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**UNDERSTANDING DIFFUSION OF INNOVATIONS WITH SMALLHOLDER
COFFEE FARMERS IN TURRIALBA, COSTA RICA**

A Thesis in

Rural Sociology

by

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ABSTRACT

The diffusion of innovations framework explains how innovations – ideas, behavior, practice, or technology perceived by the target audience as new – are spread and adopted within a population. Serving as the basis for agricultural extension services since its conception in the 1960's, this theory has received criticism for its application in an international development context. By its nature, the framework drives focus and resource allocation to larger and “innovator” farmers, and therefore, away from smallholders, who are classified as the late adopter or laggard groups. It overlooks smallholder farmers yet they produce over 80% of the world's agricultural supply. Extension, research and development interest need to better understand the process behind why and how smallholder farmers do or do not adopt an innovation, as this is where the highest impact can be made. Improving smallholders' livelihoods improve rural areas and returns capacity to rural peoples and ways of life. With a better understanding of smallholder decision-making emerges efforts that are more efficiently and effectively tailored to diffuse innovative technology and practices to smallholders that can improve production, yield, quality, health, and others.

This thesis investigates smallholder coffee farmers' decision-making process when choosing to adopt an innovation. Smallholder coffee farmers are interviewed via semi-structured, open ended key informant interviews throughout the Turrialba coffee-growing region in Turrialba, Costa Rica, following a phenomenological research approach. Five key concepts relating to the diffusion of innovations theory were investigated. Themes emerged across the five key concept areas relating to how smallholders were influenced to make their decisions. The conclusions and recommendations drawn are specific to the participants in the Turrialba region.

Table of Contents

List of Tables	vi
List of Figures	vii
Acknowledgments.....	viii
Chapter 1	1
Introduction	1
Adoption, Diffusion, and Applied Research	2
Understanding Locally Based Adoption and Diffusion.....	5
Chapter 2	8
Context: Coffee and Costa Rica.....	8
Review of Academic and Research Literature: Smallholder Decision-Making and Innovation Diffusion and Adoption	20
Chapter 3	42
Research Methodology	42
Research Approach	43
Research Goal	44
Research Questions.....	44
Study Location	45
Type of Study	52
Sampling	53
Sample Description	54
Data Collection.....	55
Instrument Development	57
Operationalization of Key Concepts.....	57
Data Analysis	66
Limitations	67
Chapter 4	69
Research Findings.....	69
Participant Characteristics.....	70
Access to Resources	76
Innovation Characteristics.....	86
Community	95
Gender	102
Chapter 5	108
Conclusions, Implications and Further Investigation	108
Research Question 1.....	109
Research Question 2.....	113
Research Question 3.....	117
Research Question 4.....	120
Research Question 5.....	124

Conclusions	127
References	129
Appendix A: Key Informant Protocol	140
Appendix B: IRB Approval.....	144

List of Tables

Table 1: Percent of Women from Coffee Producing Households that Work on the Farm by Coffee Region	47
Table 2: Population of Coffee Producing Households and Coffee Workers by Sex in Turrialba Region	51
Table 3: Horizontalization – Participant Characteristics	71
Table 4: Horizontalization – Why do you grow coffee?	73
Table 5: Horizontalization – Inputs for Production	76
Table 6: Horizontalization – Barriers to Accessing Inputs	77
Table 7: Horizontalization – Experience with Education or Training	78
Table 8: Horizontalization – Experience with Government and/or ICAFE	79
Table 9: Horizontalization – Most Trusted Source of Support	80
Table 10: Horizontalization - Boosters to Producing Coffee	81
Table 11: Horizontalization – Barriers to Producing Coffee	82
Table 12: Horizontalization – Innovation: Pruning Method	87
Table 13: Horizontalization – Innovation: Fungicides	88
Table 14: Horizontalization – Innovation: New Variety	89
Table 15: Horizontalization – Community Descriptions	96
Table 16: Horizontalization – Community Interactions	97
Table 17: Horizontalization – Importance of Being a Part of Community	97
Table 18: Importance of Coffee to Community	98
Table 19: Horizontalization – Interactions with Other Coffee Farmers	99
Table 20: Horizontalization – Tasks On the Coffee Farm	103
Table 21: Horizontalization – Tasks Off the Coffee Farm	104
Table 22: Horizontalization – Primary Decision-Makers and Female Role	105

List of Figures

Figure 1: The Coffee Belt: Coffee Producing Countries by Species	11
Figure 2: Costa Rican Coffee Industry Breakdown	19
Figure 3: Proportion of Adoption from different communication channels	22
Figure 4: Five Adopter Categories within a Social System	22
Figure 5: Diffusions of Innovations Conceptual Model	23
Figure 6: Community and Social Fields with Strong and Weak Ties	34
Figure 7: Conceptual Model	40
Figure 8: Study Location of Turrialba (Cantón #305) in Costa Rica	46
Figure 9: Description of Land Use in Turrialba Region (Ha)	48
Figure 10: Description of Shade Use in Turrialba Region (Ha)	49
Figure 11: Total Number of Farms by Size of Farm in Turrialba Region (Ha)	50
Figure 12: Total Land Area by Size of Coffee Farm in Turrialba Region (Ha)	50

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Chapter 1

Introduction

In 2000, the United Nations established the Millennium Development Goals (MDGs), a list of eight goals for the world to achieve by 2015 in order to eradicate extreme global poverty and its many dimensions (UN General Assembly, 2000). While addressing the fight against extreme global poverty, the MDGs also include quantifiable measures for promoting gender equality, environmental preservation, education and basic human rights across the globe (End Poverty 2015, 2015; UN General Assembly, 2000). These eight goals set the strategic framework and focus for all participating UN members' international development programs, policies and research agendas (UN General Assembly, 2000). In effect, these goals focus research and aid agendas to serve, empower and build resiliency in the world's most vulnerable populations (UN General Assembly, 2000). Among these populations are those living in rural areas who depend on small-scale family agriculture and related activities for their livelihoods in developing countries. Approximately 1.4 billion men, women and children across the globe constitute this population description (Walpole *et al.*, 2013). Not only do they lack access to basic resources, but smallholder farmers produce 80% of the global food supply and are the most vulnerable to climate change and market fluctuations (Walpole *et al.*, 2013).

The UN declared 2014 the year of Family Farming, as development, aid and research desperately needed to refocus attention on smallholder farmers. This refocus of attention is needed to not only support the 1.4 billion vulnerable livelihoods dependent on smallholder farming, but to also ensure the sustainable production of the majority of the world's food supply (Walpole *et al.*, 2013). Smallholder farmers in rural areas are a keystone unit across the MDGs (UN General Assembly, 2000). Strengthening their resiliency and capacity allows for decreased

levels of rural poverty, higher education levels, increased food production, improved food quality and nutrition, promoting gender equality as women constitute a majority of smallholder farmers, and promoting environmental preservation with improved practices (UN General Assembly, 2000). Focusing on rural, small-scale agriculture-dependent populations has the potential to make progress across all of the MDGs (Walpole *et al.*, 2013).

In an effort to contribute to this refocused attention, this research seeks to understand issues pertaining to smallholder agriculture and more specifically, those dependent on small scale, yet high return commodity agriculture for a living. Extension, applied research and development efforts aim to improve capacity, resiliency and livelihoods. Achieving these goals involves introducing best practices, increasing education, diffusing new feasible and effective innovations, among others. This research focuses on the process for diffusing innovations with smallholder farmer populations, particularly on the smallholders' decision-making process when choosing to adopt, or not adopt, a diffused innovation. The overall goal of this research is to provide insight into the factors influencing or motivating smallholders' decision-making regarding innovation adoption, and how that insight could help development efforts be more effective, efficient and useful to build capacity for improving rural livelihoods. This research takes a phenomenological approach in understanding how five independent factors influence a smallholder farmer's decision-making process in choosing to adopt an innovation (Moustakas, 1994; Rogers, 2003; Sick, 1998; Wilkinson, 1991).

Adoption, Diffusion, and Applied Research

The diffusion of innovations theory, conceived by Everett Rogers in the 1960s, explains how new ideas and technologies are spread and adopted throughout a population (Rogers, 2003). Since its conception, this theory has been supported and further expanded by thousands of

studies in various fields and has been applied to increase the efficiency and effectiveness of innovation diffusion throughout the world (Rogers, 2003). In particular, it has served as the basis for agricultural extension services in transferring technology and sustainable agricultural practices to farmers (Rogers, 2003; Rodriguez, Molnar, Fazio, Sydnor, & Lowe, 2008). The theory indicates several key elements that influence the rate and success of adoption, which include innovation characteristics, the social system, communication channels and time. These are widely cited across literature as key concepts in diffusion of innovations research (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Marra *et al.*, 2003; Rodriguez *et al.*, 2008).

This theory has been studied, tested and applied across various academic and practical fields (Rogers, 2003). Although it has been widely accepted and appropriately applied, the theory can be limiting when used in an international agricultural development context (Stephenson, 2003). As a field of research and practice, international agriculture development has quickly increased only within the past few decades. In the post-World War II reconstruction era of the 20th century, it emerged from international trade and policy as a new set of ideas and practices (Ruttan, 1998; Zoomers, 2006). While each decade since has seen different emphases on select aspects of development, the establishment of the Millennium Development Goals in 2000 declared war on poverty and sought to focus attention on human development (UN General Assembly, 2000; Zoomers, 2006). This declaration by nature focused attention on the most poor and vulnerable populations: rural people dependent on small-scale family agriculture in developing nations. Yet applying a diffusion of innovations framework with farming populations in developing countries can yield unintended consequences as the framework does not promote participatory approaches nor does it account for varying cultural landscapes

(Stephenson, 2003; Rodriguez *et al.*, 2008). And smallholder farmers fall victim, reaping the potentially devastating consequences of inappropriately applying this theory.

Appropriate and effective diffusion of innovations will maximize the efficiency of effort and resource allocation, and will also maximize the benefits gained by the target population, minimize their exposed risk and be adopted and implemented. The main purpose of any development effort is to incur long-term behavior change to realize the intended goal. However the diffusion of innovations theory encourages a top-down approach and does not promote participatory action in developing or diffusing an innovation (Stephenson, 2003; Rodriguez *et al.*, 2008). Zoomers (2006) assesses lessons learned from an aggregate of mistakes across 46 rural development projects conducted across Asia, Africa and Latin America, ultimately noting that success relies on the “degree in which projects fit the local context and local trends...” (p. 23) It is essential for the needs, perspectives and traditions of the targeted population to be known and integrated in the innovation development, communication and dissemination.

Anecdotal evidence describes a consistent pattern with development efforts taking a top-down approach by developing and introducing an innovation without accounting for the needs and traditions of the targeted population or providing any sort of explanation or education on the innovation. These efforts often fail, wasting both the inputted resources and opportunity for improvement. And innovation does not always connote a positive change to the targeted audience; thus a participatory approach is necessary for incorporating the needs and knowledge from the targeted audience into the innovation development.

Local participation and dialogue are crucial elements to bring “development interventions better in line with the livelihood priorities of the population” (Zoomers, 2006, p. 23).

Additionally, research demonstrates that an individual’s perceptions of phenomena, whether or

not they are accurate, drive an individual's behavior (Dijksterhuis & van Knippenberg, 1998). Thus incorporating local perceptions in innovation development and diffusion increase the ability to bring interventions in line with local priorities and needs. This research project attempts to address this lack of understanding in the broader international development context by focusing on the diffusion of innovations from a smallholder coffee farmer populations' perspective in the Turrialba region of Costa Rica.

Understanding Locally Based Adoption and Diffusion

Extension, research and development interests need to better understand the process behind why smallholders do or do not adopt an innovation, as this is where the highest impact can be made. It is essential to gain this understanding from a smallholder perspective to facilitate a collaborative effort between extension and target audience. With this understanding emerge efforts that are more efficiently and effectively tailored to diffuse innovative technology and practices to smallholders that can improve production, yield, quality, health, and others. And ultimately, effective collaborative diffusion of innovations efforts will build rural capacity and betterment of rural livelihoods.

The purpose of this research is to better understand a smallholder farmer's decision-making process when choosing to adopt an innovation on their farm from their perspective. Additionally, this research will assess the role of community engagement and gender in this decision making process, as these variables are scant throughout the literature, yet are believed to be important factors influencing how decisions are made.

Smallholder coffee farmers in the Turrialba region of Costa Rica are the target population for this research. Costa Rica is a development success story, with high levels of education and access to resources throughout the country, yet poverty levels remain stagnated at 20% ("Costa

Rica”). Small-scale family agricultural households characterize the majority of this poverty-stricken population (“Costa Rica”). And whereas smallholder farmers produce up to 70% of the global coffee supply, smallholders in Costa Rica are responsible for 92% of the national production (Eakin *et al.*, 2009; ICAFE, 2015). Additionally, coffee production is more than a means for sustaining livelihoods for Costa Ricans, it is tied to their national identity and pride (ICAFE, 2015).

Smallholder coffee farmers in different communities throughout the Turrialba region were interviewed via open ended, semi-structured key informant interviews. This research takes a phenomenological approach and is designed on the principals of phenomenological research theory (Moustakas, 1994). The diffusion of innovations theory provides a framework for the development of the key informant interview protocol (see Appendix A) that measures the first three independent factors [(1) innovation characteristics, (2) participant characteristics, (3) access to resources]. Community engagement and gender theories will frame the development and integration of the additional questions. The following questions are asked and investigated:

- How do the participants’ characteristics influence their decision-making process in adopting an innovation?
- How do the participants’ access to resources influence their decision-making process in adopting an innovation?
- How do the innovations’ characteristics influence smallholder farmers’ decision-making process in adopting an innovation?
- How does community engagement influence the smallholder’s decision-making process in adopting an innovation?

