benefits depend on the way organizations are configured (Boto & La Peccerella, 2008; CLAC, 2010).

On the contrary, other studies suggest that a third party certification such as Fairtrade and Organic represents a high cost for farmers to obtain it and to keep it. Additionally, the need of been in an organization to access to the international markets, represents a limitation for farmers that works independently (Fonseca ET AL.,2008; Bara et al., 2015).

Under this context, the viability of this certification was assessed for the case of the FCSASF Society in terms of level of organization, production system and potencial market.

6.1.1.1.1 Level of organization

Assessment of compliance with Fairtrade standards by the FCSASF Society is summarized in the figure 24 (each standard is explained in detailed in Annex G).

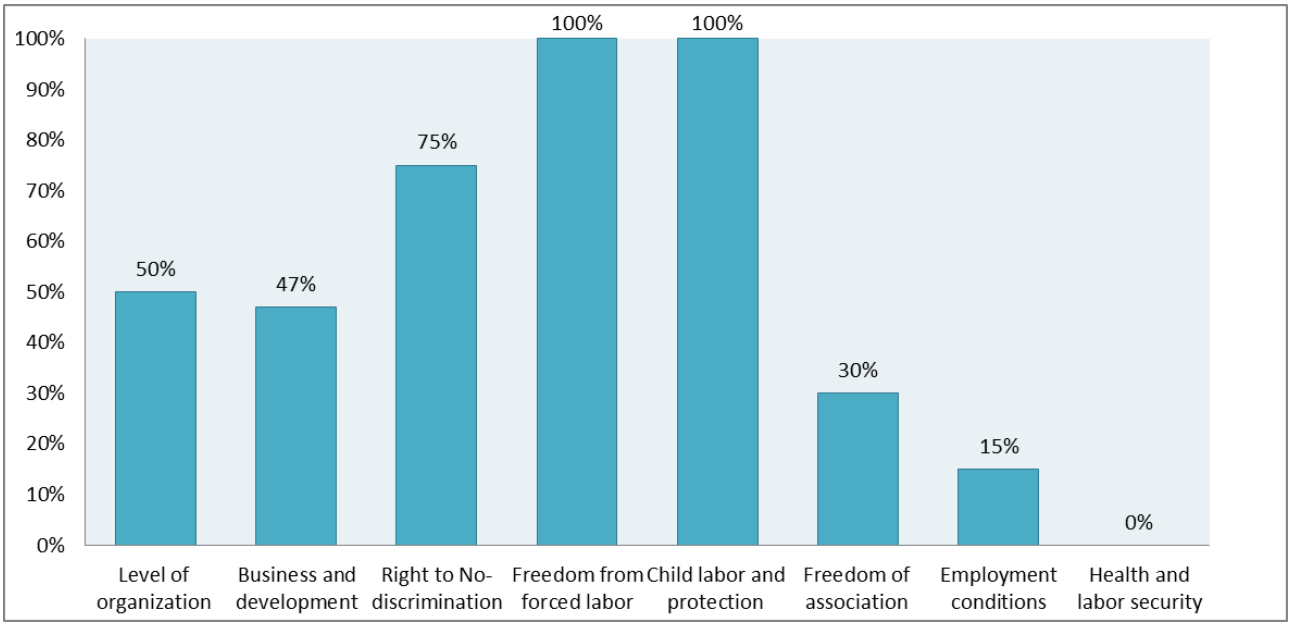

Figure 24. Assessment of compliance with Fairtrade standards in terms of organization level by the FCSASF Society

Source: Data obtained in the interviews held with farmers of the FCSASF Society and Legal representative of the organization considering the standard in the Fairtrade Standard for Coffee for Small Producer Organizations. Version 2011 (Fairtrade International, 2011) and the Fairtrade Standard for Small Producer Organization. Version 2011 (Fairtrade International, 2011) (See Annex G).

The fact that the FCSASF Society is already organized represents an advantage to obtain the Fairtrade certification. However, the organization demands that the agricultural work should be done mainly by the family unit and workers should not be hired throughout the year (Fairtrade International, 2011). This is a limitation since farmers of the FCSASF Society commonly hire workers from different places to help with the harvesting and weeding tasks. Especially, those farmers whose family members are no longer living in the community of San Francisco, which is the most common scenario identified in the diagnosis phase.

On the other hand, the child labor protection and right to no-discrimination are statements hard to assess. Despite the fact the legal representative of the FCSASF Society assured that people under 18 years are not hired and minorities are included, the reality might be different. In a study case assessed in Veracruz, in the OCOZACA Cooperative[13] farmers recognized that they are hiring entire families, including children, from poorer neighboring communities, in the harvesting times. This is a clandestine practice that is hard to control and avoid, since this have been the *modus operandi* in the coffee system that couldn't have been substituted with other practices. Additionally, farmers claimed that this is the only affordable labor force they can pay. Many of them claim that this represents a support for these families that do not have other sources of income than the coffee harvesting.

In terms of employment conditions and health insurances, the FCSASF Society has the lowest performance. This was previously determined in the diagnosis phase and confirmed here again. Farmers in the FCSASF Society hire informally their workers, and do not offer any insurance or contract. This is a logical situation, considering the fact that they themselves do not have any insurance neither their family members.

Even though the FCSASF Society has a well-defined administrative structure, the members have not been submitted to elections in the corresponding period of time. This situation threatens the democratic system of the FCSASF Society and represents an important limitation to access to a Fairtrade organization.

In general terms, the FCSASF Society has the advantage to be organized and legally established. However, this represents only part of the requirements established in the standard. Many limitations are found in terms of organization, legal requirements and employment condition, adding to other constrains identified in the diagnosis such as lack of participation and sense of

[13] OCOZACA (comes from the combination of the names of the two first producing communities involved in the organization: Oco from Ocotlican and Zaca from Zacamitla). It is an organization conformed of 24 small-farmers located in Zacamitla. Municipality of Ixhuatlan del Café Veracrúz. They are currently managing a Fairtrade and CERTIMEX certification. The organization started to be re-invented after the earliest coffee organization failed due to economic problems and corruption. Many of the members were brutally affected, leading them with high debts and no hope to start a new project. Mister Felipe Melchor, the current responsible of INCAFESAM, saw the potential of the area to restart an organization. Years of hard motivational work, capacitation with experts and a strong sense of team was the key to start a successful sustainable model. The organization was established on t market. he principles of hard work, innovation and high quality products in order to access to a differentiated.

belonging among the members. These limitations should be solved, not only to get a certification, but also for any other program where the organization wants to be involved.

6.1.1.1.2 Production systems

Fairtrade establishes in their principle number 10 (see table 2) the necessity of the implementation of sustainable techniques and technology to minimize the gas emissions and environmental impacts. However, a minimum level of pesticides and chemical substances are allowed, and environmental requirements are not strict as those presented in the Organic certification. The results of the standard assessment of the productive systems are summarized in figure 25.

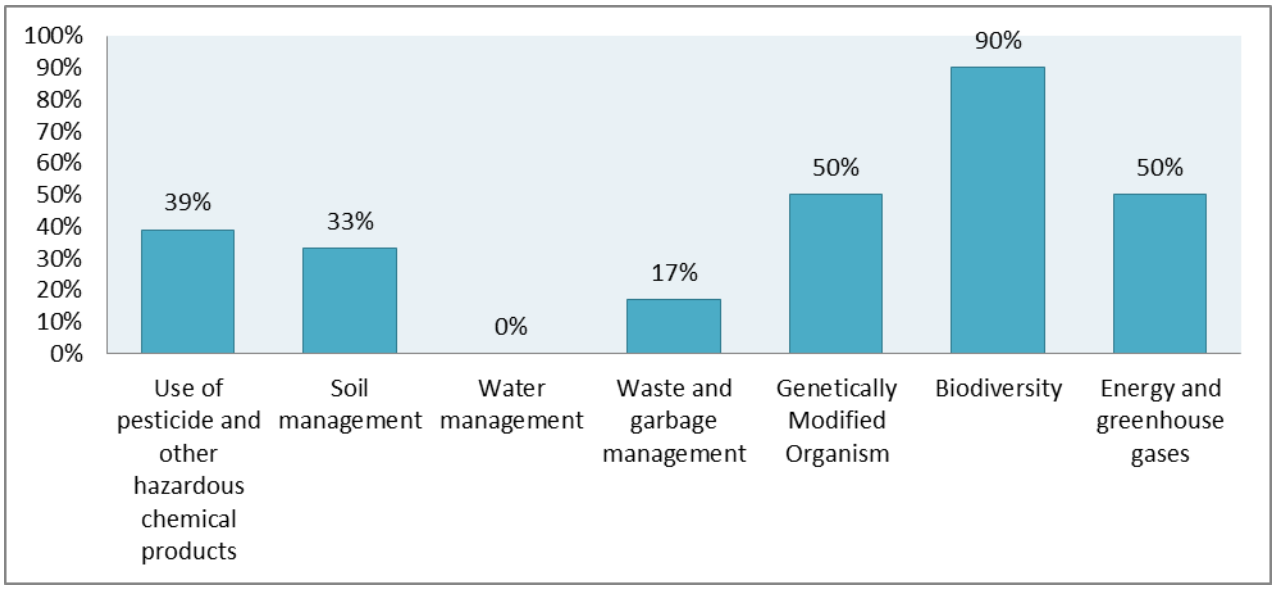

Figure 25. Assessment of compliance with Fairtrade standards in terms of productive systems by the CSASF Society

Source: Data obtained in the interviews held with farmers of the FCSASF Society and Legal representative of the organization considering the standard in the Fairtrade Standard for Coffee for Small Producer Organizations. Version 2011 (Fairtrade International, 2011) and the Fairtrade Standard for Small Producer Organization. Version 2011 (Fairtrade International, 2011) (See Annex G).

Biodiversity management is still the strongest component. In this context, the traditional polyculture management represents an advantage for them in terms of biodiversity conservation and reduction of vulnerabilities. However, one of the main critiques by farmers enrolled in a Fairtrade certification of OCOZACA group is that biodiversity management is not performed by all the farmers the same way. As a result, farmers that invest time and money to have a plots highly biodiversified with live barriers receive the same economic benefits of those that accomplished the minimum requirements.

In term of soil management, farmers involved in the FCSASF Society only accomplish 33% of the requirements. An expected result since many of them do not fertilized their plots and the practices to reduce erosion problems are only implemented when economic resources are available.

Despite the fact that more than 80%of the farmers do not use pesticide, those that are still using it do not comply with the security protocols and proper storages techniques. As a result, the performance in this area decreases.

The water and waste management standards receive the lowest percentage of accomplishment. The community still does not count with a formal waste collection system and water is not reused or treated in any case.

According to farmers of the OCOZACA Cooperative, the most difficult part to obtain the certification was the accomplishment of the standards, such as: adaptation to the norm, avoiding some techniques such as *chapeo*, establishment of life barriers and removing all the plastic garbage from the soil. Despites that, farmers are aware of the importance of these techniques and the benefits perceive after years of implementation.

In general terms, some of the requirements can be achieved after some modifications, while some others do not depend directly on the FCSASF Society, such as the waste collection system. Additionally, some of the standards require the investment of money in infrastructure and materials, which might result a difficulty for the FCSASF Society in the present moment.

6.1.1.1.3 Market conditions

The current crisis in the coffee market seems to be a good opportunity to explore other markets, and considering the way coffee is produced in Mexico, certification alternatives are proposed to be developed (Escamilla P, et al., 2005). Despite the fact Fairtrade coffee is one of the first sustainable coffee alternatives in the market, in the last years, the sales have not increase as other certification programs have done (See figure 9). The per-annum growth of Fairtrade production and sales has been the same over the last five years, resulting in a constant ratio of sales to production (30 %) over the same period. Taking in consideration the principles established in Fairtrade, where many of them are related to the trading systems and the advantages of a competitive price in the market, this results an issue to farmers that make an effort to accomplish all the requirements to assure a minimum price, but at the end do not perceive the benefits of the fair trade (Potts et al.,2014). This situation was reported by one of the farmers interviewed in OCOZACA Cooperative; he considered unfair the income perceived by them (9pesos/kg of cherry) compare to all the work investment they had to do. Additionally, for some other farmers the price

received do not seems fair, basically because the price is not based on production costs and the fee is not adjusted annually. It is imporntat to mention that in order to have easy and rapit access to cash money, they still sell part of their production to middleman (called in Spanish *Coyote*), when the prices are higher. It means that the fair trade is not assure in this cases.