- How do gender roles influence the smallholder farmer's decision-making process in adopting an innovation?

In the following four chapters, this thesis will explore the complexities of diffusion of innovations theory and identify the gaps in the literature, particularly in the field of international agriculture development. It will seek to address some of these gaps and provide justification and explanation as to how those gaps can be filled. Chapter two offers a thorough literature review on the concepts addressed above. And it gives a context for the cultural, historical and current role of coffee production in Costa Rica at large, as well as specifically the Turrialba region. Chapter three describes the methodology used to collect and analyze this data. Justification and details of the study site in Turrialba, Costa Rica and the chosen participants are also given. Chapter four details the results of the data collection and analysis, and chapter five provides an overall summary of findings, conclusion and recommendations. Finally, cited references, data collection instruments, and IRB approval are provided.

Chapter 2

Context: Coffee and Costa Rica

Central America

Central America is a region characterized by rich cultural and bio-diversity, but also severe political, economic, and development challenges that plague each country differently. The seven countries (Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica and Panama) of Central America bridge the North and South Americas, separating the Pacific Ocean from the Caribbean Sea (Leonard, 1987). With a total landmass amounts to 533,726 km², the economies of the respective countries are mainly based on agriculture and natural resources (Leonard, 1987). Three different climatic zones characterize Central America: (1) hot, humid and yearlong rainy tropical lowlands along the Caribbean, (2) cool and damp interior uplands on the isthmus, and (3) the lower Pacific slope and coastal plains that are hot and dry with intermittent torrential rain during May through October (Leonard, 1987).

Historically, Central America has faced periods of severe political turmoil, civil conflict, and environmental degradation. Since the 1950's, Central American countries have experienced alarming rates of deforestation, due to poorly managed and unsustainable agriculture systems, and increased infrastructure construction and tourism (Utting, 1991; Butterfield, 1994). Other major challenges include poverty and inequality, political instability, addressing bottlenecks to intra and extra regional trade, and improving security (Central America Overview, 2014).

The World Bank reports that the region, within the last decade, has achieved moderate growth despite these setbacks, certain countries, like Panama and Costa Rica, are outliers, experiencing much higher growth than their neighbors (Central America Overview, 2014).

Costa Rica

An estimated 4.8 million people live in Costa Rica, where its citizens enjoy better standards of living than its neighboring Central American countries and one of the highest life expectancies in the world (Costa Rica, 2015). It is home to the *pura vida* lifestyle, exquisite beaches, and exotic, lush rainforests.

Costa Rica, bordering Nicaragua to the north and Panama to the south, is considered a development success story. Over the past 25 years, Costa Rica has experienced significant economic expansion and growth due to “outward-oriented, export-led growth, openness to foreign investment, and gradual trade liberalization” (Costa Rica Overview, 2014). It is now an upper-middle income country, with decreasing poverty rates and increasing GDP growth rates, despite a brief setback during the 2008 global financial crisis (Costa Rica Overview, 2014). Although traditionally dependent on agriculture (particularly beef, bananas and coffee), Costa Rica has diversified its economy to include emerging technology and tourism industries. The agriculture sector accounts for 6% of its GDP, whereas the industry and services sectors represent 20.5% and 73%, respectively (Costa Rica, 2015).

However, this economic growth and development progress mainly benefits the skilled labor and upper classes, overlooking the poorest people in Costa Rica. While it has one of the lower levels of poverty in Central America, the nation’s poverty level has stalled at about 20% for almost twenty years (Costa Rica, 2015). Inequality rose, as evident by the Gini coefficient going from 0.439 to 0.434 in 2009 to 2010 (Costa Rica Overview, 2014). The Gini coefficient measures statistical dispersion intended to represent income distribution of a nation’s residents, most commonly used to measure inequality (Yitzhaki, 1979). Additionally, illegal immigration from Nicaraguans seeking seasonal work causes tension between the two countries. These

immigrants represent the majority of the unskilled labor class in Costa Rica, most of who work during the coffee harvests (Costa Rica, 2015; Costa Rica Overview, 2014; Sick, 1998).

The country is divided into seven major provinces, which are then subdivided into cantóns and districts (*región*). This research is set within the Turrialba growing región in the Turrialba cantón, located in the Cartago province. The coffee growing regions as specified by ICAFE, the national coffee institute, do not directly overlap with political boundaries. The geographic setting will be further discussed in Chapter 3.

Global Coffee Market

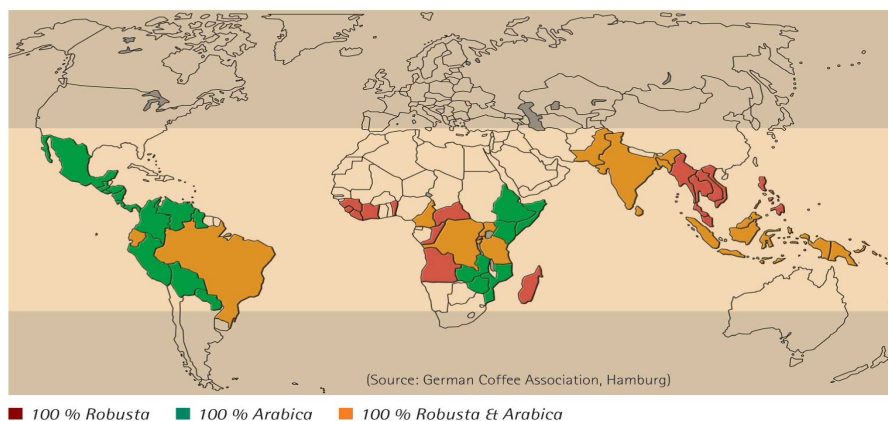
Production

The global coffee market is one of the most volatile markets in the world. Coffee is the second most traded commodity in the world, following only petroleum, and is the source of livelihood for an estimated 100 million people throughout the world (Jha *et al.*, 2011). The coffee export system has doubled in volume and grown 3.5 times in value since the 1960's, generating billions of annual export dollars and occupying some 10 million hectares globally for production (Varangis *et al.*, 2002). Coffee is primarily produced in the global south in communities facing resource challenges, including but not limited to food access and availability (Caswell, 2012; Jha *et al.*, 2011). Researchers and practitioners have recently begun to study the link between coffee dependent communities and food insecurity (Caswell, 2012; Jha *et al.*, 2011; Olson *et al.*, 2012). In developed economies, like USA, Europe and Japan, coffee is considered a staple good, yet during the world economic crisis and rising global price of coffee, consumers are more likely switch to in-home consumption of lesser quality products (ICO, 2009).

The global coffee supply consists of two commercial species: *Coffea arabica* and *Coffea canephora* (Arabica and Robusta, respectively). As shown in Figure 1, these species are grown

in specific areas within the “coffee belt”, the areas with similar geoclimatic features within 10 degrees north and south of the equator. Both Arabica and Robusta species have differing conditional needs for optimal growth, with the latter being more hardier and resistant to climatic changes and diseases, thus easier to grow and considered lesser quality (International Coffee Organization, 2014). Arabica coffee is higher quality and taste than Robusta, but due to rising prices, Robusta is more readily purchased and consumed (ICO, 2009). Central America, as shown in Figure 1, only grows Arabica, the higher quality species.

Figure 1: The Coffee Belt: Coffee Producing Countries by Species



Source: German Coffee Association

Current Coffee Crisis

Within the past two decades, the global coffee market experienced a drastic shift in its structure and exacerbating its volatility. This volatility is precipitated by not only climatic events and transformations, but also in changes to production technology, processing techniques, consumer demands, and market regulation. During the late 1980s, the International Coffee Organization’s means of regulating export quotas from each producing country, The International Coffee Agreement, collapsed in 1989. This collapse left each country responsible for regulating its production supply volume and quality. Following its collapse, an oversupply of

beans flooded the market, driving down the global price for coffee as well as its quality (Ponte, 2001; Osorio, 2002; Lindsey, 2003; Eakin *et al.* 2006).

The effects of this dissolution, in combination with climatic changes and shifts in consumer demands, contributed to the current coffee crisis. In response to this crisis, the market price of green coffee reached historic lows, the quality of traded coffee declined, a handful of multinationals gained control of the market, and the emergence of new production technologies made the producing environment increasingly competitive (Rice, 2003; Varangis *et al.*, 2002; Eakin *et al.*, 2006; Ponte, 2001; Lindsey, 2003).

Before the ICA's collapse, coffee-producing countries heavily regulated the quality and quantity of their volume exports to meet ICA stipulated quotas. Without ICA restrictions, individual countries maximized their production and thus flooded the market (Ponte, 2001; Rice, 2003). And in the aftermath of the collapse, producing countries were forming their own systems of regulating their national coffee sectors, mostly deregulating, privatizing and liberalizing agricultural production and national agricultural institutions. This increased the uncertainties faced by global coffee farmers (Varangis *et al.*, 2002).

Along with the collapse of the ICA and market oversupply, several other factors exacerbated the looming coffee crisis. Exporting countries and less industrialized nations experienced a relatively slow growth in coffee consumption, thus the growing supply of coffee did not meet a growing demand. This growing discrepancy in supply and demand rates worsened the ensuing market flood (Lindsey, 2003; Ponte, 2001; Rice, 2003; Eakin *et al.*, 2006).

Two specific countries, Brazil and Vietnam, played a major role in the current crisis. Upon dissolution of the ICA, Brazil experienced a series of frosts that crippled their supply. This

in a way compensated for the excessive global supply entering the market, however Brazil quickly recovered and revamped their production. They reemerged as a dominant producing country in 1997 with critical changes to their production technology. Meanwhile, Vietnam went from being the 17th largest producing country in 1990 to the 2nd largest supplier in 2001, jumping from one million sacks to over 12 million sacks during the timeframe. Vietnam's contribution mainly consisted of the lower quality Robusta beans, which added to the depression of global price and quality (Eakin *et al.*, 2006; Ponte, 2001; Lindsey, 2003; Varangis *et al.*, 2002).

New processing technologies increased the competitiveness of the buying market for Arabica by improving the quality and taste of the Robusta species. Robusta is the lesser quality coffee species, as it is more tolerant to climatic changes, pests and diseases, and has a more bitter taste. It is more cheaply produced than the Arabica species, and thus it is less expensive on the global market. Vietnam's addition to the market glut mainly consisted of Robusta beans. New processing techniques increased the quality and taste of Robusta beans, allowing larger volumes to be marketed and sold to higher end markets at lower prices than competitive Arabica beans. Central American coffee production mainly consists of the higher quality Arabica beans (Varangis *et al.*, 2002; Eakin *et al.*, 2006). Thus, the increased quality of Robusta beans amplified the competitiveness of the higher end markets on which Central American farmers can sell their more expensive Arabica beans.

Finally, the market shifted from diversified control to being dominated by only a handful of multinational corporations. This shift has had a depressive effect on market prices, as the few market controllers have the capacity to hold and process large stocks of green coffee. Some of the major coffee roasters include Sara Lee, Nestle, Proctor and Gamble, and Phillip Morris. Market dominance by only a few roasters, buyers and traders allows the gap between farm gate

and retail prices to widen, and makes it increasingly difficult for smallholder farmers to enter markets or receive competitive wages for their crop (Rice & McLean, 1999; Eakin *et al.*, 2006).

The combined effects of these various shifts in the global coffee market in the past two decades have resulted in a profound change in the market's infrastructure. And most particularly, they have had compounded effects on smallholder farmers throughout the world, particularly in Latin America. Smallholder farmers in Latin America are extremely sensitive to market fluctuations, lacking the ability and resources to easily adapt to climatic and structural market changes. Latin America, consisting of Mexico and Central American countries, used to be the second most productive region in the world after Brazil. However, it recently fell to fourth place behind Brazil, Vietnam and African producers, and is extremely responsive to the production of the other regions. For example, the price for a 46-kilogram bag of coffee fell from \$95.55 in December 1996 to \$49.00 in May 2002 on the New York Coffee, Cacao, and Sugar Commodities Market (International Coffee Organization, 2014). The latter price does not even support production costs for a smaller farm.

La Roya

In addition to the global events of the past two decades spurring the coffee crisis, Central American coffee growers recently experienced another production crisis of their own known as *La roya*. *La roya* (Coffee Leaf Rust) is an obligate parasitic fungus (*Hemileia vastatrix*) that hosts on plants in the *Coffea* genus and reproduces in a complex and ingenious fashion. It functions to produce thousands of tiny spores that are able to travel via air, water or rain viable for long distance until it finds a proper host (live coffee plants). From this point, it enters the plant via the stomata and causes the infected leaves to fall off. Coffee plants without enough leaves are not able to conduct enough photosynthesis to accumulate adequate energy and

resources for fruit production, resulting in a severe decrease of fruit (coffee berry) production (Avelino *et al.*, 2004). The parasite thrives in certain environmental conditions, such as free moisture and temperatures between 21-25 degrees Celsius (Nutman *et al.*, 1963).

First introduced to South America in Bahia, Brazil in the 1970s, the rust is the most economically important coffee disease, responsible for eradicating coffee production in Sri Lanka in the 1850's (who has since changed to tea production) and devastated Brazil's production in the 70s (Abbay, 1876; Monaco, 1977). In recent years, Central America has experienced a coffee leaf rust epidemic where 53% of its production has been lost due to the disease, the worst in Central American history (International Coffee Organization, 2014). The intensity of this outbreak may be attributed to climate change, where warming temperatures at higher altitudes and increased rainfall are likely to allow *la roya* to exist in areas previously uninhabitable (Avelino *et al.*, 2006).

Considering that there are over 351,000 coffee growers in Central America and that coffee directly provides a livelihood for more than 2 million Central Americans, this outbreak has extremely serious consequences. Preliminary figures report that 2.5 million bags of Central American coffee were lost in the 2012/2013 growing year and that it resulted in a loss of 437,000 jobs in rural areas during the same year. Estimated figures report that up to 1 billion dollars of revenue were lost due to *la roya* throughout Central America, causing six countries to declare a state of emergency (Mallen, 2014). That number is expected to grow for the 2013/2014 and 2014/2015 coffee year (Monthly Coffee Market Report, 2013). Central American coffee production has taken a major hit in recent years, and most particularly the small-scale farmers.

Smallholding Coffee Producers in Central America & Costa Rica

Millions of smallholder farmers throughout the world depend upon coffee as their major source of income and are the most vulnerable to the changing dynamics of the market and environmental realities. It is estimated that small-scale farmers are responsible for producing 70% of the world's coffee supply (Eakin *et al.*, 2009). As previously stated, smallholder farmers are a marginalized population that is most susceptible to market and climatic changes, and they often lack access to the necessary resources to build self-capacity and resiliency to thrive. Smallholders additionally struggle due to what White (2012) calls, "the chronic government neglect of small-scale agriculture and rural infrastructure" (p. 11). Smallholders are the backbone of the global coffee supply yet market, resource and environmental realities discussed above may alter the viability of a smallholder farmer to rely on coffee for a livelihood. They need directed support and attention

Particularly in Central America, coffee is an extremely important crop that supports the livelihood of 2 million Central Americans (Monthly Coffee Market Report, 2013). According to ICAFE, the Coffee Institute of Costa Rica, 92% of Costa Rican coffee is produced by smallholder farmers, defined as those who have less than 5 hectares of land for coffee production (ICAFE, 2015). The production by smallholder farmers represents 44% of the total land dedicated to coffee production (ICAFE, 2015).

Smallholder farmers in Costa Rica are family farmers, generally with 4-5 family members and children in school (Ruben & de Ruiter, 2002). Despite Costa Rica's high literacy rate and universal access to education, most family farmers do complete beyond primary level of education. Once their children finish primary level, they generally leave school and work on the family farm or in the household (Ruben & de Ruiter, 2002). Smallholding farms earn little cash,

thus it is common for smallholder farmers to diversify their crops, turn to pasture for livestock or seek employment elsewhere (either locally or faraway). The latter example increasingly places pressure on women to sustain the households and family farms while the husband is away seeking outside employment (Ruben & de Ruiter, 2002; Budowski & Bixby, 2003). In this setting, women generally lack access to economic resources and opportunities, and are not viewed as equal or competent compared to larger farms or dominant elite to make decisions regarding how to market or sell their crops (Gudmundson, 1989; Budowski & Bixby, 2003).

Although Costa Rica is a ‘development success story,’ still 20% of its population lives in poverty, and smallholder (family) farmers tend to most often fall into this category. In this setting, small-scale farmers are extremely sensitive to fluctuations in the global coffee market, climate changes, lack of access to resources and opportunities, and often lack the power and ability to build resiliency and capacity on their own. Smallholder farmers dominate Costa Rica’s coffee production, thus this industry is dependent on smallholders’ success.

Coffee in Costa Rica & Turrialba

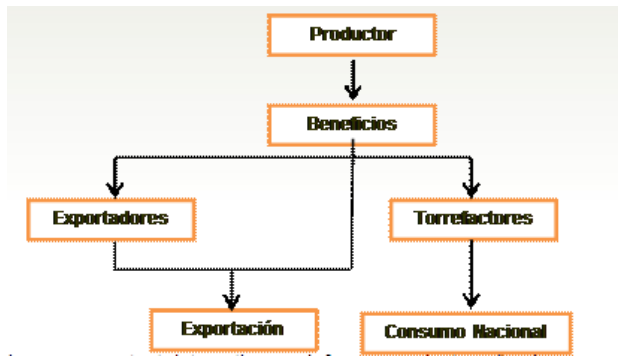
Costa Rica received its first coffee seedlings from Cuba in the late 18th century and has been one of the largest producers in Central America ever since. The quality and production of coffee is integral to Costa Rica’s national identity and Costa Ricans feel a strong national pride for their coffee (Cardoso, 1977; Sick, 1998). As required by law, Costa Ricans are only allowed to grow and process Arabica (the higher quality of the two species) in a national effort to maintain the high quality and standard of Costa Rican coffee on the global market. Unique to Costa Rica, each coffee region signed the *Convenio de Mejoramiento de la Calidad*, which dictates only licensed processors (usually cooperatives, larger farms or those with enough resources to purchase the equipment and license) are able to process coffee (ICAFFE, 2015). Thus farmers sell

only ripe coffee cherries to processors, not green coffee beans or unripe cherries, so that processors can select only the best quality coffee beans to export. This is in a national effort to maintain strict quality control (ICAFFE, 2015).

The most famous Costa Rican coffee varieties are San Marcos de Tarrazu, Tres Rios, Heredia, Alajuela, Dota and Volcano Poás. And the government actively promotes coffee picking during harvest season as a national pastime and patriotic duty (ICAFFE, 2015). Coffee production is not only important for Costa Rica's economy, but also for their national identity as well (Costa Rica, 2015; Costa Rica Overview, 2014).

While the coffee market in Costa Rica is handled by the private sector, the state maintains control and oversight via ICAFFE, the Instituto del Café de Costa Rica, who provides instrumental support and regulation in the Costa Rican coffee industry. The industry is comprised of only four sectors: producers (*productores*), cooperatives or processors (*beneficios*), exporters (*exportadores* or *torrefactores*), and the roasters (ICAFFE, 2015). The interactions between these elements are displayed in Figure 2. ICAFFE is a public, non-governmental institution that nationally promotes coffee production and activities (ICAFFE, 2015). It functions to support all members of the coffee supply chain in Costa Rica in various ways including promoting ethical and unique production models, national marketing and milling and international marketing, research and developing useful technologies, and setting fair prices for Costa Rican coffee (ICAFFE, 2015). ICAFFE maintains a strong relationship with CATIE, the tropical agricultural research and higher education center, located in Turrialba, Costa Rica. CATIE is an internationally funded institute that works in partnerships with ICAFFE, however ICAFFE is the agent working directly with farmers in Costa Rica (ICAFFE, 2015).

Figure 2: Costa Rican Coffee Industry Breakdown



Source: Adapted from ICAFE, 2015

In recent years, *la roya* greatly affected Costa Rica. As a result of the outbreak, the Costa Rican government declared a state of phytosanitary emergency in January 2013. *La Roya* affected an estimated 64% of all coffee growing land, with losses in the 2012/2013 harvest year to be at 74,000 bags, increasing to 190-230,000 bags in 2013/2014. An estimated 14,000 jobs were lost in rural areas in Costa Rica due to the *la roya*. The total damage in production value in the 2012/2013 year we estimated at \$14 million. The Costa Rican government, in response to their issuing a state of phytosanitary emergency, put a \$40 million proposal to Congress to support a coffee farmer's assistance program to help rebuild and strengthen their farms (Monthly Coffee Market Report, 2013).

Costa Rica has eight different coffee producing regions throughout the country located in either the lowlands (less than 1000m) or the highlights (above 1200m) near the many volcanoes. The Turrialba region is located on volcanic and alluvial soil on lands ranging between 600 and 1300 meters (ICAFE, 2015). The region sees on average 2600 millimeters of annual rainfall and an average annual temperature of 21.5 degrees Celsius. The region has approximately 8,500 hectares of land dedicated for coffee production (ICAFE, 2015). The recent *roya* outbreak has severely depressed the coffee production in the Turrialba region. A majority of the coffee

farmers throughout the region rely on selling their coffee cherries to cooperatives. But after *la roya*, only two cooperatives currently exist in Turrialba: Santa Rosa and Juan Viñas, to whom all the smallholders (and others without processing equipment) sell their yield (Dr. E. Somarriba, personal communication, 28 January 2015).

The Turrialba coffee-growing region has a total population of 69,546, according to the 2011 Costa Rica Census (Total Population Statistics, 2011). The rural region is predominately dependent on agriculture-based activities, including livestock for meat and dairy, coffee and sugar cane production (Censo cafetelero, 2003). The site is further discussed in Chapter 3.

Review of Academic and Research Literature: Smallholder Decision-Making and Innovation Diffusion and Adoption

This research study focuses on key external factors influencing the smallholders' decision-making process to adopt an innovation on their farm. A thorough literature review is presented to justify the identification and inclusion of the five chosen concepts in their relation to a farmer's decision-making process.

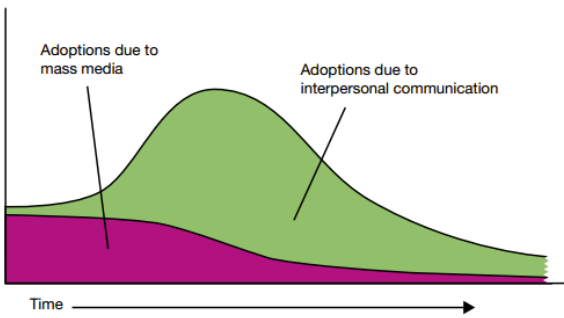
Roger's Diffusion of Innovations Theory

While studying corn hybrids at the University of Iowa, Everett Rogers conceived the diffusion of innovations theory that explains how innovations spread throughout and are adopted within a target population (Rogers, 2003). Since its conception in the early 1960s, this theory has been applied across many academic and professional fields, and has been used as the basis for agricultural support and outreach (extension, government supports) in transferring technology, practices and knowledge to farmers (Rogers, 2003; Rodriguez *et al.*, 2008). The theory focuses on both innovation qualities and the population through which it is diffused (Rogers, 2003).

Adoption is “the mental process an individual passes from first hearing about an innovation to final adoption,” whereas an innovation is anything – technology, knowledge, practice, idea – perceived by the target audience as new (Rogers, 1963, p.17; Rogers, 2003). Diffusion is the process in which an innovation spreads throughout a population, whereas adoption is the process in which the target population (either macro or micro level) considers all of the factors presented and decides to implement said innovation in daily life (Feder & Umali, 1993; Rogers 2003). Micro level studies on diffusion and adoption look at the decision making process for how individuals or households choose to adopt an innovation, whereas macro level studies look at aggregate adoption trends to understand patterns in the diffusion cycle (Feder & Umali, 1993; Feder *et al.*, 1985).

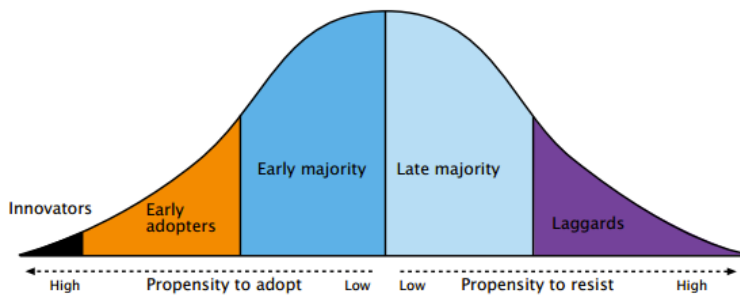
There are four main elements as described by theory in the diffusion of innovations: the innovation, the communication channels, time and the social system (Rogers, 2003). The innovation has five perceived qualities that influence adoption: relative advantage, compatibility, complexity, trialability and observability (Rogers, 2003). Innovations that are perceived by the target audience to have greater levels of these characteristics see higher adoption rates (Rogers, 2003). Communication is the means in which individuals create and exchange information regarding the innovation via communication channels that can be either mass media or interpersonal networks (Rogers, 2003). Figure 3 demonstrates the proportion of adoptions due to interpersonal networks versus mass media diffusion, as adoptions are based on individual perceptions of information (Rogers, 2003).

Figure 3: Proportion of Adoption from different communication channels



Time is considered in three ways for diffusion research. First, the innovation-decision process for an individual described above is a 5-step process: knowledge, persuasion, decision, implementation and confirmation (Rogers, 2003). Second, time is measured by the innovativeness of the individual, meaning the degree to which the individual will adopt compared to others within the social system. Figure 4 shows the five categories of adopters within a social system based on their innovativeness, including innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%) and laggards (16%) (Rogers, 2003).