On the other hand, some farmers of the OCOZACA Cooperative consider that one of the main benefits of been part of a Fairtrade certification was the stability of the prices and that the main benefits is the fact that they are now organized.

Leaving aside these limitations, and considering that the FCSASF Society finds a client that is committed to buy their coffee every cycle, it is probable that the volumes and quality requirements are not going to be achieved, at least not in the current situation that is facing the FCSASF Society. As the coordinatior of CLAC for small-scale farmers in Mexico inmentioned (CLAC Coordinator, Personal Communication, 2016. 3.23) regardless the volume of product and the limitation it represents for small-scale farmers, she respond that " we have been working on the profitability of the plots. We go on that walk to go create awareness that we must be more profitable precisely because that has to do with the amount of product harvested in a certain area under certain conditions". In fact, the volume and the costs of permanence in the certification, were the main problems faced by the FCSASF Society during the period of time they had the Naturland certification. In the best of their productive years, they couldn't reach the volumes required by the international clients. To overcome this kind of problems, organizations such as OCOZACA have created a Federation of Cooperatives with other coffee producer organizations in the State of Oaxaca and Chiapas, in order to reach the neccessary volume require to be exported.

The coffee quality is other problem that needed to be solved before considering get into a the Fairtrade certification. Even though Fairtrade don't manages high quality standarts as Specialty coffee does, a minimum of quality requirement needs to be accomplished. Problems of fermented or defective grains are damages that threaten the export of grain.

6.1.1.2 Participatory Organic Certification

6.1.1.2.1. Level of organization

The POC was designed in response to the limitations of the third-party certifications for the small-scale farmer. In terms of level of organization, the POC is intended for individual and/or small group of producers who destine their production to consumption or for the local, regional and national market (Tianguis y mercados orgánicos, 2016). In this case, the farmers of the cooperative can get involved as an organization or as individuals. This gives a broader range of action, since a smaller group of farmers or a single one can get this certification, with fewer requirements to meet.

6.1.1.2.2 Production system

The productive standards are stricter compared to those of Fairtrade, since organic production must be ensured in this certification. It means that the level of permissiveness is lower and many practices must be reoriented and strictly accomplished under an organic perspective. The results of the standard analysis are presented in the figure 26 (for more detailed information about each standard, refer to Annex H).

Starting with the periods of conversion, it is probable that it can be shortened since many of the farmers stopped using chemical and pesticide 15 years ago. However, some of the farmers still implement some kind of pesticide listed in the red list. Other important point is the record of the background management; many details are not registered and documented by the farmers. This might represent a problem.

The highest score obtained was the wood usage because farmers are using wood for their own consumption and keep planting timber trees. Erosion prevention is accomplished in a 58% and weeding and pest management 50%, since many of the preventive practices implementation depends on economic resources availability and labor force. Soil improvement, receive one of the lowest score, basically because of lack of fertilization and soil test. Recycling and reuse of the sub products of coffee such as coffee pulp is not implemented, as well as any mechanism to save energy.

Regarding the harvesting and transformation of ripe coffee cherry, some mechanisms and steps are not carried out properly, such as: cherries harvesting, storage of coffee, record of production

and quality control, among many others (See detailed information Annex H). In this case, farmers of the FCSASF Society need to improve their techniques and management skills.

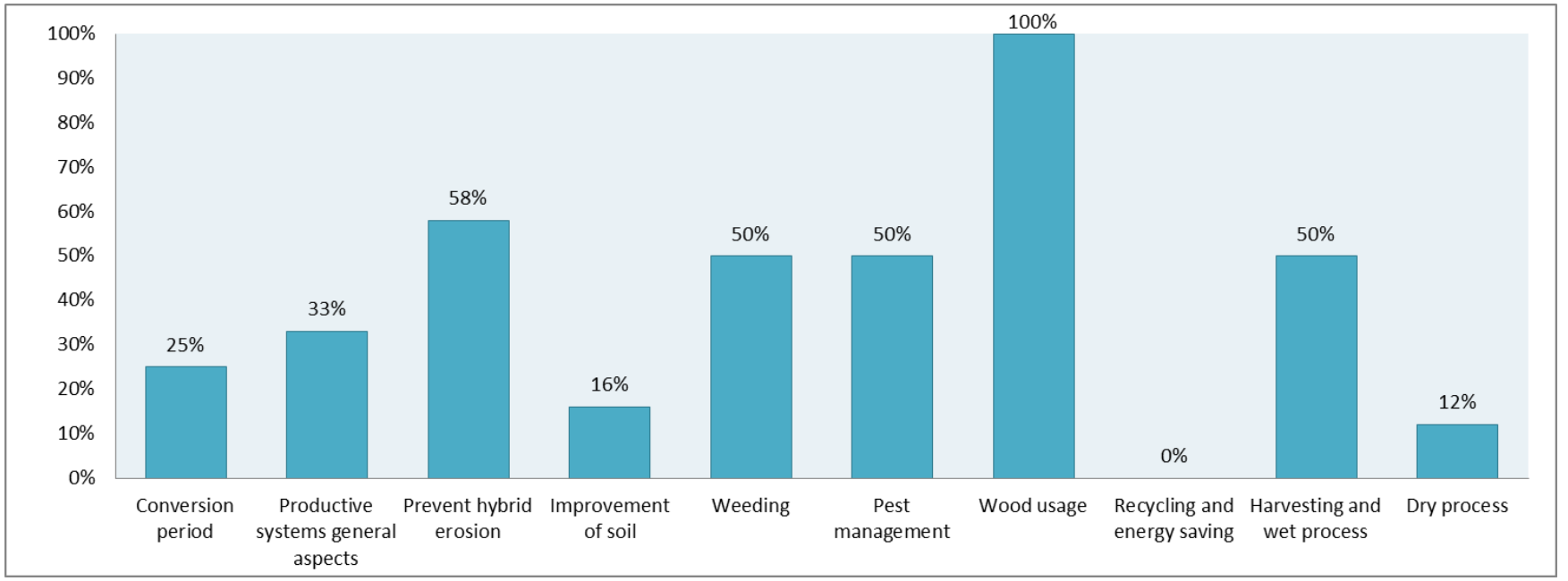

Figure 26. Assessment of compliance with POC standards in terms of productive systems by the CSASF Society

6.1.1.2.3 Market conditions

According to Schwentesius – Rindermann and collegues (2013), The REDAC has been the most important movement created in Mexico that promotes the locally consumption of organic production since 2004. In 2013 REDAC counted with 28 markets in Mexico and nine in construction process, proving that there is a growing interes of this alternative by mexican people.

The POC label is only valid at national level, and farmers themselves must be in charge of selling and deliver their product to the final consumer through the *tianguis*, markets and direct delivery (Tianguis y mercados orgánicos, 2016). In San Luis Potosi, there is only one *tianguis (*Market of organic and natural products Macuilli Teotzin*)* around 8 hours from the community of San Francisco, and take place only one day per month. This

might represent a limitation in terms of selling opportunities and distances between the FCSASF Society and the market. Additionally, the FCSASF Society does not have any transportation mean, what increases the costs.

It is important to mention that the Organic *tianguis* was established just in 2012 and the POC alternative was established just two years ago as a legally certification. It means that it is a recent alternative. In fact, none of the farmers or staff working in the CCT that were interviewed knew about this type certification. According to coordinators of the *tianguis* in San Luis Potosi, it is expected that products certified with a POC will acquire more space in the market in the next years. Additionally, the *tianguis* in San Luis Potosi is currently going through a legal process of accreditation to be recognized as an organic market with all the requirements set by law. This might take a couple of month. Therefore it would be considered a tangible alternative once this step is finished. Until now, farmers and other producers are selling their product with the label of "natural product"(Coordinator of the Tianguis, Personal Conversation 2016.07.16).

According to a coffee farmer that is holding a POC, nowadays she is selling its coffee based on the cost of production, resulting in a higher price compare to conventional coffee (Farmer POC in Aquismon, Personal communication, 2016.05.02). She has the advantage that her plots are located in a very touristic area, right there were she produces the coffee and she sell it to the tourist that comes to visit the area. Additionally, her son who is studying and working in the city of San Luis Potosi help her to sell the coffee in different places, besides the organic *tianguis*. However, without this favorable condition, she would face certain limitations to sell her product.

6.1.2 VIABILITY OF SPECIALTY COFFEE ALTERNATIVE

Specialty coffee was not an alternative considered at the beginning of the study. However, it is included within the possible alternatives since it was recognized that different organizations and independent small-scale farmers are participating in this relative new market.

Specialty coffee is defined as the "the highest-quality green coffee beans roasted to their greatest flavor potential by true craftspeople and then properly brewed to well-established Specialty Coffee Association of America (SCAA) developed standards. Specialty coffee in the green bean state can be defined as a coffee that has no defects and has a distinctive character in the cup, with a score of 80 or above when graded according to SCAA Standards" (SCAA, 2016). Unlike conventional coffee market which has been focused in quantity not quality, specialty coffee looks for unique beans with different aromas and flavors that are produced by small-scale farmers in

mini-plot, where all the data of origin is specified. It was proposed that if small-scale farmers focus their effort on quality, but not quantity, they could find a way in the coffee business nowadays (Bajak, 2014).

Despite the fact that specialty coffee is not usually classified as a sustainable coffee, it might be a good option for small scale farmers to improve their economic source of income; and depending how the system is managed, it could be an environmentally and socially sustainable alternative as well. During the field trip, it was visited a Specialty Coffee Farm, that produces Specialty coffee using organic standards. However, this type of coffee does not demand organic production standards and chemicals are allowed.

The general factor to be considered in order to achieve this product is:

- The variety must belong to Arabica coffee
- Altitude above 1000 m.a.l.s,
- Selective harvesting
- Master roaster is in charge of roasting
- Good production practices.

In order to analyze the viability of this alternative, three aspects are considered: Level or organization, productive system and market conditions.

6.1.2.1 Level of organization

Compare to certain certification such as Fairtrade, specialty coffee do not require a specific level or organization. What matter in this type of production is the origin of the coffee. In fact, it can be developed by one farmer or a small group of farmers by mini-lots of differentiated production. In this context, The FCSASF Society could define a group of farmers with the better practices and performance willing to dedicate some hectares of their plots to start producing specialty coffee. This has been the way the OCOZACA organization is starting to develop specialty coffee plots.

6.1.2.2 Production systems

Specialty coffee is not defined by pre-stablished standards in the production phase. However, the cultivation, harvesting and processing process should be carried out so that high quality beans occur. As a result, only high quality products will accomplish the cupping, roasting, water and brewing standards established By SCAA. It means that in order to have high quality coffee, the production phase is fundamental, and, even though there is not a define guideline of Specialty coffee production, there are some basic elements to take in consideration. The lists of requirements were established based on the coffee management of “Sustainable Coffee Farm, La

Herradura, Xalapa. Mexico" . This farm has been improving their production technique in a way that years after years have earned a higher score for its coffee (year 2013 obtained 90.44points) and different awards (Second Harvest 2010, First Harvest 2011) (Agroentorno, 2012).

These basic requirements of production were assessed for the case of FCSASF Society. The results are presented in the figure 27.