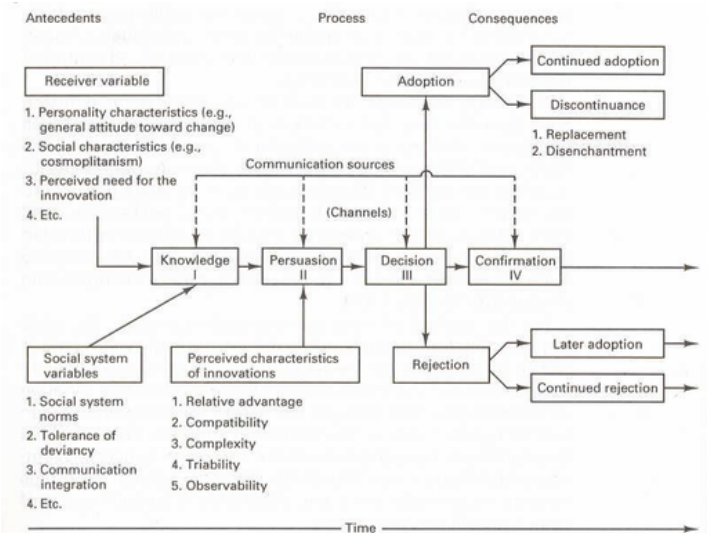
Figure 4: Five Adopter Categories within a Social System



And finally, time is measured as the rate of adoption, regarding the relative speed in which an innovation is adopted throughout the social system (Rogers, 2003). The social system is the context in which the population exists where the innovation will be diffused (Rogers,

2003). The social system is comprised of the individuals living within the system and the systems' structure itself, although there has been limited research to understand how the system structure influences adoption rates (Rogers, 2003). Figure 5 displays Rogers' diffusion of innovations conceptual model (Rogers, 1995).

Figure 5: Diffusions of Innovations Conceptual Model



Source: Rogers, 1995

Current extension, research and development efforts are rooted in diffusion of innovations theory as it outlines how innovations are diffused; they focus resource and innovation allocation on the “innovator” group because according to theory, the innovation will diffuse throughout the target audience from it (Stephenson, 2003; Rogers, 2003). Literature shows that farmers make their decisions to adopt based on a wide variety of different factors (Feder *et al.*, 1985; Feder & Umali, 1993; Fuglie & Kascak, 2001; Ghadim & Pannell, 1999; Knowler & Bradshaw, 2007). These factors include expected utility of the innovation given land availability, access to credit, land quality, risk, farm size, farmer education, and varying regional (or place-based) factors (Feder *et al.*, 1985; Feder & Umali, 1993; Fuglie & Kascak, 2001; Ghadim & Pannell, 1999; Knowler & Bradshaw, 2007; Marra, Pannell & Ghadim, 2003).

Demographic and social factors such as availability of labor, farmer age and experience, and access and frequency of interaction with knowledge sources are shown to have varying levels of influence over the decision to adopt (Ghadim & Pannell, 1999; Knowler & Bradshaw, 2007).

It should be explicitly noted that the term “innovation” does not connote either a positive or negative change. Innovations are adopted technologies, ideas or behaviors that are perceived as new by the target audience, regardless of the effect of that adopted change to the target audience (Rogers, 2003).

Role in Agricultural Development: Shortcomings and Oversight with Smallholder Farmers

There has been much criticism and unintended consequences of applying this framework in an international context as it overlooks the complexities of varying cultural landscapes (Stephenson, 2003; Rodriguez et al., 2008). The majority of populations in developing countries depend on small-scale agriculture for their livelihood, yet the introduction of new technologies has only received partial success, evident by observed adoption rates (Feder et al., 1985). The framework drives focus and resource allocation to larger and “innovator” farmers, and therefore, away from smallholders, who are classified in the laggard groups (Rodriguez et al., 2008). And aggregated research (macro-level) assumes that influencing factors don’t vary across country, regions or even communities (Knowler & Bradshaw, 2007). There is a need to investigate innovation diffusion and adoption at the micro level with these marginalized populations to (1) better understand how they receive and are influenced to adopt, and (2) to then tailor diffusion methods to better suit those needs (Feder & Umali, 1993; Feder et al., 1985; Knowler & Bradshaw, 2007). Failure by extension agents, researchers, and practitioners directly impact and affect rural life, particularly those dependent on small-scale agriculture to maintain a livelihood.

Exclusion of Smallholder Populations

In developing countries, innovator groups are larger farms with more access to resources, better connections and higher levels of affluence. The lifestyle and access to resources are so different between these larger farmers and smallholder farmers that innovator groups are not reliable or even feasible change agents to diffuse innovations to the smallholder (Stephenson, 2003). But innovation diffusion methods are tailored to the innovator group and often do not address the smallholder, yet it is the latter population where higher impact could occur, particularly among high demand crops such as coffee.

Focusing on innovator groups also holds potential to create a wider gap between the larger and smallholder farmers, as larger farmers are able to increase yield, production, and quality as a result of the innovation, affecting market prices, which impacts the smallholder even more as they now receive lower prices and no innovation (Stephenson, 2003). Smallholders are overlooked in the diffusion of innovations theory and there is little research to understand how innovations are effectively diffused *to smallholders* (Stephenson, 2003; Feder & Umali, 1993; Feder *et al.*, 1985). They produce over 80% of the world's agricultural production, thus it is essential to know how to best diffuse innovations directly to smallholders by understanding what influences their decision or ability for adoption and implementation (Walpole *et al.*, 2013).

Until the early 1970s, rural sociologists were the champions of adoption-diffusion research, particularly as it pertained to agriculture in both developed and developing countries (Ruttan, 1996). However, following the rapid growth of development research in the 1960s, adoption-diffusion research shifted to being primarily a concern of economists. It became an increasingly important research subject for development economists just as it was declining in

rural sociology, resulting in the current breadth of economic and empirical studies on adoption-diffusion, but lack of qualitative and participatory research (Ruttan, 1996).

Feder & Umali (1993) account for issues with using economic modeling to investigate innovation diffusion and adoption patterns with farmers, noting that “non-adopters [in which smallholders are generally categorized due to time lags] were frequently excluded from the sample, thus resulting in sample selection bias and consequent biases in the estimated coefficients” (p. 229). Not only does this issue not account for smallholders in economic models, but the effects of this exclusion is magnified with biased coefficient calculations. This research based on these economic models is used by extension, policy and development worker to better target audiences in order to allocate resources in diffusing new technologies, information or practices to improve production and quality (Feder & Umali, 1993).

Feder & Umali (1993) explain that, “experience has shown, however, that several factors can constrain technology adoption: lack of credit, limited access to information and inputs, and inadequate infrastructure,” which can be exacerbated depending on the type of technology (p. 230). Other barriers to adoption include aversion to risk, inadequate farm size, and insufficient human capital (Feder *et al.*, 1985; Feder & Umali, 1993; Marra *et al.*, 2003). Government and support agencies try to overcome this challenge by information provision (i.e. extension) or providing subsidies or support programs (Feder & Umali, 1993). These government solutions, however, can lead to more harm than good, yielding resource misallocation or even further marginalization of resource-lacking populations (i.e. smallholders) (Feder & Umali, 1993).

Need for Participatory Research

As described above, innovation diffusion research in development contexts is primarily a concern of economists, mostly looking at micro and macro level decision patterns via economic models. While incredibly insightful, they fail to truly account for heavily dynamic and uncertain variables, such as farmer perceptions and motivations, interpersonal relationship ties and gender roles (Feder & Umali, 1993; Greiner & Gregg, 2011; Greiner, Patterson & Miller, 2009). The aversion to risk is a frequently cited influential variable, however it is dependent on the individual's *perception* of risk (Marra *et al.*, 2003). It is a dynamic variable and almost impossible to quantify, thus rarely accounted for in empirical modeling (Ghadim & Pannell, 1999; Marra *et al.*, 2003). As Wilkinson (1972) stated, interpersonal ties, whether strong or weak, are dynamic, unbounded and impossible to quantify. These cannot be accounted for in economic modeling. There is a lack of research that seeks to ascertain the farmers' perspectives (Feder *et al.*, 1985; Greiner, Patterson & Miller, 2009). This is a constraint as "farmers' technology choices are based on their subjective probabilities and hence, on their exposure to information regarding new technology" (Feder *et al.*, 1985, p. 274). Understanding technology diffusion and adoption from the farmers' perspective can point to variables, factors, or influences that are otherwise unaccounted for in theory, economic modeling or empirical literature.

Diffusions of innovations research must be tailored and adapted to culture, and most importantly, directed for smallholders. Smallholders are responsible for the world's food supply and are among the most vulnerable populations in the world: diffusion efforts must be tailored to the needs and cultural ways of smallholding populations in order for effective adoption, implementation and development success. Extension, research and development interests need to better understand the process behind why smallholders do or do not adopt an innovation. With

this understanding emerge efforts that more efficiently and effectively diffuse innovative technology and practices to smallholders that can improve production, yield, quality, health, and others to the most vulnerable and marginalized populations. And ultimately, these efforts aim to improve rural livelihoods and ways of life.

Decision-Making Process

The decision-making process is the dependent concept in this research, as it looks at the external factors influencing this process as a farmer decides to adopt an innovation on his or her farm. Decision-making is a process happening within an individual or as elements of a social process presented as events that happen between people (Saaty, 1990; Sick, 1998; Vroom & Jago, 1974; Dams & Hunt, 1976). The basic steps involved in a decision-making process include (1) defining the objective, (2) identifying possible choices, (3) collecting relevant information, and (4) drawing appropriate inferences (Dams & Hunt, 1976). Dams & Hunt (1976) conclude that when choices are limited and resources are scarce, such as with small-scale farmers, then inferences are “relatively simple and the decisions are usually un-innovative” (p. 3).

Saaty (1990) explores the analytic hierarchy process (AHP) in making a decision. He summarizes that humans are influenced by a hierarchical external set of factors when making a decision, and emphasizes the complex nature and highly interrelatedness of those factors uniquely applied in each situation. Thus it is crucial to use a participatory approach to tease out those factors from the decision-maker, not the reverse. Saaty’s (1990) conclusion drives the motivation for taking a participatory approach for this research in identifying factors influencing a farmer’s decision-making process to adopt an innovation,

“The moral is that we are sometimes led into developing blind expectations for that to which we are accustomed out of habit, and not necessarily because its truth is something written in granite. We believe that our own tempered understanding should produce closer results to experience than simply following tradition, which has possibly rutted our thinking, and induced us to forego change in search of better ways that give better answers” (p. 26).

It is essential for this research to undertake a participatory approach to fully understand what influences a smallholder farmer’s decision-making process to adopt an innovation.

The diffusion of innovations theory and applied research, described in the above sections, identified several concepts that influence an individual’s decision to adopt an innovation. These concepts constitute the first three main research concepts: innovation characteristics, participant characteristics and access to resources. These will be further described in the following sections in as to how they pertain to the decision-making process.

Participant Characteristics

Rogers (2003) describes the importance of understanding the target population through which an innovation will be diffused, breaking down this population into “adopter categories” (Figure 4). The five categories are listed in descending order for the category’s propensity to resist an innovation: innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). Innovators represent 2.5% of the population and are very eager to try new innovations and take risks; early adopters represent 13.5% of the population and are considered opinion leaders who are eager to try new innovations yet aren’t the quickest risk takers; early majority represents 34% of the population and are rarely leaders, yet are willing to take more risk than the average person; late majority represent 34% of the population and are skeptical of change, but will take risk after seeing the innovations success with another adopter; and laggards

represent the final 16% of the population and are the most conservative and skeptical of change group (Rogers, 2003).

Smallholders and rural peoples are generally categorized as either late majority or laggards, as they are bound by tradition and very conservative in their decisions (Stephenson, 2003; Rogers, 2003). The late majority category is generally convinced to try an innovation after seeing its success by another adopter while laggards are the hardest to convince to try an innovation (Rogers, 2003). The way innovations are diffused is to understand the target population, and focus efforts on the innovator and early adopter groups with the idea that the descending groups will eventually adopt after witnessing its success (Rogers, 2003; Stephenson, 2003). This research concept addresses the personal context, motivation and history of the smallholder farmer in understanding its influence on his or her decision-making. To understand the participants' characteristics, it is necessary to understand their tradition, motivations and perceptions for why and how they make decisions (Rogers, 2003; Greiner & Gregg, 2011; Greiner, Patterson, & Miller, 2009; Feder *et al.*, 1985).

Access to Resources

While the participants' characteristics influence their decision-making process, their access to resources is also a highly cited influential factor on their decision-making process to adopt an innovation (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Knowler & Bradshaw, 2007). Increased access to external resources, such as inputs, information, labor, technology, and assistance (expert or communal), allow a farmer more options, knowledge and ability to make more efficient and better informed decisions (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Knowler & Bradshaw, 2007). Farmers with higher access to resources are generally more exposed to new innovations and able to make quicker decisions with higher

risk than those with lower access to resources (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Knowler & Bradshaw, 2007). This research concept will assess the participants' level of access to resources and how their access to resources influences their decision-making process when adopting an innovation on their farm. The literature widely cites the participants' access to resources as a key factor influencing a farmer's decision or ability to adopt an innovation (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Knowler & Bradshaw, 2007).

Innovation Characteristics

In diffusion of innovations theory, there are five main characteristics of the innovation that are detailed to influence adoption (Rogers, 2003; Feder, *et al.*, 1985; Fuglie & Kascak, 2001; Ghadim & Pannel, 1999; Knowler & Bradshaw, 2007; Marra *et al.*, 2003). These five characteristics act to different extents in each adopter category and are defined here: (1) Relative advantage – the degree to which the innovation is perceived as better than the idea, practice or tool it replaces; (2) compatibility – how consistent the innovation is with the values, experiences and needs of target population; (3) complexity – the degree of difficulty to which the innovation is understood or used; (4) triability – the extent to which the innovation can be tested or experimented before potential to adopt; and (5) observability – the extent to which the innovation can be seen and provide tangible results (Rogers, 2003). And in addition to these five main innovation qualities, the way in which the innovation is diffused can also influence adoption (Rogers, 2003). Interpersonal communication is more effective than mass communication as it allows for the potential adopter to be able to experience more of the five qualities than via mass communication (Figure 3) (Rogers, 2003). This research concept addresses how the information channel and innovation characteristics described above influence a smallholder's decision to adopt a respective innovation. Literature has shown that these characteristics and means of

diffusion influence a decision to adopt at various intensities depending on the adopter group (Rogers, 2003; Feder *et al.*, 1985; Knowler & Bradshaw, 2007).

While the diffusion of innovations theory describes the importance of a *social system* through which innovations are diffused as well as impact of interpersonal communication for diffusing said innovation, it does not account for community, community engagement or community supports in its theory (Rogers, 2003; Stephenson, 2003). Additionally, it does not include references or acute understanding of the effects of gender dynamics within target populations on decision-making (Rogers, 2003).

However, these are believed to have an influence on decision-making. For example, Sick (1998) utilized a participatory approach to study the power dynamics between gender and land acquisition rights in terms of decision-making influence, finding that regardless of *de facto* or legal realities, community recognition and sociocultural norms dictate power and decision-making influence. These include what society or the community considers “appropriate” for who, in regards to things such as occupation, ownership, land acquisition, gained skills, and opportunities. As Sick (1998) concludes, “bargaining power, opportunities, expectations and ambitions of men and women, young and old, vary accordingly” (p. 209). In Costa Rica, Sick (1998) provides insight that community influences and gender roles play a crucial role in decision-making within smallholder coffee households. The role of community and gender dynamics will be further discussed below, as it exists in literature and how it pertains to decision-making for innovation adoption in agricultural contexts.

Role of Community

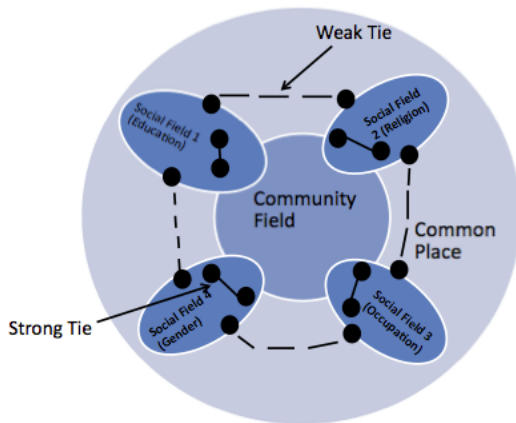
The role of community and community engagement will be explored in this research in how it relates to farmers making decisions on their farms. Review of diffusion of innovations research frequently cited that farmers receive information from other farmers, but have not further explored these informal information channels (Feder *et al.*, 1985). Additionally, Rogers (2003) accounts for the importance of social systems, but does not address community. This research defines community as a process between individuals and a physical place.

Community is a dynamic and interactional social process, which emerges when individuals living in a physical locale interact and exercise agency to address common needs, values and interests (Wilkinson, 1991; Kaufman, 1959; Granovetter, 1973; Bridger, Brennan & Luloff, 2011). It is rooted in a common physical place, where individuals function, live and work to fulfill daily needs (Bridger, Brennan & Luloff, 2011; Kaufman, 1959; Wilkinson, 1991). Thus two major factors must be accounted for in community: a common physical place and interaction between individuals towards each other and the place. Individuals interact with each other and form interpersonal relationships based around mutual interests, values, and needs. These interactions demonstrate where placed-based needs lie (Granovetter, 1973; Wilkinson, 1970). Social fields develop from these interactions, and these individual social fields concern themselves with singular needs, values or interests within the community (Granovetter, 1973; Wilkinson, 1970). The social fields have potential to generate a community field once different social fields interact with each other (Wilkinson, 1972). The community field is the broader field that encompasses interaction between social fields within a common locality to address the needs, interests or values for individuals within that community (Wilkinson, 1970, 1991; Bridger *et al.*, 2011). The community field is where various social fields exhibit and exercise agency and

collective action, as they are able to mobilize and utilize resources across the social fields (Bridger *et al.*, 2011). This description of fields is presented in Figure 6.

The entire process of building community via community and social fields relies directly on the interactions between individuals in a given locale to address common needs, interests or values. These human interactions can never be predicted, thus a field is a holistic interaction nexus, unbounded and dynamic (Wilkinson, 1972, p.313). These interpersonal relations are what Granovetter (1973) addresses as social “ties,” that can either be strong, weak or nonexistent. They can additionally be positive or negative direction. These interpersonal ties are micro social interactions that relate to macro level social theory, however are rarely accounted for in social theory (Granovetter, 1973).

Figure 6: Community and Social Fields with Strong and Weak Ties



According to Granovetter (1973), the strength of these interactions depends on “a combination of the time, emotional intensity, intimacy, reciprocal services which characterize the tie,” similarity between individuals and frequency of interactions (p. 1361). Therefore individuals within a similar social field share higher levels of similarity and also increased

frequency, thus their interpersonal ties will be stronger than those between individuals from different social fields (Granovetter, 1973). These weaker interpersonal ties between social fields bridge different individuals and groups across various social fields. Granovetter (1973) explains the importance of these weaker interpersonal ties in the diffusion of information and knowledge across social fields within a broader community field. The likelihood to spread information between two points within a community field increases when there are various paths in which that information can travel (i.e. between strong *and* weak ties; within *and* across social fields) (Granovetter, 1973). The inclusion of micro level interpersonal interactions accounts for various forms of knowledge and information diffusion across a community.

Smallholder farmers are excluded from economic modeling of technology diffusion and adoption due to the time lag between diffusion and actual adoption. Yet it is identified that this time lag generally derives from the fact farmers receive their information regarding yields and innovation success from other farmers (Feder *et al.*, 1985; Feder & Umali, 1993). This points towards the idea that social interactions between farmers could influence the decision to adopt or not. Additionally, Sick (1998) noted that community perceptions heavily influence gender roles and gender specific behaviors in small-scale coffee growing areas in Costa Rica, it is likely that community is present in these areas. Thus these informal communication channels, particularly in these smallholder coffee growing areas with strong community, can provide alternative paths for knowledge diffusion that can potentially affect how a farmer learns about new technologies, practices or ideas, and decides to adopt an innovation on his or her farm.

Additionally, the role of the family is crucial to understanding rural ways of life and community, particularly in agricultural dependent areas. The family's role in rural areas has implications for rural household wealth, health, education, migration patterns and

intergenerational transfer of skills (Lichter & Eggebeen, 1992; Bokemeier, 1997; Hofferth & Iceland, 1998). Family structures are shown to be particularly stronger in rural areas compared to urban areas, but regardless have a strong influence in education drop out behavior (Lichter, Cornwell & Eggebeen, 1993). The study of family farms in rural areas centralized foci on gender divisions in labors and responsibilities as well (Sachs & Alston, 2010).

Gender Roles

Since the establishment of the 2000 Millennium Development Goals, the international community has been paying closer attention and greater focus on gender disparities within the global agricultural context (UN General Assembly, 2000). It has become increasingly apparent that agricultural interventions, programming and focused research that aims to alleviate poverty or increase capacity and resiliency will undoubtedly have gender implications (Cole *et al.*, 2014; Bolwig, 2012; Katz, 2003; Buvinic & Gupta, 1997) The literature analyzing gender dynamics and disparities in global agriculture, particularly in the light of aiming to increase food security and alleviating poverty, highlights their significant influence in affecting productivity, household security and viability, and resource allocations (Bolwig, 2012).

Analysis of gender roles in household farms and rural life involve examining roles and responsibilities for both male and female members (Little, 2006; Sachs & Alston, 2010). Gender identities in rural life must be analyzed through a lens identifying and reconfiguring ideas of power and inequality in rural communities (Little, 2006). Gender division in labor activities in rural agricultural settings are identified and discussed in order to shed light on the presence of power dynamics and inequalities existence in households. Understanding these power dynamics and inequalities is crucial to improve rural livelihoods (Little, 2006; Sachs & Alston, 2010).

Farming schemes are generally skewed towards men, regardless of the labor breakdown by gender (Bolwig, 2012). Women constitute a majority of small-scale farmers in developing countries, but societal or cultural norms disallow them to access agricultural extension services, inputs, financial support, or extra training to help improve their management. In addition to maintaining farms, women are generally also responsible for taking care of the household and the children. Thus they are more likely than men to make decisions that invest incomes back into household needs, including supporting their children (Bolwig, 2012; Schalatek & Burns, 2013; Chipande, 1987). Research, policy and development agencies have directed their focus into better understanding the women's role (direct or indirect) on agricultural production and how the women are, or are not, supported. In result, it is the aim to figure out how women can be better supported regardless of cultural stigmas in order to increase their viability and success of their farm and their household (SOFA Team & Doss, 2011; Schalatek & Burns, 2013; Buvinic & Gupta, 1997; Katz, 2003).

Gender roles in Costa Rica

The literature regarding gender roles in small-scale agriculture in Costa Rica maintains that it is a very gender divided landscape. In Costa Rica, coffee production and processing is considered a male domain. Small scale coffee farming in Costa Rica align with this gender division, whereas the men are responsible for tending the coffee (and other crop) fields whereas the women provide the crucial domestic support in maintaining the household (Sick, 1998; Reinhardt, 1988; Ortiz, 1973). Both men and women take their respective roles seriously and the division between each is clear: men are reluctant to undertake any domestic duties whereas women prefer household work to agricultural work (Sen, 1990).

These views of gender divided roles in Costa Rica, in combination with the limited access to resource and opportunity for smallholder farmers, can place added pressure on women in family farming households (Gudmundson, 1989; Budowski & Bixby, 2003; Ruben & Ruiters, 2002). If men have to seek outside work to supplement the limited income small-scale farming yields, women then must maintain the household and the family farm, but receive little to no support (Budowski & Bixby, 2003; Ruben & Ruiters, 2002). Additionally, women head of family farming households constitute a large portion of the poverty stricken population, primarily due to unequal treatment and lack of resources (Budowski & Bixby, 2003; Ruben & Ruiters, 2002).

However, women and children do contribute to the agricultural production by providing necessary domestic support throughout the year and indispensable help during harvest time (Sick, 1998; Cardoso, 1977). Coffee fields in Costa Rica are generally steep and host poisonous snakes, so if women with young children do not have access to childcare, they often cannot or do not help on the farm or during harvest (Sick 1998). Even in female-headed agricultural households in Costa Rica, women generally will not do all of the labor on the farm and will hire male help to do necessary maintenance, chemical application and assistance during harvest. A Costa Rican female head of the household described coffee labor as stating, “That is men’s work...it is just too heavy for us,” even though that same woman actively participates in equally laborious work such as harvesting sugar cane and carrying firewood (Sick, 1998, p. 196). In Costa Rica, women’s status is tied to their domestic and childcare. Cultural and social barriers deter women from participating or heading a coffee farm (Agarwal, 1989, 1992, 1994). Women coffee farmers are less confident than their male counterparts and lack access to information, trainings and opportunities to make coffee farming feasible. However, those that do grow coffee suffer cultural or social consequences as being deemed “not respectable” or losing female support (Sick 1998).

Throughout the world and particularly in Costa Rica, women play either a direct or indirect role in the success of agricultural production (Buvinic & Gupta, 1997). Whether women are actively engaged on the coffee farm, which the literature points is not the case in Costa Rica, or solely engaged in the house, how do these gender dynamics affect the way coffee farmers make decisions on their farms to adopt an innovation? Are women not engaged in coffee production in Costa Rica due to cultural or societal pressures? Do women have an influence over changing a practice or adopting a new technology on the farm if they are not actively involved? And if they are actively involved, how does that affect the decision-making process? This research seeks to explore from the farmer's perspective the role women play on the coffee farm and how they do, or do not, influence decisions made regarding the farm.

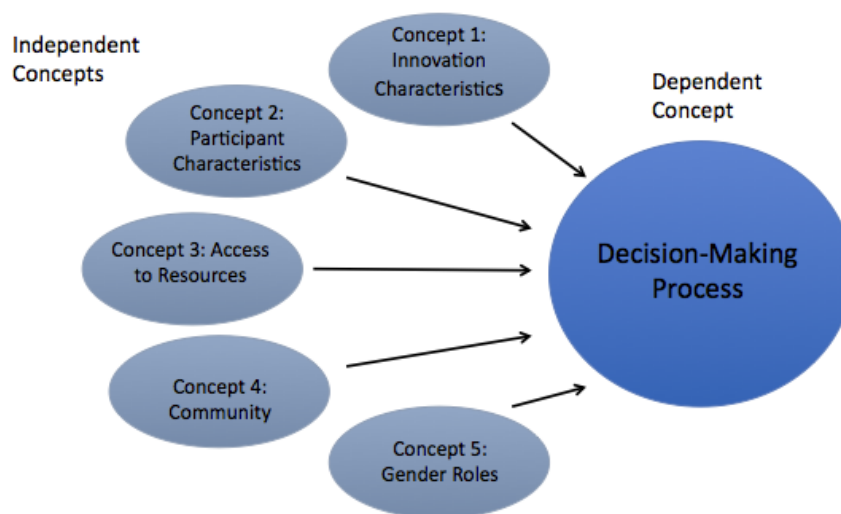
Theoretical Framework

Smallholder farmers are among the most marginalized populations in developing countries and often lack access to necessary resources, an issue exacerbated by their exclusion from innovation-research. They make up the majority of populations in rural areas and it is crucial to understand them as a target population in order to improve rural livelihoods. In innovation diffusion research, there is a need to address smallholder populations directly as well as include participatory research to better understand influencing factors to adopt. The reviewed literature points to several factors that influence a farmer's decision to adopt an innovation, however do not address the role of community and gender in adoption. Figure 7 is a conceptual model for this research.