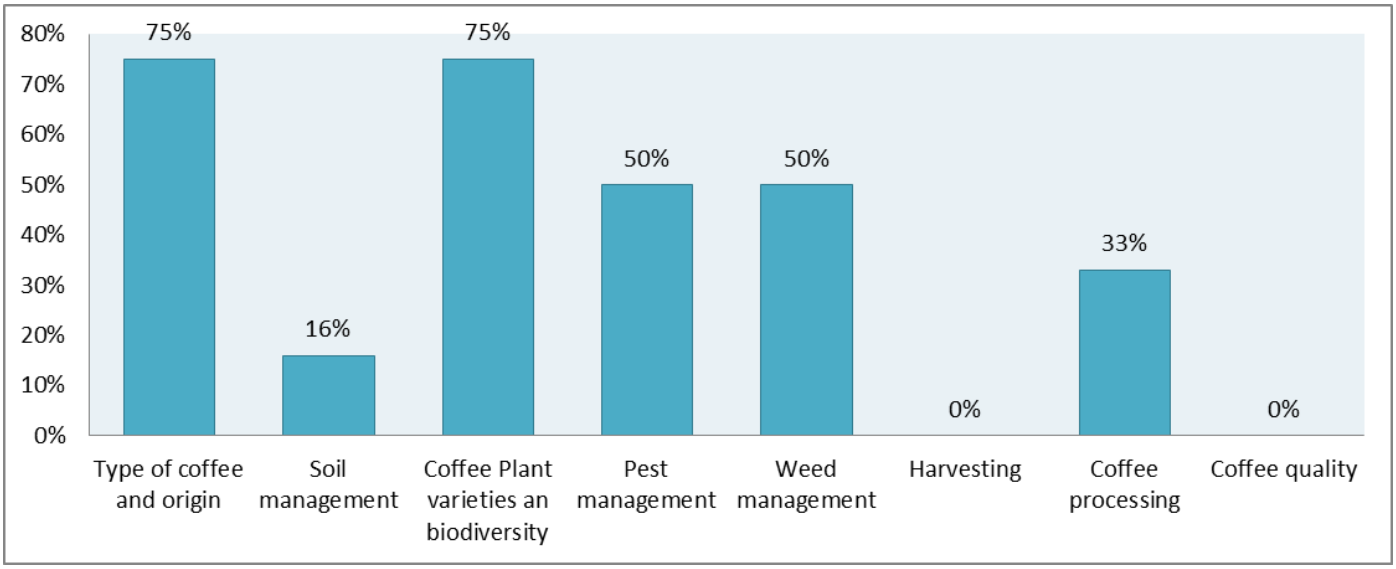

Figure 27. Assessment of compliance with Specialty coffee productive minimum requirements

The first requirement here announced is the type of coffee and origin. In this context, the FCSASF Society farmers are using high quality varieties (see table 16 to see detailed information about the varieties used). However, many of the plots are using old plants. It is important to mention that the new varieties that are trying to be introduced in the state of Tamazunchale are not recognized for their quality, but for their resistance to the rust leaf, Standard or less than Standard quality (Example, Costa Rica variety) (Anacafé, 2013). If farmers start using this coffee varieties and eliminating varieties such as Bourbon and Caturra, this might threaten the possibility to get into the specialty coffee field.

Additionally, biodiversity is, as for the other alternatives, the component that reaches the highest compliance percentage. On the other hand, pest and weed management techniques are implemented but these are not done in an integrated way. The coffee processing has many problems that were also mentioned in the POC viability analysis. Due to the problems in the coffee production, coffee quality do not fulfilled the minimum requirements to reach the 80 points (See

section 4.4.4.2 Organoleptic and physical description of the coffee Café Corca). Additionally, it has been not recently tested by a qualified barista, except for this study.

On the other hand, altitude is also a factor consired in specialty coffee. This are required to be grown above 1000 m.a.l.s (strictly high), it means that not all the plots of the farmers of the FCSASF Society are suitable candidates for producing specialty coffee. However, during the field trip to Veracruz, experts in the field claimed that farmers with coffee plots localted under this altitude have been awarded as best specialty coffee of the year. This depends directly on how farmers are managing their productive systems and the tecniques that are been implemented.

The other important topic are the volumens of coffee required. It represents a advantage for small-scale farmers that ussually manage less than 5 ha. Specialty coffee is required in low volumens. According to one farmer of OCOZACA, who started a mini-plot of the variety Garnica for specialty coffee production, the implemented practices do not differ much from those that he already had been developing. They recognized that the biggest difference is the selectived harvesting, but all the other practices are common for them. However, it is important to mention that this farmer has followed organic standard of production since 2000. As a result, many good management practices were already implemented.

In general terms, the performance of the FCSASF Society in the production must be improved an analyzed in each state in order to reach high quality beans.

6.1.2.3 Market conditions

The emerging of new alternative are making more conscious consumers regarding some topics such as quality, safety and sustanability standards. At the same time, the coffee culture has been promoted by offering different flavors, aromas and places to aquire the product (Gaucín, 2012). As it was mentioned by the manager of Expo Café, the emergence of coffee bars in Mexico are promoting “slowly but surely” the consumption of specialty coffee. Mexican consumers are appreciating the flavors of coffee as happened with wine (Rodriguez, 2014). Specialty coffee consumption rose in the last years much more than other differenciated markets, mainly in US and followed by Europe. In 1999 less than 10% of specialty coffee was comprised in the market share, and almost 10 years later, it changed to 40% (Hengan, 2015). However, specialty coffee consumption has increased also in emerging markets such as Brazil, India and China where high demand for quality coffee are competing with the most developed market represented by US (SCAA, 2012).

In Mexico, in the last years, the efforts to promote this maket has increased by the side of the farmers and coffee companies. According to Sylvia Gutierrez (2014), it has been identified 60 regions in Mexico where specialty coffee can be produced.

The specialty coffee market in San Luis Potosi is mainly focused in 4 coffee shops. However, these stores are using specialty coffee from Veracruz, Nayarit and Chiapas, but not from San Lusi Potosi. In fact, there is no production of this product in the state. According to Julieta Vázquez, it would be a market niche that farmers of San Luis Potosi could occupy, only if the coffee production system is improved. This could be a profitable potencial national market.

In term of prices, the difference is definitely and important factors. Regular market of roasted coffee in San Francisco, in average, reaches prices between 80-120 pesos/kg. Specialty coffee in June 2015 reaches 27.72 $/pounds, which represents around 1097pesos/kg. Prices of specialty coffee from 2014 to 2105 have increased 12.5% (SCRPI, 2015).

In order to assess the viability of the alternatives presented, here is summarized a table of accomplishment of each alternative.

Table 19. Table of accomplishment of each alternative

Alternatives	Level of organization	Production system	Main critical points to be improved
Fairtrade certification	Medium	Low	Low volumes, low quality, inner organizational problems, lack of traceability.
POC	Medium high	Low	Lack of accomplishment of the organic standard, market in development, low infrastructure
Specialty coffee	Medium high	Low	Low quality and lack of traceability.

The level of accomplishment follows these values: high 100%- 80%, medium high 60% - 79%, medium 40% -59% low ≤ 39%.

Even though here is exposed some general information about the market conditions of each alternative, it is necessary to conduct a thorough market analysis for each option in case some of these alternative are considered. However, it seems that the specialty coffee is a market niche not occupied in the state, which can be an opportunity to take in consideration.

6.2 PROPOSAL OF ALTERNATIVES FOR A MORE SUSTAINABLE SYSTEM

The diagnosis phase and viability analysis shows that some alternative are more viable than others. However, each of them could be developed only if some conditions are changed. In any case, there are critical inner points that affect the viability of all the alternatives presented. These are: the level of organization of the FCSASF Society and the production system of the farmers, which includes the cultivation, harvesting and coffee processing. Additionally, the FCSASF Society has been affected by external elements such as changes in the climate and the coffee prices, among many others. However, many of these problems or constraints identified also in other cases (case 1 and 2) were managed through different strategies enabling them to be less vulnerable in front of external threats. Develop more resilient systems through the diversification of its activities and seeking market niches accessible and favorable for them, has been the strategy implemented by many small-scale farmers to overcome the coffee crisis.

In fact, all the successful cases here addressed have a common pattern: the diversification. Each of the systems made use of their own strengths and resources in order to make a more resilient and sustainable system through the diversification of their source of income and its inner activities. Some cases, such as the OCOZACA Cooperative has used the certification as a mean to address a market that will provide them with a stable price. From here, they have created a network of activities that has integrated not only the farmers but their families. Including the children that are been integrated in educational programs. Other cases such as the MUKEMAL cooperative are looking to maintain their systems by applying a different logic of production and dabbled into a market that was not developed in the area until now. The Sustainable Coffee Farm, “La Herradura”, have been using their experience and knowledge not only to produce high quality coffee, but to deliver workshops and conferences to different stakeholders, becoming that way a national reference for sustainable coffee production.

The management and development of each case is different, but all of them share a common idea: do not depend exclusively on coffee. This should be the starting point to be considered by the FCSASF Society members. Their dependence on coffee has made the organization a vulnerable system and less resilient in front of the external changes.

Case 1. OCOZACA Cooperative - An example of a successful diversified system

The main focus of this cooperative of small-scale farmers is to work as part of an extensional program, looking for the diversification and independence of governmental programs. In order to achieve this, the cooperative has developed activities in different areas: educational activities addressed to children, farmers and other stakeholders; capacity building for internal and external farmers; workshops conducted by farmers of the cooperative, experimental nursery, coffee tours, academic exchange with the University of Chapingo and other National and International institutions. Additionally, they are managing two international certification models: Fairtrade and Certimex and currently dabbling in the specialty coffee market (**See Annex J**). The main objective is to "sale knowledge" through a diverse range of workshops and activities that are offered to the public and other farmers. At the same time, the organization offers services of food and residence for visitors, in which many of the farmers' wives are working. On the other hand, they manage a conventional and organic Beneficio, where all the employees are members of the organization.

It was interesting to see that the Fairtrade certification is one of the elements of the whole systems, but not the main reason for the organization. In fact, the certification has been used as a starting point to have a stable source of economic income, however, it was evidenced that other markets want to be approached, such as the national market and specialty coffee. The figure 28 summarized the complex system managed by the OCOZACA Cooperative in order to diversify their activities. Each element is interconnected with each other. That way they are complementing their activities. The sense of this organization is to diversify their activities, based on coffee as the main concept. From here, other activities were created.

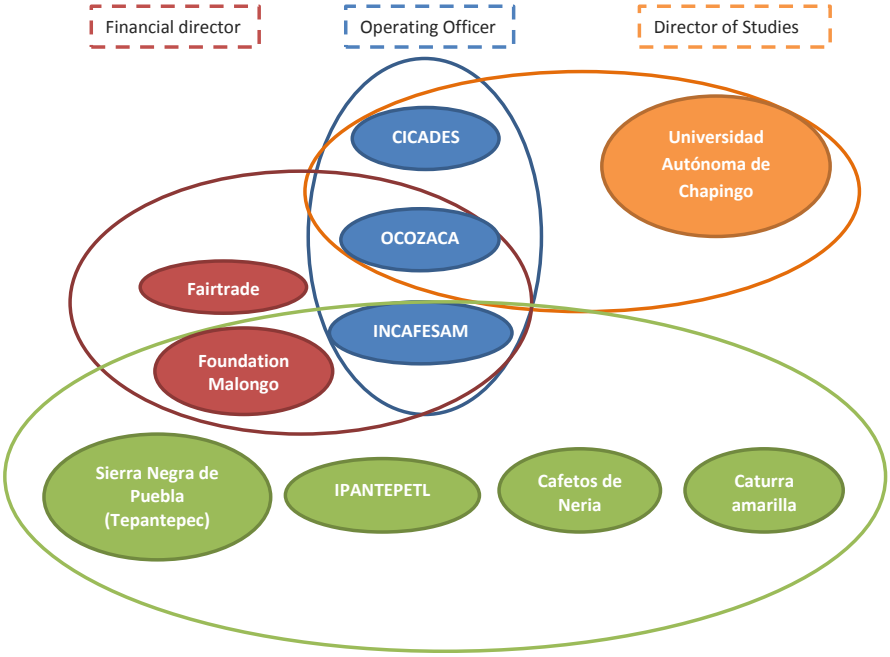

Figure 28. OCOZACA Cooperative Organizational scheme

CICADES: is the professionalization center of OCOZACA managed by the farmers themselves. It means that they deliver the workshops base on their own knowledge and experience to other farmers and interested groups. **INCAFESAM**: the commercial entity that works with the financial director and others productive organization (green color) in other states of Mexico. **Foundation Malongo** is the sponsor and first client of OCOZACA. **Universidad Autónoma de Chapingo** is the academic assessor of the OCOZACA Cooperative for the exchange of knowledge.

Source: Own elaboration with data obtained in the questionnaire and interview with one of the coordinator of the INCAFESAM.