The diffusion of innovations theory provides a framework on which this conceptual model is based (Rogers, 2003). The theory outlines major factors influencing the adoption of

innovations in target populations, including the innovation's characteristics (concept 1), the participant's characteristics (concept 2) and the participant's access to resources (concept 3). These three concepts have been identified in the diffusion of innovations theory and applied research to have an influence over an individual's decision-making process to adopt an innovation (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Knowler & Bradshaw, 2007; Greiner & Gregg, 2011; Greiner, Patterson, & Miller, 2009; Stephenson, 2003). However while the diffusion of innovations theory indicates the importance of interpersonal communication between individuals and the social system of a target population, it overlooks the process of community, community engagement, and gender dynamics within a target population as influential factors on the decision-making process (Stephenson, 2003; Rogers, 2003; Sick, 1998). Community (concept 4) and gender roles (concept 5) are included in this research as factors potentially influencing the participants' decision-making process (Wilkinson, 1991; Sick, 1998; Buvinic & Gupta, 1997; Agarwal, 1989; Gudmundson, 1989; Granovetter, 1973).

Figure 7: Conceptual Model



This research aims to better understand the smallholder farmers' decision-making process to adopt an innovation through their perspective via a phenomenological research approach. This project focuses on smallholder coffee farmers in the Turrialba region of Costa Rica. The following chapters detail the methods, results, discussion of results, and final conclusions, reflections and steps for further investigation.

Chapter 3

Research Methodology

A cross-sectional descriptive case study was conducted to explore and better understand the factors that influence a smallholder farmer's decision-making process in adopting an innovation on their farm (Schwartz *et al.*, 2001; Brennan & Dodd, 2009). Five overall questions guided this research process to investigate the relationship between five key concepts with the decision-making process. Three of these five concepts are derived from existing theory pertaining to diffusion of innovations while the final two are rarely cited in diffusion of innovations literature, but are believed to have an influence on the decision-making process. These five concepts include: (1) innovation characteristics, (2) participant characteristics, (3) access to resources, (4) level of community engagement, and (5) gender roles.

This research took place during the winter and spring of 2015. An initial one-week scoping trip was made in January 2015 to Turrialba, Costa Rica. The purpose of this scoping trip was to establish contacts, to gain a better understanding of the locale, and to identify a sample population for this research. During this visit, several key contacts were established at CATIE, who mainly consisted of researchers and extension agents. These contacts have years of experience working with smallholder coffee farmers in Turrialba, as well as other cantóns of Costa Rica and Central American countries. This initial scoping trip facilitated access and feasibility in returning to Turrialba in March 2015 to conduct the field research.

As this research involved human participants, an IRB was submitted to and approved from Penn State University's Office of Human Protections. The IRB research approval can be found in Appendix B.

Research Approach

This research study takes a phenomenological approach to gain a deeper understanding of the influences and motivations behind a smallholder coffee farmers' decision-making process to adopt an innovation on his/her farm. Phenomenological research “describes the meaning for several individuals of their lived experiences of a concept or a phenomenon,” seeking to synthesize a description of *what* the individuals experienced and *how* they experienced it (Moustakas, 1994). The phenomenon studied in this research is the decision-making process in choosing to adopt an innovation, as the collective participants of this study all experienced this phenomenon when given an opportunity to change or invite a new practice, tool or method on their coffee farm. The study design, data collection instruments and protocols, and analysis are rooted in the principles of phenomenological research to investigate and gain a deeper understanding of this decision-making process.

Phenomenological theory is popular among social science research (Natanson, 1973; Dukes, 1984) and is heavily immersed in its philosophical assumptions that drive the theory (Moustakas 1994). The several core philosophical assumptions on which this theory rests include: it is the study of lived experiences by persons, the view that these experiences are conscious ones, and the development of describing the essence of these experiences (Moustakas, 1994; van Manen, 1990). Stewart and Mickunas (1990) discuss four philosophical perspectives phenomenological theory takes: (1) re-involving the traditional tasks of philosophy into research, (2) suspending suppositions in research, (3) acknowledging and integrating the intentionality of consciousness, and (4) refusing the subject-object dichotomy. Phenomenological theory places a strong emphasis on understanding perspectives of phenomenon and removing suppositions so as to “grasp the very nature of the [phenomenon]” (van Manen, 1990, p.177). Two approaches exist in phenomenological research, however since this research focuses on gaining a deep

understanding of the decision-making process, it will follow a transcendental approach (Moustakas 1994). As Moustakas (1994) describes, transcendental phenomenology is focused less on the researchers' interpretation and more on descriptions of the participants' experiences from their perspective.

This research study is designed and analyzed under the guiding principles of transcendental phenomenological theory as it seeks to gain a deeper understanding of smallholder farmers' (participants) decision-making process (phenomenon) when choosing to adopt an innovation on their farm. The following design, methods and analysis sections will pull heavily from the principles established in phenomenological research theory.

Research Goal

The overall goal of this research project is to better understand a smallholder farmer's decision-making process when choosing to adopt or not adopt an innovation on their farm. Mainly, this research seeks to understand from the smallholder's perspective what factors influence, motivate or hinder their decision to adopt an innovation on their farm. This goal is accomplished by investigating the following research questions via a mixed-methods approach, utilizing primary qualitative data and secondary quantitative data measures.

Research Questions

The following questions frame this research:

- How do the participants' characteristics influence their decision-making process in adopting an innovation?
- How do the participants' access to resources influence their decision-making in adopting an innovation?

- How do the innovations characteristics influence smallholder farmers' decision-making process in adopting an innovation?
- How does community engagement influence the smallholder's decision-making in adopting an innovation?
- How do gender roles influence the smallholder farmer's decision-making process in adopting an innovation?

Study Location

This research selected Turrialba, Costa Rica as its site location to conduct the case study. Turrialba is a cantón located in the Cartago province of Costa Rica and is broken down into four regions including Paraíso, Jiménez, Turrialba and Siquirres (see Figure 8). This research focuses on the Turrialba region within the Turrialba canton. Situated 11 miles northeast of the Turrialba Volcano, Turrialba's climate is influenced by the Atlantic slope and Eastern Central Valley, characterized by heavy amounts of rainfall. Its coffee growing regions vary in elevation (600m to 1300m) and are broadly known for their early ripening coffee beans (ICAFE, 2015).

Costa Rica, and more specifically Turrialba, was chosen as the site location for this case study for several reasons, including the national identity tied to coffee production, gender representation and facilitated access. The majority of coffee farms in Turrialba (58%) are smallholding, with areas between 1 and 5 hectares (INEC Censo Cafetalero, 2003).

As introduced and discussed in Chapter 2, coffee production has a long history and cultural significance in the Turrialba region as well as Costa Rica in general. Coffee quality and production is closely tied to Costa Rica's national identity, thus there is national support, infrastructure and desire to maintain a high quality standard. This provides an interesting case

study to look at how levels of sense of community and community engagement interplay with a smallholders' decision-making process.

Figure 8: Study Location of Turrialba (Cantón #305) in Costa Rica

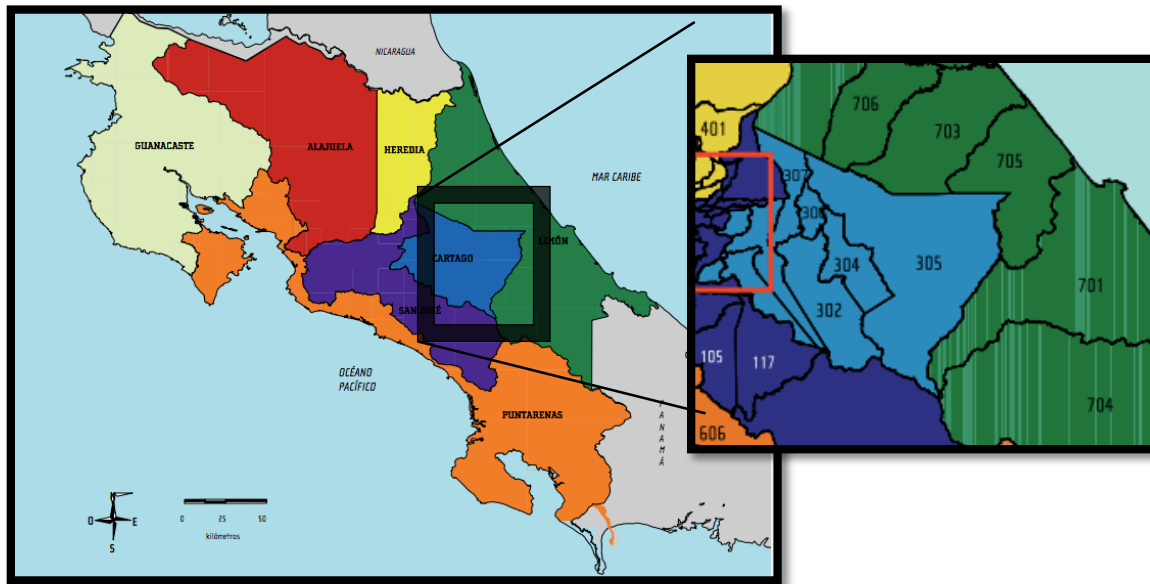


Figure adapted from INEC Census 2011

Additionally, women are underrepresented in coffee production in Costa Rica (see Table 1). This research seeks to gain insight on how gender roles influence the decision-making process to adopt an innovation. Turrialba cantón and region have higher representation of women dedicated to working on the coffee farms compared to other regions (Table 1), so using the Turrialba region as a case study allows this research to investigate this underrepresented population. What roles do the women play in coffee production and how does this varying level of participation affect decision making on the farm in terms of innovation?

Table 1: Percent of Women from Coffee Producing Households that Work on the Farm by Coffee Region

Canton	Total Workers	Number of Women	% Women
Turrialba	2663	469	18%
Coto Brus	3299	277	8%
Valle Central	2189	261	12%
Valle Central Occidental	3742	228	6%
Tarrazú	6064	572	9%
Pérez Zeledón	5463	763	14%
Zona Norte	1121	249	22%
Region			
Turrialba	2150	385	21.81%

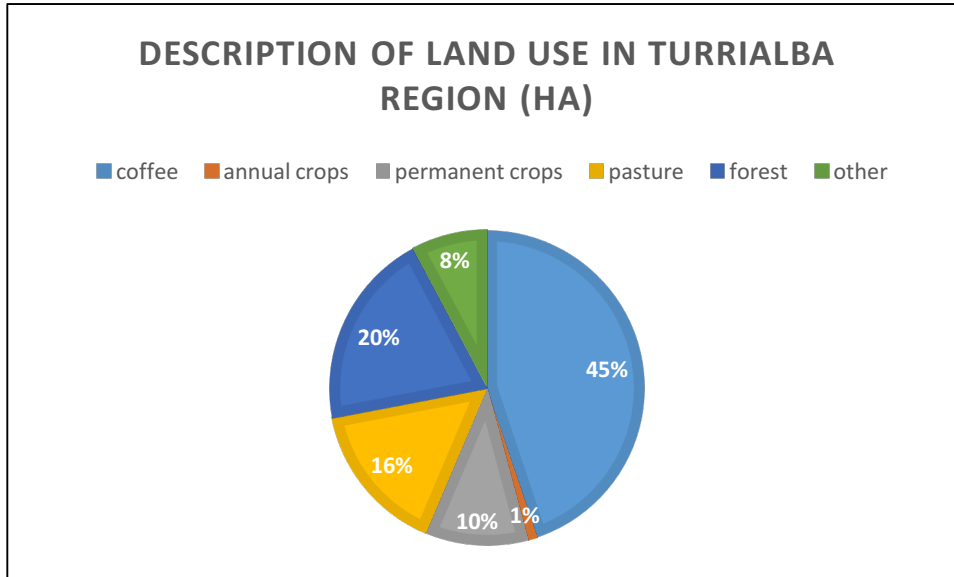
Source: INEC Censo Cafetalero 2003

Finally, access to the Turrialba region was facilitated as a result of establishing connections through CATIE. Penn State's College of Agricultural Sciences and CATIE had recently signed a memorandum of understanding (MOU) to promote and facilitate exchange of research and opportunities between the two institutions. This MOU was signed in May 2014, when I had the opportunity to meet and discuss my research interests with the Director and Deputy Director of CATIE. This connection further developed over the course of the next several months and I initiated contact with several other researchers at CATIE. In January 2015, I visited CATIE on an initial scoping trip to further establish these connections, gain a deeper understanding of the local context and facilitate access to farmers. After this trip and several conversations with local experts with years of experience working with smallholder farmers throughout Costa Rica, Turrialba was selected as the location to conduct this case study.

Turrialba is a rural cantón that is heavily dependent on agricultural production. Of its total agricultural land (27,029.54 ha), 42.6% is dedicated for coffee production (11,514.61 ha) (INEC, censo cafetalero p. 71). The cantón is broken into four coffee producing regions: Paraiso, Jimenez, Turrialba and Siquirres. This research focuses on the Turrialba region within the

Turrialba cantón. The land use distribution for the Turrialba region within the cantón is shown in Figure 9. Coffee production represents 44.86% of the total land use in the Turrialba region.

Figure 9: Description of Land Use in Turrialba Region (Ha)



Source: *INEC Censo Cafetalero 2003*

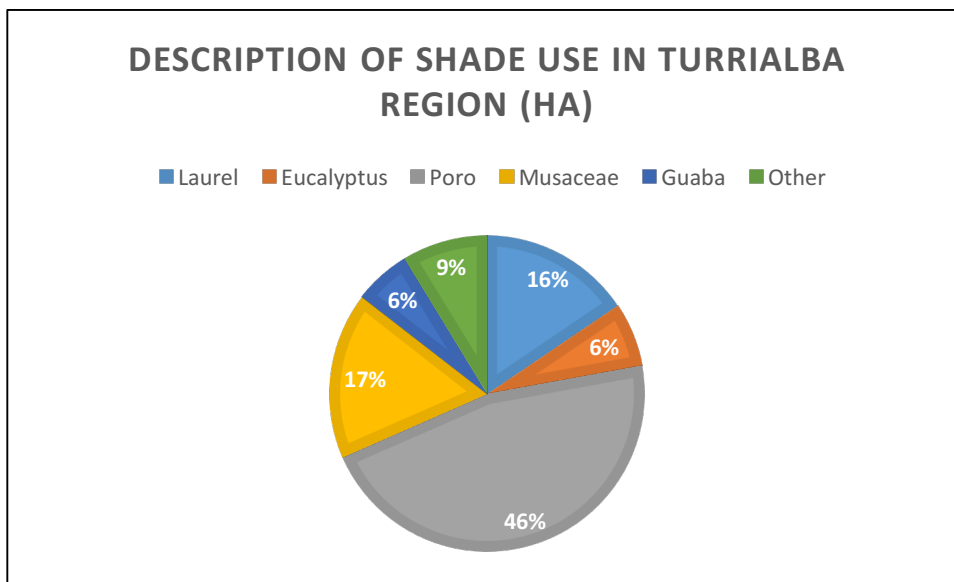
As evident in Figure 9, coffee production is the dominant use of land in the Turrialba region and is an important economic activity for Turrialba. This section will further elaborate on the specifics of coffee production in the Turrialba region and the demographic make up of coffee farmers in Turrialba.

The use of shade trees (such as service trees or various species of timber and fruit trees) is a common practice with coffee production. Figure 10 highlights the use of different types of shade trees used within the Turrialba region. Poro and Guaba are both service trees that aim to provide shade for the coffee plantation as well as nitrogen fixing properties for soil health (OIRSA 2000). Musaceae refers to species of tree in the scientific family *Musaceae*, including banana and plantain. They are fruit trees that are used to provide shade as well as extra sources of income or sustenance through fruit production. However fruit trees compete with the coffee

for nutrients and water (OIRSA 2000). Eucalyptus and Laurel are both types of forest trees used on coffee plantations to provide shade to the coffee plants, to increase habitat for birds and other pollinators on the plantation, and as an added source of income for the farmer through timber production. Additionally, timber trees such as Eucalyptus and Laurel are able to extract nutrients deeper in the soil that the coffee plant roots cannot reach and thus are able to increase the coffee plants' access to those nutrients (OIRSA 2000).

In the Turrialba región, there are a total of 1,716 total coffee farms as of 2003, with a dedicated 7,933.76 Ha dedicated to coffee production (INEC Censo Cafetalero 2003). The majority of farmers in the Turrialba region (94%) own their farms, while the remaining 6% either rent or are provided with the land (INEC Censo Cafetalero 2003).

Figure 10: Description of Shade Use in Turrialba Region (Ha)



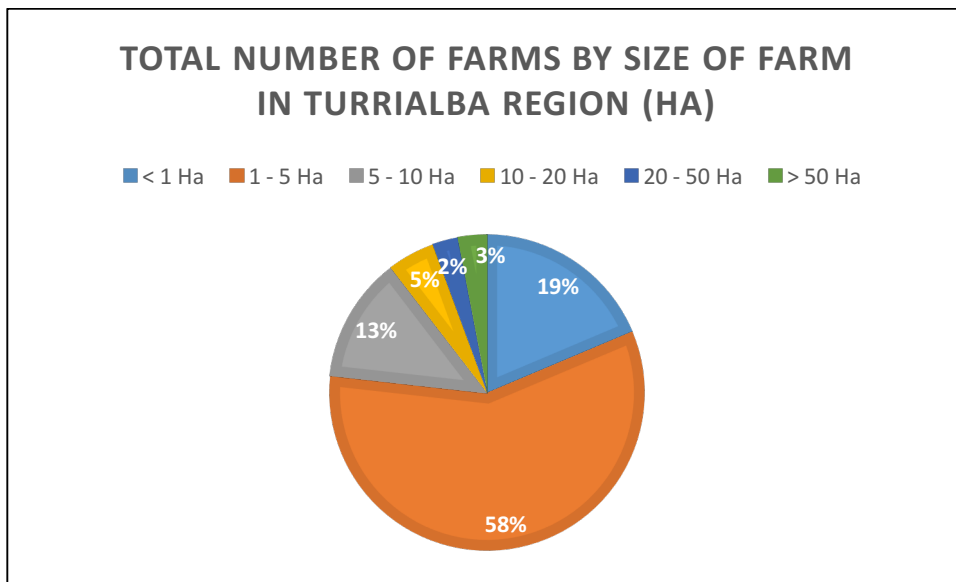
Source: INEC Censo Cafetalero 2003

Figures 11 and 12 describe the total land area and number of farms by farm size throughout the Turrialba region. In Costa Rica, a smallholding farm is considered less than 5 hectares of land. In the Turrialba region, there are 1325 coffee farms that are 5 hectares or less,

constituting 77% of the total number of coffee farms in the region (Figure 3-4). Mid-sized farms are considered those between 5 and 20 hectares, which account for 18% of the total number of coffee farms in the region, and the final 5% of farms are large farms, those greater than 20 hectares (Figure 11). However as shown in Figure 12, large farms account for 68% of the total coffee producing land, whereas smallholding farms account for 16% of the land (Figure 12).

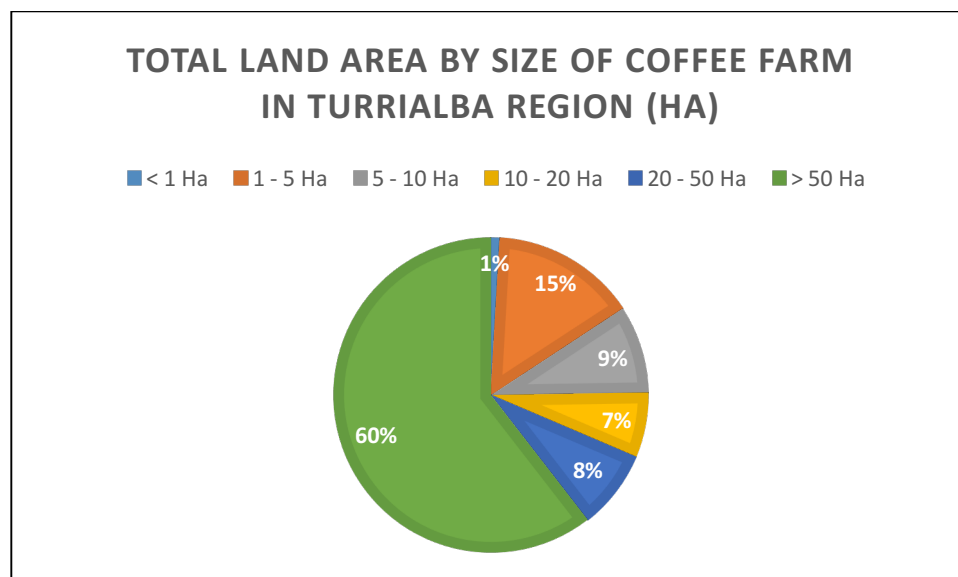
The majority of farmers in the Turrialba region are considered smallholder. The entire sample for this research (24 participants) are considered smallholder farmers, with less than 5 hectares of land dedicated to coffee production.

Figure 11: Total Number of Farms by Size of Farm in Turrialba Region (Ha)



Source: INEC Censo Cafetalero 2003

Figure 12: Total Land Area by Size of Coffee Farm in Turrialba Region (Ha)



Source: *INEC Censo Cafetalero 2003*

In the Turrialba region, the household population of coffee producers is 6,291 people as of the 2003 Coffee Census. However, of that total population, 2,150 individuals from these households are actually dedicated to working on the coffee farm. As shown in Table 2, of the total population in the coffee producing households, the majority of those dedicated to working on the coffee farm are men (82.10%). As exemplified in Table 1, the Turrialba region has one of the higher percentages of women involvement on the coffee farm than other coffee producing regions of Costa Rica.

Table 2: Population of Coffee Producing Households and Coffee Workers by Sex in Turrialba Region

	Coffee Producing Household		Dedicated to Working on the Farm	
Men	3282	(52.17%)	1765	(82.10%)
Women	3009	(47.83%)	385	(17.90%)
Total	6291		2150	

Source: *INEC Censo Cafetalero 2003*

Type of Study

This research adopted a cross-sectional phenomenology case study approach, utilizing primary qualitative data and secondary quantitative data measures (Schwartz *et al.*, 2001; Brennan & Dodd, 2009). As the purpose of this research was to further explore and gain a deeper understanding of a social phenomenon within a small community, it was conducted as a descriptive case study. Phenomenological approaches are more concerned with describing how a collectively lived phenomenon is experienced than they are with explaining causes of said experiences or phenomenon (Denscombe, 2004; Moustakas, 1994).

From theory, in-depth literature reviews, personal experiences and anecdotal evidence, a baseline understanding of the issues pertaining to diffusion of innovations within an international development context is comprehended. This research seeks to investigate this phenomenon, particularly how diffusion of innovations applies (or does not apply) to smallholder farmers and their decision making process. The phenomenological approach is taken so as to bracket out my previous experiences or suppositions regarding this phenomenon and understand it deeper from the smallholders' perspective. It attempts to describe this decision-making process solely from the smallholders' perspective.

The study is set up as a case study of smallholder farmers in the Turrialba region of Costa Rica. Case studies are used to better understand phenomena, groups, individuals, societies and complex interactions within a localized setting (Denscombe, 2004, Yin, 2009; Gray, 2014). While they provide rich information on that locality, they cannot always be generalized to the public. However, case study research provides an in-depth baseline from which to establish a larger study. Given the nature and limited resources for this research, a phenomenological case

study was the best suited design to gain a deeper understanding of the decision-making process for a smallholder farmer regarding innovation adoption.

The unit of analysis for this research is the individual. Since this research is focused from a phenomenological approach to understand the farmer's experience in deciding to adopt an innovation or not (i.e. "life-world experience"), the most appropriate unite of analysis for this research is the individual (Gray, 2014, p. 24).

Sampling

This research used a pairwise sampling approach. As with qualitative research, it is essential to not sacrifice "thick description" for comparative description, and must not trivialize the complexity and uniqueness of each case (Onwuegbuzie & Leech, 2007). When doing case studies, the ability to appropriately and effectively investigate the phenomenon heavily relies on the selection of cases (Patton, 1990; Stake, 2000; Yin, 2009). The sampling technique employed for this research adhered to the guiding principles of phenomenological research theory (Gray, 2014; Denscombe, 2004; Moustakas, 1994). Criteria for participant selection were established after in depth discussions with local experts, extension agents and researchers in order to target the correct population. This was done immediately after the initial scoping trip in January 2015.

Twenty-four smallholder coffee farmers or their wives in the Turrialba region were identified as participants for this research study. These farmers and wives were purposively selected as participants. Access to these participants was facilitated through key contacts at CATIE. This sample size of 27 participants is slightly above the range of 6-25 participants suggested by Morse (1994), Patton (2002), Polkinghorne (1989) for phenomenological research.

Sample Description

The sample for this study is described in the following section. Twenty-three (22) coffee producers and two (2) spouse of a coffee producer were interviewed through semi-structured, open-ended key informant interviews. Two (2) researchers at CATIE and one (1) extension agent at ICAFE were interviewed as well to gain their perspective. Each of the participants was selected based on the criteria that they were a part of a coffee-producing household of less than 5 Ha (smallholding status in Costa Rica) in the Turrialba coffee-producing region. The system structure of coffee farms is prevalent and diverse in Costa Rica, whereas any size farm could maintain a full sun, intercropped, or shaded system. The participants were chosen to represent these different shaded systems, but all were classified as smallholder (less than 5 hectares).

Fifteen different communities were represented throughout the sample. The sample is comprised of eighteen (21) male participants and six (6) female participants. The representation of females in the sample (22%) is between the reported representation of females in coffee producing households and those dedicated to working on the farm (47.83% and 17.90%, respectively) (Table 2). The sizes of farms represented in this sample range from .35 hectares to 4 hectares. While coffee represented a main source of income for each of the sample participants, only 2 participants relied solely on coffee production. The most common other main sources of income include sugar cane production, pension from the government, wages from outside work (including seasonal jobs in the United States, transportation services, and work on larger farms), alternative agricultural products (including fruit production, timber sales, dairy production, and cilantro and vegetable production), and other professions (including being a bar owner, landscaping business and a construction business).

Data Collection

Data collection for this research utilized a mixed methods approach. However as this research was conducted under the guiding principles of phenomenological approach, an emphasis was placed on qualitative methods (Gray, 2014). Phenomenological research methods seek to gain a thick description of participants' experiences, attitudes and beliefs to tell a larger narrative regarding their conscious towards a collectively experienced phenomenon. Therefore, phenomenological research primarily utilizes qualitative methods such as semi-structured or unstructured interviews, observations and personal experiences of the researchers, and secondary archival measures to triangulate the collected data (van Manen, 1990; Tashakkori & Teddlie, 1998). The data collection for this research consisted of 24 semi-structured, open-ended interviews with key informants and community participants, and of analyzing secondary quantitative measures.