Case. 2. MUKEMAL cooperative

The second examples correspond to a case where farmers have diversified not only their activities, but also their crops. As it has been mentioned, crop diversification is one of the most common strategies to reduce vulnerabilities and become less dependent on a unique source of income. This approach has been developed by the MUKENAL cooperative. Located in the community of Oxchuc, Chiapas, a group of 8 farmers have chosen in 2008 to organize themselves in a cooperative association under the name MUKENAL. Currently, the organization is formed by 4 members. This organization of small-scale farmers emerged with the main purpose of overcoming many of the difficulties faced as small-scale farmers and to develop strategies to improve this situation. Under an innovative perspective, they started to diversify their crops by introducing commercial fruits, mainly peach and avocado in order to gain independence from a single crop, that is represented by coffee for some of the members. Contrary to many of the farmers in the area, the MUKENAL Cooperative has applied a different agricultural logic. They are planting their crops systems under the following strategies: diversification of crops, crop rotation, soil conservation and low chemical implementation by implementing the knowledge acquired throughout the workshops and their own shared experiences. "Meanwhile, the majority of farmers here in Oxchuc keep using herbicides such as gramoxone and burning their lands" (Gómez-Santos, C (personal communication), 17.05.2016).
In the year 2008 and 2009, they started to look for capacitation and technical advisors in the whole country in order to diversified their crops under an agroecological perspective. Additionally, they support each other in activities such as weeding and harvesting. During the year 2011-2012, they did a trip to different places in Mexico (Michoacan, San Luis Potosi and Zacatecas) in order to visit model plots and receive technical capacitation. They work with other indigenous groups belonging to the Tenek ethnic group located in San Luis Potosi.

Mr. Salvador Gómez López, is the only coffee producers of the organization since his parcels are located in an appropriated zone for coffee growing (between 1400 and 1500 m.a.s.l). Currently, the productive unit is conformed not only by coffee but also by avocado trees, peach trees and Milpa. Nowadays, for Mr. Salvador the coffee production occupies a second level of importance in terms of productivity while avocado occupies the first place and peach the third one. In the farm, it is evident that the majority of the effort is focused on the avocado production (the creation of terraces, the use of manure and the time investment in this activity). Mr. Salvador assured that the productivity of avocado per hectare is much higher compare to coffee (according to him, 1 Ha of avocado correspond to 4 ha of coffee, in terms of production). In bad years for coffee production, Mr. Salvador has an alternative activity that helps him overcome the thin months, which is the avocado production. Other activities that the rest of the members are developing are production of the fungi *(Pleutorus ostreatus*) which is an alternative to satisfied nutritional needs and it's a source of income that does not require an important initial investment (SAGARPA, ...). As well has honey production, manure, among others.

Once the inner elements are functioning correctly, external alternatives can be added to the system. The proposal is presented in a number of steps that the organization should follow in order to improve its performance.

6.2.1 STEP 1. IMPROVEMENT OF THE INTERNAL SYSTEM

6.2.1.1 Improvement of the Level of Organization

It was observed that diversified systems such as the OCOZACA Cooperative and MUKEMAL manage a different logic of organization. In this case, each of the farmers has to fulfill a role and each of them is vital for the organization. Their action and plans should be discussed by all the members and there is a constant feedback between each other in order to grow all together as a unit. To achieve this level of complexity it is necessary to have highly motivated members willing to actively participate in the organization and develop other activities besides the coffee production. In this sense, the level of self-reliance and sense of belonging in the FCSASF organization must be strengthened in order to move into other areas that are not within the comfort zone, such as do workshops, participate in the organization's activity, take different positions and responsibilities and not being just passive members. In this context, the FCSASF Society has still work to do since the lack of confidence and integration in the decision making was determined to be one of the problems in the organization.

Additionally, the dependency on governmental programs is an important barrier that farmers need to overcome. Many of these programs have created so much dependency on farmers that many of them do not feel confident to undertake their own projects without the backup of the state. In this case, the FCSASF Society needs to improve and change the logic of how they have been working until now. According to Mr. Melchor[14], (Melchor, Felipe, Personal Communication, 05.06.2016), it is necessary to strengthen the trust and create awareness of all the knowledge the farmers have that can be used as their instrument to overcome their problems. This way they feel capable of undertaking new challenges and motivated to start their own project.

In order to address new alternatives, the FCSASF Society must strengthen and improve some aspects already mentioned in their organization status. It was determined that the viability of each alternative considered for this study depend largely on this aspect. Here are presented some starting strategies that have been already implemented by small-scale farmers of other states in Mexico with similar problems.

[14] Representative of INMECAFÉ and leader of OCOZACA Cooperative

Table 20. Strategies to improve the level of organization of the FCSASF Society

Problem to be tackle	Strategy for solution
Lack of participation of the members and confidence in the organization.	- Respect election dates and include all the members to be part of the representative committee. - Include all members in the decision making process. - Develop mechanism to assess satisfaction of the members that are easy to apply. - Develop mechanism to improve farmer's confidence, through the implementation of workshops and motivational speech. - Visit and/or invite producers from other places to share their experience. Example, farmers of the OCOZACA Cooperative.
Isolation of the organization	- Establish contact with universities, educational institutions and NGO located in the area. - Get in contact with other small-scale producers that are facing the same situation. - Visit successful cases in other places. - Participate in fairs and events.
Lack of involvement of young people in the organization.	-Develop workshops for children and young people to start integrating the youngest generation in this activity. -Integrate the young kids in activities that are easy to do and do not interfere with them in their schooling activities.
Low economic resources	- Develop extra activities that can provide additional inputs of money. It could be the development of small nurseries for the plants selling. Each farmer can dedicate a couple of hour to develop this activity and sale the plats to other producers of the area. - Open its facilities (*Beneficio* and Laboratory) to the public by offering its services. They could rent the laboratory to universities to make practices. At the same time this will generate other economic activities such as the rent of rooms, selling of food, among others. - Create composting for selling and own consumption (manure, vermiculture). - Improve their productive system (explained later). - Create work commissions composed of the same members in order to support each other with the activities. That way they won't require money to start working their plots.

Once the FCSASF Society has reaches a more stable level, they can consider to integrate other alternatives to their system, through the joint decision of its members and what are their objectives.

6.2.1.2 Improvement of the productive systems

The strategies that are going to be implemented in this area depend directly on the alternative the organization considers appropriated to be developed. Each alternative has established some rules that were presented in the Annex G, H and I. However, some study cases have achieved sustainable systems without managing this type of alternatives. In any case, there are basic elements that a productive system should meet in order to improve its performance. These are: (These strategies were gathered during the field trip).

Table 21. Basic strategies to improve the productive coffee systems.

Area	Problem to tackle	Specific area	Possible strategies	Recommended for
Cultivation	Quality and resistance	Plants quality	- Creation of nurseries to have plants available the whole year for the renewal of the crops. This will also provide an extra source of income by selling their plants to other farmers in the area. - Crop high quality seeds in order to have strong plants and do not waste time and money the following years.	POC and Specialty coffee
	Quality and resistance	Soil fertility	- Creation of compost areas making use of the hulk that is wasted in the *Benefico* and the local organic residues. - Fertilization of plants at least 2 times per year. - Carrying out soil tests to schedule the fertilizations throughout the year considering what are the missing components.	POC and Specialty coffee and Fairtrade
	Quality and resistance	Pest and diseases management	- Use organic substance to control/prevent pest and diseases. - Harvest completely the cherries and pick cherries	

			from the soil. - Shade regulation and of natural repellents.	
Harvesting	Quality and resistance	Low resistance/ high quality coffee varieties	- Varieties such as Bourbon, Typica and Caturra are high quality variables, but low resistances. If the organization looks for quality coffee (Specialty market), they should keep this plants and implemented good soil fertilization practices and pest and disease control.	Specialty coffee
		High resistance/ low quality varieties	In case the organization looks for quantity and now high quality, they can implement varieties such as Costa Rica, which are less demanding.	Fairtrade, Organic
	Quality and yield	Proper cherries	- Selective harvesting of ripe cherries.	Specialty coffee and Fairtrade
	Quality		- Selective harvesting of the varieties	Specialty coffee
		Damages for uncontrolled fertilization	Waiting periods less than 24 hours.	POC and Specialty coffee and Fairtrade
Processing	Quality /environmental conservation	Water waste	- Reuse the residue water of the wet coffee process (only if the process has follow organic standards) to water other crops. - Implement rustic water harvesting systems.	POC and Specialty coffee and Fairtrade
	Environmental conservation	Waste management	- Recycle those material that can be sold (canes, some plastics)	Fairtrade and POC
	Quality	Drying process	- Use concrete clean floor or/and drying beds to not contaminate the bean (this last one is required for specialty coffee)	POC and Specialty coffee and Fairtrade
	Quality and yield	Pulping process	- Invest in a disk pulping machinery to protect the grains	Specialty coffee and Fairtrade

	Quality and yield	Storage	The bags should be placed 10 cm from the floor. No other substance should get in contact with the coffee grain that can contaminate the product.	Specialty coffee and Fairtrade

6.2.2 STEP 2. DIVERSIFICATION OF THE SYSTEM

It is important to understand that diversification in this context can refer to the implementation of different activities that, in theory, seems to be contradictory. Farms that are producing specialty coffee to supply the national and international market are accompanying this activity with diversified productive systems for their own consumption and local selling. This not only strengthens its economic source of income, but also protects the environment and provides healthy food to the farmers. The important idea that derived from the cases analysis is that sustainability is achieved by diversification of the system and those alternatives that seems contradictory can be develop parallel, only if the conditions are appropriated. Under this context, the FCSASF Society should start by improving their organizational level and adapt its productive systems according to the alternative of convenience.

To start considering the diversification as a strategy to improve the system, it is important to decide what the resources they already have, and what can be done to improve its performance and/or diversify its uses. Here was determined some resources that can be implemented to diversify the system. For example, in terms of infrastructure, the FCSASF Society has a total equipped *Beneficio* and a laboratory of entomopathogenic fungi. Additionally, they have a work force that is represented by the members of the organization and their traditional knowledge. The FCSASF Society will be provided with a local nursery for coffee plants for all the farmers in the Municipality. The Beneficio is equipped with appropriate areas to develop different activities, such as compost, coffee storage, among others, as well as the technical support of the CCT. These elements can be used as a starting point to develop alternative activities and restarting that way the production system which has been practically stopped the last 4 years.

The figure 29 presents different scenarios of alternative that can be developed as long as some **limitations** are improved through the implementation of **strategies** described here in the text. Here are presented three market orientated alternatives, each one with different logic and vision. As it was found in the field, each of them has been implemented by small-scale farmers that are looking to accomplished different goals. As it is presented in the figure 29, diversification can be

accomplished by using their own **resources** and looking for activities that not only provide a different source of income, but strengthens the system.

In order to achieve a more sustainable system, the FCSASF Society needs to figure out what are their possibilities, goals and options. This study provides a general overview of what options exist today and what could be the main mechanisms developed to move towards each of them.

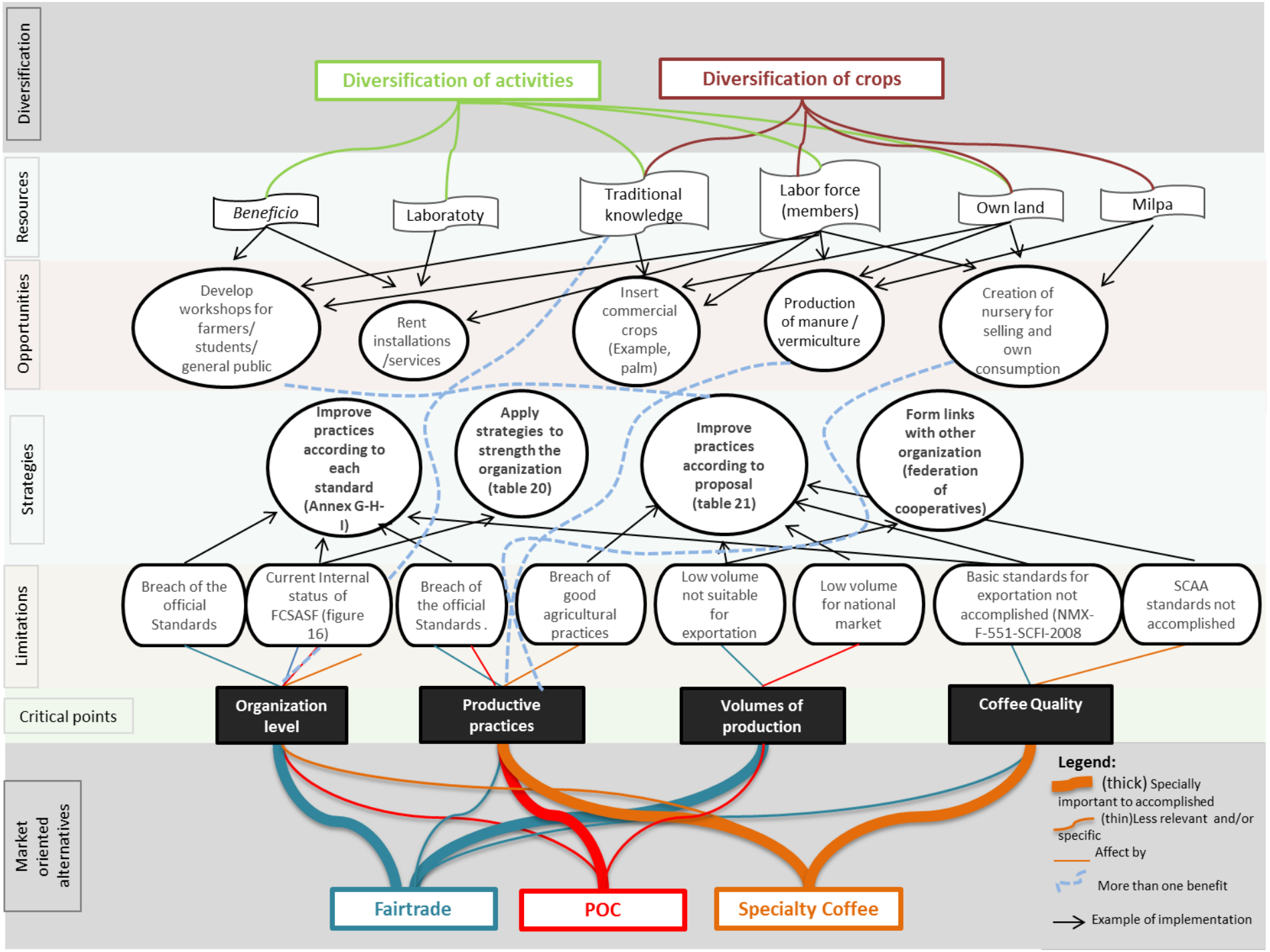

Figure 29. Graphic representation of possible sustainable alternatives in a diversified context

CONCLUSIONS

- The viability of sustainable coffee alternatives in the rural community of San Francisco in the specific case of FCSASF Society depends on many internal and external factors. Here was identified that the level of organization, the poor management of the farm systems and agricultural practices are the main constrains that need to be overcome in order to achieve a more sustainable model. It is probable that by strengthen their internal system that external factors will have a minor effect on them. In fact, it is probable that farmers are going to become more independent and require less government support, for example.
- The diversification of the system is considered the most appropriated alternative to be developed in order to overcome basic problems, such as economic constrains, social exclusion, integration of young people and reduction of the state of vulnerability, among many others. Their dependence on coffee as their main source of income has created a vulnerable system and less resilient in front of the external changes. Therefore, developing more resilient systems through the diversification of their activities can be the most appropriated strategy to be implemented.
- Successful cases have achieved more sustainable models by taking full advantage of their internal resources and developing strategies to overcome the inherent instability of the coffee business. Under this context, the FCSASF Society can make use of their human resources, infrastructure (The Beneficio and Laboratory), traditional knowledge and the management of biodiverse agroforestry systems in order to develop other activities that can provide new sources of income and jobs opportunities for young people. This can be achieved by the development of other commercial crops (such as plantain), workshops, the rental of its facilities for commercial and/or educational purposes, among many others. The organization must evaluate what are their interests and goals, and based on that, they could design their own activities.
- It was evidenced that market orientated options such as Fairtrade, Specialty coffee and POC combined with other alternatives, can be implemented as a diversification strategy as long as all the requirements are accomplished. Even though, some options represents more limitations than others, such as production volumes, coffee quality, organic

standards accomplishment, they can all be achieved by implementing strategies, such as improving agricultural practices, make alliances with other organizations, among others. In this context, the specialty coffee seems to be a more likely option, since it is a market not develops in the area, it is required in low volumes and some of the parcels have the climatic conditions to develop this type of coffee. However, quality of coffee must be improved.

- Regardless the options the FCSASF Society is willing to develop, each of them have limitations that can only be overcome by developing a strong internal system in terms of the level of organization and the production system. Farmers of the FCSASF Society have to overcome problems such as the lack of participation and the low sense of belonging of the member in order to considered themselves capable of developing new and independent projects that does not requires the support of governmental programs.

RECOMMENDATIONS

- The next step of this study can be the definition of a strategic with the members of the FCSASF Society, considered the option here presented and others that were not included in the study. It is recommended to start this kind of projects with a pioneering group of farmers that are willing to take the first steps and work with new ideas. It does not mean that the rest of the farmers are not consulted and included. In fact, all the process and decisions should be taken in group. However, using sample groups can a strategy to assess the suitability of certain activities.
- It might be convenient to integrate farmers that were not members of the organization that are willing to participate. During the data collection, many farmers claim to be interested in being part of this organization.
- Since many of the alternatives here presented depend on the market status, it is necessary a market analysis in case that some of the market orientated strategies is going to be implemented, especially for the Fairtrade certification. Additionally, it is recommended to do a value chain analysis.
- The organization must start creating nexus with other stakeholders in order to extend their scope of action. This will provide them with future clients, knowledge and other visions. It is recommended to get in contact with other small-scale farmers that are going through similar situations. Learning by sharing experience is a strategy that can be more appropriate and beneficial than simply taking courses.

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ANNEXES

Annex A. Self-diagnosis guide for Economic Organizations" by SAGARPA (2008).

AUTODIAGNOSTICO ORGANIZACIONAL

I. In the space "mark here", please mark the following:	
Existence of the document or complete activity:	*3*
Existence of the document or activity that is partial and incomplete	*2*
No existence of the document or activity:	*1*

Name:	Nasario López Rubio	**Type of society:**	Rural Productive Society (RPS)
Address:	San Francisco. Center. Building La flor de Café de la Sierra Alta de San Francisco.	**Date of constitution:**	Year 2000
State:	San LuisPotosi	**Main activity:**	Dry and wet coffee processing
Municipality:	Tamazunchale	**Secondary activity:**	Roasting and grinding of coffee
		Years in operation:	16 years
		Complete name of the legal representative:	Nasario López Rubio
		Position and validity (years in the position accordign to the status)	4

IMPORTANT: The score obtained through the analysis will allow to know the development level

CONCEPT	Score
I. ORGANIZATIONAL AXIS	
1.1. MEMBERSHIP (PARTNERS)	
Individuals: With legal capacity	2
Entities: legally constituted	1
Total number of members: individuals and corporations	133
Women	19
Indigenous	66
Different capacities	0
Older than 60 years	80
Under 18 years	None
1.2. LEGAL ISSUES	
Constitutive Act of the organization:	3
Inscription in the registers:	1
Existence of powers in society (Book of Records)	1
Partners' contributions to the capital or assets	3
Certification of contribution or actions	1
Rules for distribution of stock ownership	1
	10
MANDATORY MEATING AND APPROVAL OF REPOTS	
Publication of the assembly call Oral Ordinary	3
Minutes of the Regular Meeting of Members	3
Annual record in ordinary annual meetings of the partners	3
Publication of call for Extraordinary Meeting of Members	3
Books of Acts of the General Assemblies	3
Reports of the Board of Directors and Supervisory or Commissioner	2
Approval of the Financial Statements (Balance, Results)	3
Constitutive Laws	1
	21
BOARDS OF DIRECTORS AND SURVEILLANCE	
Nomination Board of Directors or Management Unique	3
Changes in Board of Directors (according Statutes)	1
Changes in surveillance board (according statutes)	1
Meetings calender of the Board	3
Proceedings book Board of Directors	3
Increases in: the Membership of the Society	3
Increases in: the Capital Heritage	1
Rules of distribution utilities	1
	16

CONCEPT	Score
1.3. GOVERNMENT AND STRUCTURE	
Vission	3
Mission	3
Values	3
Company organization	3
Acting Board	1
Commissioners or Supervisory Board Acting	3
Support Internal committees Board of Directors	1
Director or Manager: Steering: 1; Partner 2: Employee: 3	1
Standards and General Rules of the Society	3
	21
1.4. AFFILIATION	
Groups and Business Chambers	1
Productive system	3
Political and religious association	1
NGO	1
	6
II. ADMINISTRATIVE AXIS	
2.1. HUMAN RESOURCES	
Operating Procedures Manual and Administration	3
Squad List of the staff Society	3
Area description, Posts and Staff Functions	3
Internal regulations	3
Personal records	3
Registration Patronal in the IMSS	1
Record of the staff assistance	1
Performance Control	1
Staff Training, Directors and Officers	3
Evaluation work or Personal External Offices	1
	22
2.2. MATERIAL RESOURCES	
Preventive maintenance of the goods company	3
Physical facilities property of the organization	3
Machinery and equipment property of the rganization	3
Transport Equipment of the Society	1
Information Systems and licenses for the use	1
Computer Equipment and Communication	1
Internet access and Web Page	1
Safeguarding of the material resources	3
Rules of purchase and sales	3
	19

CONCEPT	Score
2.3. ACCOUNTANCY AND FISCAL	
Application of the Chart of Accounts established and approved	3
CashBook and Mayor	3
Accounting System or Specialized Software Manual	1
Balance sheet	1
Statement of Income	1
Cash flow	1
Compliance with tax obligations and labor	3
External Audit Practiced the Organization	1
	14
2.4. INTERN CONTROLS:	
Partner Satisfaction	3
Client Satisfaction	1
Provider Satisfaction	1
Arrivals and Departures of the money and goods	1
Applied Internal Audit	1
Business plan	1
	8
III. FINANCIAL AXIS	
ANNUAL BUDGET	
Income	1
Expenses	3
BANK ACCOUNT	
Checking accounts and other sight	3
Investment accounts in different time periods	1
CREDITS RECEIVED BY THE COMPANY	
short term	1
Long term	3
From providers	1
From partners	1
FUNDS ESTABLISHED	
Guarantee Fund	3
Assurance Fund	1
Hedge fund	1
SUBSIDIES OR SUPPORT RECEIVED	
By the Government, State, Municipality	3
DEBTS OF THE SOCIETY:	
with banks and other financial institutions	1
with providers	1
with partners	1
	25

CONCEPT	Score
COMMERCIAL AXIS	
4.1. MARKET DEVELOPMENT	
Marketing Program	1
Market research	2
Distribution and sale of the products obtained	3
Products Exporters	1
Food Safety Certification	1
Certifications (Safety. ISO, etc.)	1
Own Trademark	3
Barcode	3
After Sales Service	1
Development of new products	1
Participation in fairs and exhibitions Products	1
Commercial alliance with other companies	1
Participation in projects Integ. Specialized Markets	1
	20
V. OPERATIVE AXIS	
5.1. SERVICE TO CUSTOMERS AND PARTNERS	
Training and Technical Assistance	3
Memory Production Process	1
Productive program	1
Consolidated purchases of inputs and raw materials	1
Capacity utilization	1
Transformation and Value Added	1
Consolidated sales of Products	1
Financing	1
Agricultural Insurance for Production	1
Coverage Price (Options / Futures)	1
Life Insurance and Other Related	1
Maquila own brand or maquila for third	3
	16
Total	**197**
"Level of development"	In development

Annex B. Sustainability index

Sustainable Index variable

Analysis of the economic dimension

This dimension is formed by the following sub indicators:

d) Farm profitability: is defined by the following elements:

- *Productivity*: a system could be considered sustainable if the production of green beans is enough to cover costs of production and basic needs

  Variable: Yield (qq/ha):

(4): more tan 25 qq
(3): between 20.1 and 25 qq
(2): between 15.1 and 20 qq
(1): between 10.1 and 15 qq
(0): less than 10 qq

- *Physical quality of the coffee*: the coffee quality is enough to get higher prices in the market.

  Variable: % of exportable coffee to be sold with a higher price in the market:

(4): more than 82%
(3): 78 to 81%
(2): 74 to 77
(1): 69 to 73%
(0): less than 68%

e) Net monthly income: A coffee farm is sustainable if it satisfies the economic necessities of the family group. The income was obtained by calculate price of coffee by quantity of coffee produced. The original methodology suggest consider the income of no-agricultural activities, it was not possible to do it, since many of the extra incomes are not registered by the own farmers. Additionally the economic support of governmental programs for coffee development is included.

The conversion factor is this:

$$1 \text{ qq Cherry coffee } = 250\text{kg}$$
$$1\ qq\ green\ bean\ = 46 \text{ kg}$$

Variable: the value of the basic food basket in Mexico (pesos):

(4): more than 2890

(3): between 2889 and 2312
(2): between 2311 and 1734
(1): between 1733 and 1156
(0): less than 1155

f) **Economic risks**: sustainable systems are those that diminish the economic risk, assuring the existence and stability for future generation. This sub-indicator is defined by two elements:

- *Sale diversification*: in this case, a system could be considered sustainable if a farmer could sale more than 1 product.
  Variable: number of products.
  (4) 6 or more products
  (3) between 4 and 5 products
  (2) 3 products
  (1) 2 products
  (0) 1 product

- *Dependency on external supplies*: sustainable should not be highly dependent on external supplies.
  Variable: % of external supplies. Here supplies are defined as: chemical fertilizers, manure.
  (4) between 0 and 20%
  (3) between 21 and 40%
  (2) between 41 and 60%
  (1) between 61 and 80%
  (0) between 81 and 100%

Analysis of the environmental dimension

This index is formed by the following sub-indicators:

a) **Soil conservation:** In sustainable systems, it essential to preserve and improve the soils in order to have good production. Two components include this indicator:

- *Vegetable cover management:* and important practice to protect soil from erosion. Variable: % of vegetable cover in the soil
  (4) 100% of cover (farmers do not remove the litter from the soil, the grass is properly cut (living 10cm)
  (3) between 99% and 75% of cover (farmers do not remove the litter from the soil, the grass is improperly cut)
  (2) between 74 a 50% (farmer remove part of the litter material)
  (1) between 49% and 25% (farmer remove the majority of the litter material
  (0) Less than 25% litter material is remove, the grass is cut improperly.

- *Crops diversification*:
  (4) Complete diversified system (timber trees, fruit, legumes in a correct proportion (more legumes than the others two)) with crop association and natural vegetation
  (3) Highly diversified crops with medium association.

(2) Medium diversification with low level of association between them.
(1) Low diversification with no association.
(0) Monocrop.

b) Erosion risk: a sustainable system must reduce or avoid loss of soil due to erosion.

- *Vegetation cover:*
  Variable: % of vegetable cover in the soil
  (4) 100% of cover (farmers do not remove the litter from the soil, the grass is properly cut (living 10cm)
  (3) between 99% and 75% of cover (farmers do not remove the litter from the soil, the grass in improperly cut)
  (2) between 74 a 50% (farmer remove part of the litter material)
  (1) between 49% and 25% (farmer remove the majority of the litter material
  (0) Less than 25% litter material is remove, the grass is cut improperly.

- *Soil conservation:*
  Variable: techniques used by farmer to preserve soils in an area larger area than 50% in coffee system and other crops.
  (4) implementation of lines or terrace
  (3) implementation of live and dead barriers
  (2) implementation of dead barriers
  (1) implementation of a quincunx system
  (0) implementation of furrows parallel to the slope

c) Biodiversity management: a diversified system is important to regulate the natural process and provide ecological services. This effect was assessed in two aspects:

- *Vegetable diversity:*
  Variable:
  (4) Complete diversified system (timber trees, fruit and legumes in a correct proportion (more legumes than the others two)) with crop association and natural vegetation
  (3) Highly diversified crops with medium association.
  (2) Medium diversification with low level of association between them.
  (1) Low diversification with no association
  (0) Monocrop.

Analysis of the social dimension
This dimension was asses into three sub-indicators:

d) Satisfactions of basics needs: a sustainable coffee system assures basic needs in terms of education, health and basic services.

- *Access to education:*
  (4) Access to higher education and/or capacitation courses.
  (3) Access to secondary
  (2) Access to primary and secondary education.

(1) Access to primary school
(0) No access to education

- *Access to health and coverage health:*
  Variable: distance in kilometers between the farm and the nearest complex medical center.
  (4) less than 1 km
  (3) between 1.1 and 3 km
  (2) between 3.1 and 5 km
  (1) between 5.1 and 10km
  (0) more than 10 km

- *Services*:
  (4) Complete installation of water, electricity and telephone nearby.
  (3) Installation of water and electricity
  (2) Installation of electricity and piped water
  (1) No installation of electricity and piped water.
  (0) No electricity

e) Social integration: in this variable it was consider the level of participation of the members of the community in the FCSAFS Society.
(4) Very high
(3) High
(2) Medium
(1) Low
(0) Null

- *Technical knowledge and ecological awareness:*
  Variable: Perception and knowledge of conservation, natural resources and management of their parcels.
  (4) Ecology is conceived in a holistic view, farmer knows its foundations and appropriate crop management techniques.
  (3) Farmer has a knowledge of ecology from their daily practice. Their knowledge is reduced to the farm with no use of agrochemicals, more practical conservationists, and manages crops based on them.
  (2)Technical management is limited, difficult adoption of new technologies.
  (1) The farmer do not manages ecological knowledge or perceive consequence of some practices.
  (0) Farmer has none ecological awareness. Make use of aggressive practices against the environment.

Annex C. FCSASF Society farmers questionnaire

Municipality	**Community**
Sector:	**Number of interview:**

Personal data of the producer:

Name:	**Age:**
Birthplace:	**Civil status:**
Occupation:	**Telephone number:**
Level of education Basic ☐ Secondary ☐ Superior ☐	**Ethnicity**

Social Component

Member of the family: Ages: Location of the plots:	**Work performed the family members:**	**Do the offspring support the family somehow?**
Home and land ownership: Own ☐ Rented ☐ Given ☐	**Location of the plots:**	

Husbandry system

1. Do you breed any kind of animals?
2. If yes, what kind of animal do you breed?
3. What is the purpose to breed animals?
4. With what product do you feed the animals?
5. Does the alimentation vary throughout the year?
6. Are the animals raced in an extensive or intensive way?

Productive system

7. How can you define your coffee production system?
8. In case that you manage a polyculture or commercial shaded coffee what kind of plant have you introduced?
9. What benefits do you obtain from it?
10. How many hectares (Ha) of coffee plantation do you have?
11. Do you have other productive lands?
12. If yes, please mention how many hectares (Ha) do you have?
13. What kind of crops do you have?
14. What kind of instrument do you use to work the land?

Pest management

15. Do you use any type of chemical pesticide to control pests?
16. What kind of pest do you usually have?
17. What product do you use?
18. Do you apply any mechanical/cultural practice?
19. Did you apply in any moment a chemical fertilizer or pest control in your crops
20. Where do you store the products?
21. Do you use protection equipment when any chemical pesticide is used?

Soil management and fertility

22. What kind of practices do you implemented to improve the soil fertility?
23. Do you have any type of erosion problems?
24. What kind of techniques do you implemented to control/prevent erosion?
25. Do you use any of kind of manure (cattle, poultry manure), if yes please specified
26. How much of the manure you use per hectare?
27. In what moment do you apply the manure?
28. Do you apply the manure fresh or composted?

Water management

29. What kind of source of water do you use?
30. How much do you irrigate?
31. Do you know the amount of water do you use?

32. Have you ever done any type of water analysis?
33. Do you re-use or treat the water?

Waste management

34. How do you manage the inorganic waste?
35. Do you burn any waste?
36. Is there any waste collection system in the community?
37. How does it work?

Biodiversity

38. What kind of seeds do you have been using for your coffee plantation?
39. Where do you acquire your seeds or plant?
40. What varieties of coffee plant do you use?
41. How old are your plants (years)?
42. Have you seen that biodiversity have change in the last decade?
43. Do you hunt wild animals?

Use of energy

44. Do you use any type of energy to process coffee?
45. If yes, what type of energy?
46. Do you keep a record of the energy use for this activity?
47. What do you do to reduce the effect of greenhouse gases?

Transformation system

48. After the coffee is harvested, do you process the coffee?
49. If yes, please, explain the process
50. In case of Wet processing, the depulping process is manual of mechanical
51. Do you use any kind of chemical substance to remove the mucilage?
52. How do you conduct the fermentation process? In a wood, concrete or plastic tank?
53. How do you wash the coffee? In a tank or directly in a waterbody
54. Is the water clean?
55. Is the water treated before being discharged?
56. Where do you conduct the drying of the grains?
57. Do you use any type of fuel in the drying process, besides the solar energy?

Economic component and labor conditions

58. Do you hire people to work with you in the coffee plantation? If yes, how much is the payment
59. For what kind of activities?
60. Who do you hire?
61. Do you have any type of insurance?
62. In case you or any of your employers have an accident, is there any place where you can go?

63. How much coffee do you produce per hectare of land (K/ha)cherry? (I quintal=250k cherry)
64. What is the price of the coffee in the last year?(pesos)
65. What type of coffee do you sale your coffee?
66. To whom do you sale your product?
67. How do you receive your payment per kilo?
68. Besides the equipment of the RPS, Do you have any equipment to process the coffee?
69. If yes, what kind of equipment do you have? Do you receive any financial support? If yes, what do you receive?

Organization

70. Do you participate in any governmental program?
71. What is the name of the program?
72. Are you involved in any organization, association or group that supports coffee producers?
73. If yes. Do you consider that the organization support you as a farmer?
74. What kind of help do you receive?
75. As a coffee farmer, what do you consider is the major difficulty to produce coffee?
76. Have you ever participate in a certification process?
77. If yes, what kind of certification does you had/have?
78. Do you still have the certification?
79. If not, what is the reason?

Commercial agency of Tamazunchale interview questions

Manager:

Location:

1. What is your main activity?
2. What kind of product do you receive?
3. Besides you, are there other coffee commercial traders in the Municipality?
4. Who are you main clients?
5. How do you define the price of the coffee?
6. What is the current coffee price you manage?
7. Do you have any pre-contract stablished with the producers?
8. Do you receive certifies coffee?
9. What are the main problems the coffee trade is facing?
10. What are the main differences between market in San Luis Potosi, and the main coffee producers in the country such as Chiapas, Puebla and Veracruz?

Fairtrade farmers questionnaire

Name:	**Age:**
Birthplace:	**Civil status:**
Occupation:	**Telephone number:**
Level of education Basic ☐ Secondary ☐ Superior ☐	**Ethnicity**

Social Component

Member of the family: Ages: Location of the plots:	**Work performed the family members:**	**Do the offspring support the family somehow?**
Home and land ownership: Own ☐ Rented ☐ Given ☐	**Location of the plots:**	

Husbandry system

1. Do you race animals?
2. For what purpose?
3. With what do you feed your animals?

Productive system

4. What type of system do you manage?

Rustic

Traditional polyculture

Commercial polyculture

Monoculture

Unshaded coffee

5. What kind of trees have you introduced in your system?
6. How many Hectares are dedicated to coffee production?
7. How many hectares are dedicated to other crops?
8. What kind of instrument do you use to work the land?
9. Do you have coffee nurseries? If yes, how many plants and what's the purpose?
10. Do you keep a record of the coffee that has been produce, the volume and investment?

Pest management

11. Do you use any type of chemical pesticide to control pests?
12. What type of pest do you usually have?
13. What product do you use?
14. Do you apply any mechanical/cultural practice?
15. Did you apply in any moment a chemical fertilizer or pest control in your crops?
16. Where do you store the products?
17. Do you use protection equipment when any chemical pesticide is used?

Soil management and fertility

18. What kind of practices do you implemented to improve the soil fertility?
19. Do you have any type of erosion problems?
20. What kind of techniques do you implemented to control/prevent erosion?
21. Do you use any of kind of manure (cattle, poultry manure), if yes please specified?
22. How much of the manure you use per hectare?
23. In what moment do you apply the manure?
24. Do you apply the manure fresh or composted?
25. Have you done soil tests?

Water management

26. What kind of source of water do you use?
27. How much do you irrigate?
28. Do you know the amount of water do you use?
29. Have you ever done any type of water analysis?
30. Do you re-use or treat the water?

Waste management

31. How do you manage the inorganic waste?
32. Do you burn any waste?

33. Is there any waste collection system in the community? How does it work?
34. What kind of seeds do you have been using for your coffee plantation?

Biodiversity

35. Where do you acquire your seeds or plant?
36. What varieties of coffee plant do you plant?
37. How old are your plants (years)?
38. Have you seen that biodiversity have change in the last decade?
39. Do you hunt wild animals?

Economic aspects

40. How much coffee do you produce per hectare of land (K/ha) cherry? (I quintal=250k cherry)
41. What is the price of the coffee in the last year?(pesos)
42. What type of coffee do you sale your coffee?
43. To whom do you sale your product?
44. How do you receive your payment per kilo?
45. Do you receive any financial support? If yes, what do you receive?
46. Do you do other source of income?

Certification

47. Since when have you been part of the certification?
48. What type of certification do you hold?
49. Are the requirements fair enough to be implemented?
50. What are the benefits that you receive form the certification?
51. What are the most important changes you had to do in order to be certified?
52. How many years of transition?

Additional information:

Participatory Organic Certification farmers questionnaire

Municipality	**Community**
Sector:	**Number of interview:**

Personal data of the producer:

Name:	**Age:**
Birthplace:	**Civil status:**
Occupation:	**Telephone number:**
Level of education Basic ☐ Secondary ☐ Superior ☐	**Ethnicity**

Social Component

Member of the family: Ages: Location of the plots:	**Work performed the family members:**	**Do the offspring support the family somehow?**
Home and land ownership: Own ☐ Rented ☐ Given ☐	**Location of the plots:**	**Name of the brand:**

1. From how long do you have had the certification?
2. How many hectares do you have designated to coffee cultivation?
3. Do you have other types of crops?
4. If yes, how many hectares are dedicated and what kind of production?

5. Do you own you own machinery to process coffee?
6. What kind of coffee do you sell?
7. What was the price before and after you hold a POC?
8. Did you have to invest any money to obtain the certification? If yes, how much did you invested?
9. What kind of coffee process does you implemented?
   Wet process
   Dry process
10. Did you have to change radically the way you produce before, in order to get the certification?
11. According to you, what were the most imitating elements to obtain the certification?
12. According to you, what are the main benefits obtained due to the certification in the following aspects:

Environmental aspects	**Social aspects**	**Economic aspects**

13. Do you consider that the POC takes care of the farmer's interests and necessities?
14. Do you think that the POC could improve in some way?
15. Have you ever try to apply to international certification
16. Would you recommend the POC to other producers?

Interview with management staff of the Consejo del café

Interview number:
Date and place:
Name of the interviewed:
Position:

Please, explain in a level of detail each of the questions.

1. **What are the main organizations or institution that supports coffee farmers in this different level?:**
- Local (Municipality):
- Regional (Governmental):
- National (Federal):
2. Currently is there a support program for coffee producers?
3. If yes, what are the main difficulties of these programs?
4. What do you consider is the mayor difficulty that coffee farmers present in the Municipality of Tamazunchale?
5. Is there any successful case of coffee organizations in the area?
6. What are the coffee prices managed currently?
7. What is the main coffee market currently?
8. How many producers in Tamazunchale are involved in any cooperative or organization?
9. How do you consider this situation could be solved?
10. Additional comments:

Interview with technical staff of the Consejo del café

Interview number:
Date and place:
Name of the interviewed:
Position:

Please, explain in a level of detail each of the questions.

1. In the technical level, what is the main limitation for coffee producers?
2. In the topic of pest control, what managed and promoted from the Consejo del Café? Council of coffee?
3. How is handled the fertilization process in the coffee plantation in the Municipality?
4. Is there currently, or has existed in some moment, farmers enrolled in any certification?
5. Additional comments:

Annex D. Commercial presentation of the coffee produced in FCSASF Society

Ilustration 1. Commercial presentation of Coffee of the FCSASF Society (250gr) Washed coffee

Annex E. Equipment for the dry and wet process of the FCSASF Society

Illustration 2. Water tank used to wash the coffee cherries and fertilization process.
Source: Valentina Pedrotti

Illustration 4. Coffee dryer machine
Source: Valentina Pedrotti

Ilustration 3. Pulping machine for wet method
Source: Valentina Pedrotti

Illustration 5. Hulling machine
Source: Valentina Pedrotti

Illustration 6. Roasting machine
Source: Valentina Pedrotti

Illustration 7. Roasting machine
Source: Valentina Pedrotti

Ilustration 8. Grinding machine
Source: Valentina Pedrotti

Illustration 9. Laboratory of entomopathogenic fungi.
Source: Valentina Pedrotti

Annex F. Inorganic Waste disposal in two different parcels.

Illustration 10
Floor near the coffee parcel. Presence of inorganic waste
Source: Valentina Pedrotti

Illustration 11
Floor in the coffee parcel. Presence of inorganic waste
Source: Valentina Pedrotti

Annex F. Wasted coffee hulk.

Illustration 12
Parchment hulk untapped in the *Beneficio*.
Source: Valentina Pedrotti

Annex G. Fairtrade Standard, version 2011.

To analyzed the eligibility of this alternative, the standard were assessed using a scale of value

0: is not implemented
1: it is partially implemented
2: It is implemented

LEVEL OF ORGANIZATION		Commentaries
Small farmers should be organized in cooperatives.	2	
Organizations must be politically independent and have a democratic structure in which each partner has the same voting rights	1	
Agricultural work is done mainly by members and their families	1	In many cases not enough family members are not enough to cover the activities.
They do not hire workers throughout the year.	0	
Productive system	**Score**	
Description of the product		
Pest management		
Pesticide are implemented based on knowledge	1	
Use of pesticide and other hazardous chemical products		
People have receive capacitation on properly storages techniques, how to manage accidents, etc	0	
Have personal protection equipment	0	
Be aware of the danger and risk related to the pesticide and other chemical products	0	
Do not applied any pesticide closer than 10 meters from human activities areas. The distance depends on The type of fumigation (area)	N/A	
Fumigation cannot take place in human settlement neither water bodies	2	
Storage area: explain the conditions: close and accessible only for the trained staff, ventilated , equipment in case of accident, Hazardous material properly identified, Safety Data Sheets	0	The organization does not count with this equipment neither the farmers at home.
Pesticide and dangerous material should be out of reach of children	1	It was observe that some chemicals were easily reachable for children
Hazardous material properly identified	2	
Equipment in case of accident	0	
Do not use the container of pesticide to transport food	2	

The material needs to be twice washed and properly storage	0	
Selection of pesticide		
Have a list of pesticide use by the members (using the red and yellow list of the Fairtrade standards).	0	
Material of the red list should not be use	2	
Reduce as much as possible the among of pesticide use	2	
Soil and Water		
Soil Erosion		
Identifies soil that is potentially eroded	0	
Prevent soil erosion	1	Farmers use traditional techniques to protect soil. However, the application of some practices are not properly done or not done in the required period of time.
Use of fertilizers		
Soil fertility		
Accomplish measures that have been taken in order to improve soil fertility (free to choose) could be: -Crop rotation - Intercropping - Agroforestry -Use of soil cover - Green manure -Manure	1	Manure is not implemented
Sustainability of the water sources		
Have a record of the water used	0	
keep record of the quality of the water used (by communication with the local authorities)	0	
Sustainable use of water		
Provide training regarding the proper use of water: -Estimate the among of water used -Measure or estimate how much water is extracted by the source - Maintenance to the water distribution system -Methods to recirculated, reuse and recycle water in case it is possible	0	
Existence of a monitoring plan of water quality of the residual water. Install water filtration systems	0	
Waste and garbage		
Assure that the land is free of garbage and hazardous waste	0	
Define areas for the storage and waste management (burn garbage is allowed in small quantities)	0	
Define techniques to recycling of organic matter. Good practices: -Compost -Munching -Green manure	1	

Genetically Modified Organism (OMG)		
Seeds and OMG are not allowed. You should provide a list of the country's OMG species	1	The origin of the seeds is not known in all the cases. However, for the purpose of this study they were defined as natural, not organic
Biodiversity		
- Awareness of the importance of biodiversity - Implementation of agroforestry systems - Restauration of natural ecosystems in areas not suitable for farming.	2	
You have to maintain buffer zones around the water bodies. Here use of chemical products and fertilizers are forbidden	1	The spring water is surrounded by houses. There is no pipe systems.
The recollection of wild products should be done in a sustainable way	2	
Hunting of threatened species is forbidden	2	
Do not introduce exotic species	2	
Energy and greenhouse gases (GHG)		
Keep a record of the non-renewable energies used, consider more efficient methods to use energy and replace non-renewable energies for renewable	0	
Report the practices implemented to reduce GHG: - Green manure - Increase in the organic matter concentration	2	
Right to No-discrimination		
Members of the organization should not be discriminate on the basis of race, color, religion, sexual orientation, disability, civil status; age, HIV/Aids, religion, politic orientation, and members belonged to other agencies, among others.	0	Members that do not participate in the FCSASF Society claimed that they were never invited to be part of the organization.
During the hiring process, you should not do pregnancy test, HIV-Aids or genetic diseases tests.	2	
You should not support or participate in corporal punishment, mental coercion or verbal abuse	2	
You should not support or participate in any action that involve language or physical contact that is sexually intimidating	2	
Freedom from forced or compulsory labor		
Forced work include any kind of work where a person do not offered himself voluntarily to do it and it is forced to perform under threat of some kind or penalty	2	
You should not force the employment of a worker to the employment of a partner. Partners have the right to work anywhere else.		
Child labor and protection of children		

You should not hire people less than 15 years or less than the established age defined by the local legislation, in case it is higher. In case that there is a high probability of labor child, it is recommended to include actions that treated the fundamental causes of the problems, for example, by building school near the area through the "Development plan of Fairtrade	N/A	
Children under 15 years can help their families under strict conditions: you have to make sure that children work only after school and/or during holidays. That the work they do is appropriate for their age and physical condition, do not work long hours and/or under dangerous conditions	2	
You should not submit workers under 18 years to any kind of job that could be dangerous of affect their health	2	
In case that in the past members of the organization hired under 15 years children for any kind of job or minors under 18 years for dangerous work, you should develop remediation programs	2	
Freedom of association and collective bargaining		
The members of the organization should make sure that all the workers are free to participate in an organization of workers	1	
You should not interfere in the organization of labor unions	1	
You should make sure that workers that are part of a labor union are not discriminate for that reason.		
If there is no active and recognized labor union in your area, you should encourage the workers to form one.	0	
You should encourage the capacitation among the workers to improve their knowledge about their rights and obligations	0	
Employment conditions		
You should establish the salaries according to official minimums wage for each function	0	
In case remuneration is based on production, piecework, fees, you should set the salary according the official minimum wage or as the relevant industry. In case of piecework, you should agree on a fair price with the worker.	0	
You should pay your workers at regular intervals, and payments in kind is permitted only if the worker agree.	1	
You should establish maternity leave, social security benefits and non-mandatory benefits according to the law.	0	
You should have written binding contract that specified all the necessary details	0	
You should provide the worker a copy of the contract	0	
You should increase regularly the salary, higher than the regional average and the official minimum wage	0	
You should assign all the regular work to the permanent workers.	0	
You should give the seasonal, permanent, local and migrant's workers, the same benefits and conditions of employment for the same job done. If it is not possible you have to provide any other alternative and equivalent benefits	2	
If you hire migrants and temporary workers, you should establish effective measures to guarantee the work and employment condition	0	

Health and labor security		
You and your members should develop your activities in secure places with secure equipment	0	
The following people should not perform potentially dangerous work: minors under 18 years, pregnant women or in breastfeeding period, people with chronic diseases, hepatic, or respiratory problems.	0	
You have to assure alternative jobs in case a change of work	0	
You should provide at any moment first aid kits and first aid equipment	0	
You should provide drinkable water and clean sanitary installations	0	
You should make sure that workers name a responsible for health issues.	0	
You should provide capacitation to workers that perform dangerous jobs.	0	
You should display very clearly and accessible to all the security instructions	0	
You should provide and pay all the personal protective equipment for all the workers.	0	
You should improve your health and security conditions through the implementation of the following actions: -signage warning signs -Provide instructions of security and procedures -Provide security equipment -Storage in a safety way the chemical spraying equipment	0	
Business and development		
You should keep record of at least one activity that promote the business, organization, members, workers, environmental and/or community development.	0	
You should have a countable system that keeps a track of the costs of the Development plan of Fairtrade.	0	
Once the planned activities are done, you have to have at least an additional activity that should be proved by the General Assembly.	0	
You have to have one activity in the Development plan that support sustainability	0	
You have to develop a system that helps you to gather information regarding the main necessities of the community.	0	
If you are a 2nd or 3rd grade organization, you have to have the following: a fee system and an allocation system		
An organization has to have democratic structures and an administration that allow the members to have an effective control of the organization. This organization should have: - A General Assembly - Equal right to vote for all the members - An elected council	1	Even though the organization have an administrative structure, it hasn't held election of the board in the corresponding period of time
You should hold at least one General Assembly per year.	2	
You should inform the members in an appropriate period of time about the meeting	2	

The meetings should be documented by the president of the council and it should include a list of participants	2	
You should present to de General Assembly an annual report, with the costs and accountability for their approval	0	
You should have at least one person in charge of the administration and accountability issues	2	
You should keep records and books, available to all the members	0	
You should have a bank account with more than a signatory	2	
You should share the results of the auditory with your members	1	
You should not discriminate any of the members or restrict the membership based on: race, age, HIV/Aids status, color, gender, sexual orientation, disability, language, social origin, among others	2	
Norms and rules that determinate who can be member of the organization, should not be discriminatory	2	
You should identified the minority groups inside your organization	2	
You should develop programs to foster the improve the situation of minority groups	0	

Annex H. Participatory Organic Certification Standards.

To analyzed the eligibility of this alternative, the standard were assessed using a scale of value

0: is not implemented
1: it is partially implemented
2: It is implemented

LEVEL OF ORGANIZATION	SCORE	COMENTS
Individual or legal organization can participate in the certification	2	
Conversion period		
Requirements for the conversion		
Each operator must have a conversion plan that must be updated annually and have the following information: a. Record: background of the management of the unit in the tree last years. b. Description of the current situation in the unit: crops, fertilisation, pest and diseases control, cattle rising, among others. c. A description of the aspect that should be modified through the conversion process. For example: crop rotation, manure management, cattle management, pest and diseases control, environmental conditions, water management, among others	0	
The entity in charge of the certification can recognize retroactively as part of the conversion period of time where: a. Plots that have been manage under the present statements, ensuring that not any of the forbidden products have been used or there is no risk of external pollution b. Resting plots where no forbidden substance have been used. c. Conversion period of time could be reduced in plots where traditional agriculture has been taking place and has fulfilled with the statements. d. In order the times of the conversion period, sufficient proves must be presented	1	
Chapter VI. Coffee, Mushrooms production and algae		
Organic coffee		
Productive system		
The crops will be develop under diversified shade	2	
The varieties should be adapted to the local climate conditions	2	
Seeds should be organic	NA	The origin of the seeds is unknown.
The seedbeds and nursery garden should be managed under organic techniques	0	They dont have The seedbeds and nursery
The water use must be clean	0	The quality water is unknown
High density plants that limited a good shade and stimulate the development of diseases are prohibited	1	There are plot with high density.
In organic coffee plantations should not exist inorganic garbage, nursery bags or any other plastic and metallic waste. It must be removed and not burned.	0	In some of the farmers visited it was observed the presence of

		inorganic garbage
Pruning programs and plant renovation should be done	1	This is not a program ate activity. It is inly done when
Organic crops and conventional crops should be separed through live barriers or ditches.	0	It is not common to see natural barriers between farms.
Prevent hydric erosion		
Use enough litter	2	
Planting in contour lines	0	
Use green manure preferably from legumes	2	
Avoid naked soils	2	
Stablish live and dead barriers	0	
Build terraces, live and dead barriers	1	
Improvement of soils		
Improvement of the soil pH	0	They haven't carried out soil tests to see the composition of it.
Extracted nutrients should be returned to maintain the mineral nutrient equilibrium	0	
Practices to improve and maintain at long term the fertility of the soil (legumes crops, organic manure, branches leafs)	1	
Weeding		
It should be collected mechanically and manually	1	Not leaving 10 cm of weed
Pest management		
Artificially synthesized pesticides are prohibited. Pest should be managed through pruning, shade regulation, biological control, manual control.	1	They are done but not in the proper frequency
Wood		
Wood demand should be provide in a sustainable way. It should not lead to deforestation. It must be provided enough wood from planted trees within the coffee plantation, or use alternative source of energy.	2	
Recycling and energy saving systems		
Sub products such as coffee pulp should be returned after going through a transformation process	0	
Harvesting and wet process		
Only mature cherries can be harvested. It is prohibited to harvest unripe fruit.	0	
In the transformation period only mechanical and physical process are allowed	2	
Pulping process should be done manually. If it is not possible, than the minimum fuel should be used. The pulp should be use for manure	1	The pulp is not necessarily use for manure
Chemical products to remove the mucilage are forbidden. The fermentation process should be natural. It should be done in wooden boxes or concrete tanks. Over plastic is forbidden.	2	

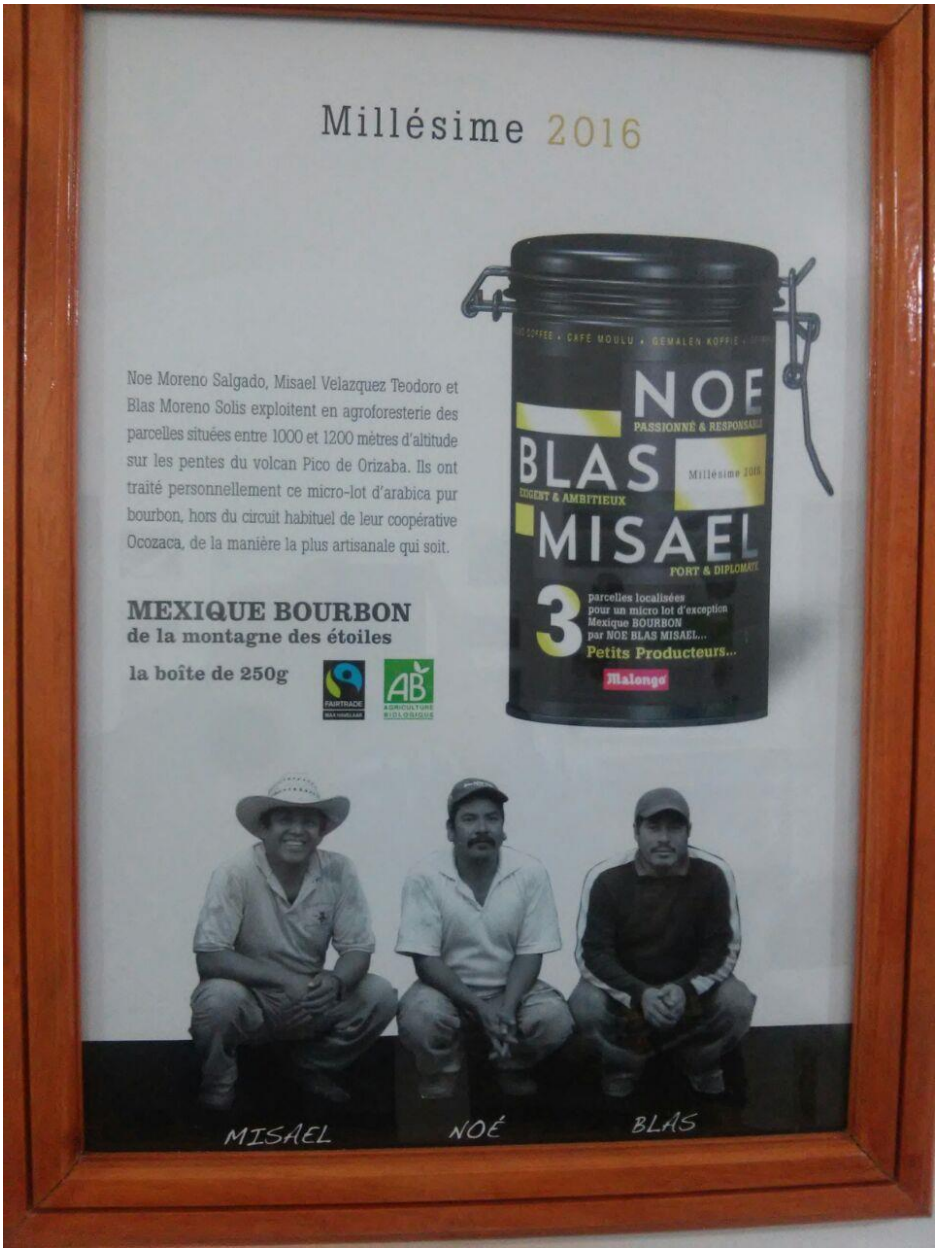
Coffee should be washed in tanks. Do not use natural water sources such as rivers, springs, wells	2	
The water should be clean and used water should not be discharged directly in natural sources. If possible, should be used pits or sinks.	0	
Drying process should be done in the sun, courtyards, drying sheds wood without resins, or any other technique that use solar energy. Plastic is not allowed for the drying process. If it is not possible to use solar energy, the usage of other energies should be moderate. Fossil fuels are forbidden.	2	
Coffee storage should be done in separate places, free of pollutants, protected from rain, without contact with the ground	0	
Producers should establish an identification systems to guarantee the correct separation of organic coffee and conventional.	0	
Dry process		
Organic coffee should be processed separately from traditional or conventional coffee. All the equipment should be previously washed.	0	
Equipment must be in perfect conditions.	1	Some are old equiptment
The processing plant must have a health and safety manual.	0	
A record of the entrances, processing reports and the output of certified and non-certified products must be done.	0	
A quality control of the raw material must and final product must be done	0	
Depots must have an appropriate distribution for the storage.	1	Small space

Annex I. Specialty coffee requirements.

Productive system		Commentaries
Type of coffee and origin		
Washed coffee	2	
Unwashed coffee, semi-washed coffee, or natural brown or natural pulped.	2	
Determine the altitude of the parcels (m.a.l.s)	1	The altitude has been determined but not for each plot
Work with coffee of origin and not mixtures	0	
Soil management		
The soil must be fertilized least two times per year (recommended organic fertilization)	0	
Know the type of soil	0	
Prevent erosion	1	
Coffee Plant varieties an biodiversity		
Include plats between 2 and 15 years	1	The farmers manages plants from different ages, include 30 years
Manage high quality varieties	2	
Have the same varieties in mini-plots	0	
Manage biodiverse systems	2	
Pest management		
Integrated pest Management	1	
Weed management		
Integrated pest Management	1	
Harvesting		
Process the coffee between the 8-12 hours after been picked (except for Natural coffee)	0	
Use clean water	0	
Harvest only ripe cherries	0	
Harvest only one type of variety	0	
Coffee processing		
Water most be clean	0	
Pulping manage should run well	1	
Foreign material must be removed	1	
The grain should not be dry on the floor but in drying beds	0	
Do not mix coffees were grown and processed on different days	1	
Coffee must be storage in a place free of chemicals or agrochemicals, animals or any material that could damage the product.	0	
Keep the bags at least 10 cm from the floor to avoid moisture	0	

Reposition the parchment costal every 20 days and keep aeration	0	
Do not, husking, peeling or the parchment coffee until ready to be classified or sold in green coffee if it is the case	0	
Coffee quality		
The coffee must be tasted by a qualify taster	0	
It must obtained a score more than 80	0	

Annex J. Specialty coffee sold in the OCOZACA Cooperative



Ilustration 12. Commercial presentation of the Specialty Coffee produced in the OCOZACA Cooperative. First version, 2016