In order to document the diverse perspectives and gain rich data regarding the factors influencing a smallholder farmer's decision-making process to adopt an innovation on their farm, key informant stakeholder interviews were used (Brennan & Dodd, 2009; Krannich and Humphrey, 1986; Schwartz et al., 2001; Elmendorf & Luloff 2001). Using interviews allows for the participants' perspectives, attitudes and beliefs on the collected experience to be documented using their own words (Giorgi, 1997; Yin, 2009). An open-ended, semi-structured interview protocol was designed in order to facilitate the conversation with the participants. This protocol design procedure is detailed in the next section.

The steps for conducting the interviews continued as follows: (1) Since these interviews would be conducted with smallholder farmers living in rural areas of Costa Rica, it was necessary to have a translator accompany and facilitate the interviews. The translator was briefed

on the interview protocol and script before conducting the interviews. (2) Individuals were identified as potential research participants as per the sampling method described in the previous section. (3) Identified individuals were asked to participate in the interview and if agreed, the informed consent statement was read to them. It was translated into Spanish for the participants. Permission to audio-record the conversations was also requested. Permission was granted for all interviews, so the conversations were audio recorded using the VoiceMemos application on the iPhone. (4) The semi-structured interview script was used to guide the conversation. As noted in (1), the translators facilitating these interviews were briefed on both the interview protocol as well as the content of the script before conducting the interviews. (5) The researcher took copious notes during the interview. If permission was granted, the researcher also took photographs of the farm. No photographs were taken of any participants or people other than the researcher. (6) The researcher took detailed and copious observational notes on the content of the interviews and on post-interview reflections regarding the participants' responses and behaviors.

Observational data and secondary data were also collected in this research study.

Observational data was recorded by the researcher via direct observations in the form of detailed and extensive field notes throughout the data collection and research period. Direct observations are usually collected in the form of descriptive and reflective notes that provide real-time information on environmental, social and behavioral context (Yin, 2009). Secondary data was secured through the 2003 Censo Cafetalero conducted by INEC, the National Census Center of Costa Rica, to provide a description of the coffee producing regions of Costa Rica, particularly on the number of producers, gender splits, types of shade, varieties, management practices and pruning used, land use and presence of pests and diseases. This information was collected in 2003 and is the most current publicly available information on coffee producers in Costa Rica.

The staff at ICAFE Turrialba, the National Coffee Institute of Costa Rica, was consulted to understand their methods and approach in distributing educational materials and support to smallholder farmers in particular. These observational and secondary data will be used to shape and augment the analysis of the collected qualitative data.

Instrument Development

Semi-structured, open-ended key informant interviews were the primary data collection method. The interview instrument used can be found in Appendix A. The instrument consisted of 15 questions, with follow up and probing questions included and used if appropriate during the conversation. The instrument was organized into 3 categories in order to add a logical and natural flow to the conversation. The instrument was carefully designed in order to ask open-ended questions on each of the five concepts relating to the smallholder farmer's decision-making process. This correlation between the instrument and independent concepts are described in the next section "operationalization of key concepts". The instrument was translated into Spanish as well to facilitate fluid translation during the interview. As the purpose of this interview was to gather rich data regarding the participants' experiences, perceptions, attitudes and beliefs, the questions were kept brief and open-ended to encourage as much detail and description as possible.

The protocol was reviewed by a panel of experts, both at Penn State University and CATIE, before use in the field to ensure validity. The panel was made of up expert academics, researchers, industry representatives and CATIE officials.

Operationalization of Key Concepts

While this study explores relationships between key concepts, further operationalization of these concepts is required to identify indicators for data collection and analysis. These

indicators allow the researcher to determine if the concept was present or not, as abstract concepts alone cannot be directly measured (Newman, 2012; Creswell, 2009). The following section details the operationalization of the key concepts to variable to measurement indicator.

Dependent concept

Decision-Making Process

This research study focuses on what factors influence or motivate the farmer's *decision-making process* in choosing to adopt an innovation or new practice on their farm. Thus the dependent concept in this research is the *decision-making process*. All of the participants will have experienced this decision-making process when choosing to adopt a new practice or innovation on their farm, and will have chosen to adopt said innovation. Measurement of this dependent concept is addressed by asking the participant what has changed on his/her farm in the past five years.

Many studies across fields have examined the decision making process, looking at what steps constitute this process and how it is shaped by outside forces. But regardless of the angle or model taken, the decision making process relies heavily on external influential factors, thus examining this process requires further investigation of those factors (Saaty, 1990; Argyris, 1976; Oppermann & Chon, 1997; Zhang, Leung, & Qu, 2007; Belch, Ceresino, & Belch, 1985; Klein et al., 1993; van de Fliert et al., 2007; Arnold & Dewees, 1999; Holden & Binswanger, 1998; Ziervogel, 2004). With the decision-making process as the dependent concept, this case study seeks to explore what independent concepts shape the smallholder's decision-making process in adopting an innovation on their farm.

Measurement Indicator:

Q (8) In the past 5 years, have you changed any of your farming practices with coffee or adopted a new technique or tool to use on the farm?

Independent concepts

Several independent concepts were explored in the nature of their relationship to the smallholder farmers' decision-making process in choosing to adopt an innovation on their farm (dependent concept). The exploration of these concepts took form in a semi-structured interview that asked pertinent and open-ended questions regarding the farmers' perceptions and experiences of each concept. Based on the diffusion of innovation literature, three of the concepts were immediately chosen as key concepts influencing a farmer's decision to adopt. However the final two concepts (level of community engagement and gender) were noticeably scarce throughout the diffusion of innovation body of literature, despite significant reference to "social structure" and "social systems." As described in Chapter 2, "social systems" and sense of "community" and/or community engagement are not interchangeable. Thus this research incorporates level of community engagement as a key concept potentially influencing the smallholder farmer's decision-making process to adopt an innovation. And while participant characteristics is a key concept, a disaggregated look at gender roles and definition of those roles are also explored as a potentially influential concept. Each of these concepts is broken down into variables that are measured by specific indicators as questions within the interview script.

Concept: *Participant characteristics*

The concept “participant characteristics” is broken down into the following variables: occupation, level of education, household size, length of residency, household occupation and level of education, land tenure, capacity to bear risks, level of connection to farm, and traditional vs. nontraditional knowledge. Sociodemographic characteristics, perceptions and motivations have been consistently used in diffusion of innovation research as key factors influencing a participants’ decision or ability to adopt an innovation (Rogers, 2005; Fuglie & Kascak, year; Greiner & Gregg, 2011; Greiner, Patterson, & Miller, 2009). This concept is operationalized and measured via the following indicators on the interview protocol.

Measurement indicators:

Q(1). Can you tell me about your history growing coffee?

Q(1a). How long have you been growing coffee?

Q(1b). Where did you learn how to grow coffee?

Q(1c). Why do you grow coffee?

Q(1d). How important is coffee to your farm? To you and your family?

Q(2) Can you tell me about your household?

Q(2a). Spouse? What do they do? Level of education?

Q(2b). Kids? How many? Ages? What do they do? Level of education?

Q(2c). What are your primary sources of income?

Q(3b). How many hectares is the total farm? How many hectares are for coffee?

Q(17). Overall, what are some benefits to growing coffee? What are some challenges?

Concept: *Access to resources*

The concept “access to resources” is broken down into the following variables: use of inputs, ability to get inputs, trainings attended, exposure to media, relationship with extension agents, non-family labor employment, access barriers, infrastructure, technology use, and support network. These variables represent common resources needed on the farm for best management and production, such as access to scarce inputs (use of inputs, ability to get inputs), access to information (trainings attended, exposure to media, relationship with extension agents), access to labor (non-family labor employment), access to technology (technology use), access to assistance (support network, infrastructure) (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Knowler & Bradshaw, 2007). The literature widely cites the participants’ access to resources as a key factor influencing a farmer’s decision or ability to adopt an innovation (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Knowler & Bradshaw, 2007). The following indicators from the interview protocol are used to measure this concept.

Measurement indicators:

Q(3). Can you tell me about your farm here?

Q(3a.) What type of shade do you use?

Q(4bii.) If non-family members mentioned, how long have they been working for you? / Who are they?

Q(5). What inputs are necessary for your farm?

Q(5a). Where do you get your seedlings / fertilizer / tools?

Q(5b). Do you receive any education/training for coffee production? If so, where?

Q(5c). Are there any types of technologies or tools that you would like to use on your farm that you don’t?

Q(5cii). Why don't you use these? / What would enable you to use these?

Q(6). To whom do you sell your coffee cherries?

Q(6a). Have you ever experienced difficulty in selling your coffee?

Q(7). When you have problems on your farm, what do you do/to whom do you go for help/information/support?

Q(7a). Why them? / How are they supportive?

Q(10). Do you work with extension agents?

Q(10a). What has been your experience working with them?

Concept: Innovation characteristics

The first concept of innovation characteristics is broken down into the following variables: economic superiority, social prestige, convenience, higher satisfaction, compatibility, difficulty/ease, trialability, and visibility. These variables represent the defined characteristics of innovations that are cited throughout the literature to shape the rate and likelihood of innovation adoption. These characteristics include relative advantage (economic superiority, social prestige, convenience, higher satisfaction), compatibility (compatibility), complexity (difficulty/ease), trialability (trialability), and observability (visibility) (Rogers, 2003; Feder, *et al.*, 1985; Fuglie & Kascak, 2001; Ghadim & Pannel, 1999; Knowler & Bradshaw, 2007; Marra *et al.*, 2003). This research seeks to identify if and how these variables influence a smallholder farmers' decision and does so through the following measurement indicators found on the interview protocol.

Measurement indicators:

Q (8a). Approximately how many? Which ones?

Q (8b). How did you hear about this innovation?

Q (8c). What had you used/done before adopting this innovation?

Q (8d). How did it change from what you were doing before?

Q (8e). How were you taught to use this innovation?

Q (8f). Why did you change/start using this new technique?

Q (8g). How has it worked out since you started using this technique? Good/bad?

Q (8h). Why wouldn't someone use this technique?

(8hi.) Do you know of anyone who rejected this?

Q (8i.) Have you told anyone else about this?

(8ii.) Has anyone else started using this technique? Who?

Concept: *Community Engagement*

The concept “community engagement” is broken down into the following variables: frequency of individual interaction, types of community groups, participation in community groups, role in community group, trust in community, local support, strength of community ties, reasons for participation, and community involvement in coffee production. This research is looking to assess the role that the farmers’ level of community engagement plays in their decision-making process to adopt an innovation on their farm. As described in Chapter 2, diffusion of innovations literature frequently cites “social systems” as key factors for influencing rate and likelihood of innovation adoption. However the literature fails to address “community engagement,” which is a different concept from “social systems” as not all “social systems” imply or contain levels of community engagement (Rogers, 2003; Wilkinson, 1972; Feder *et al.*, 1985; Feder & Umali, 1993). This research identifies several variables of participants’ engagement in community groups or events to measure their level of interaction. Interaction

among community members increases through participation in community groups and events. And increased interaction within the community allows for members to build community capacity and to become aware of shared interests or common needs (Brennan, 2004b; Brennan, 2005; Wilkinson, 1991; Brennan & Dodd, 2009; Brennan & Luloff, 2007; Granovetter, 1973). This concept is operationalized to assess the farmers' level of engagement in his or her community and the role of engagement in the decision-making process. The following measurement indicators from the interview protocol investigate this concept.

Measurement Indicators:

Q(11). Can you describe who/what you consider to be your community?

Q(11a). How often do you interact with these members?

Q(11b). In what capacity?

Q(12). Are you a part of a coffee co-op?

Q(12a). What are the benefits/challenges in being in a co-op?

Q(12b). What is it like being a part of a co-op?

Q(12c). Why did you join the co-op?

Q(13). Do you participate in any community activities that involve coffee or coffee production?

Q(13a). How were these activities started? Who is involved in them?

Q(13b). How does the community support coffee production?

Q(13c). Do local restaurants buy the coffee? If so, who?

Q(14). How is coffee important to the local community?

Q(14a). Are there any secondary businesses made from coffee production?

Q(14b). How much of the coffee produced here is exported? How much is sold locally?

Q(15). How important is it to you to engage with other community members?

Q(15a). Do you feel like you have a strong tie to your community? Why/why not?

Q(15b). Do you feel like there is a strong sense of community here? Why/why not?

Concept: Gender

The concept “gender” was broken down into the following variables: division of labor, level of participation in farm activities, and level of participation in off-farm activities. As described in Chapter 2, the international research agenda has acknowledged that focusing on women and their improved well-being actively promotes poverty alleviation, especially in rural areas (Cole et al, 2014; Joshi, 2012; Shalatek & Burns, 2013; UN General Assembly, 2000; Sick, 1998; Katz, 2003). This research aims to incorporate an understanding of gender roles on smallholder coffee farms in the form of their influence on the decision-making process. This concept is operationalized by assessing women’s responsibilities versus men’s responsibilities in the household (division of labor, level of participation in farm activities and level of participation in off-farm activities). The following measurement indicators from the interview protocol investigate this concept.

Measurement Indicators:

Q(2d). What family members are involved in coffee harvesting?

Q(4b). Who does what tasks and why do they do it?

Q(4bi). What do the other members of your family do?

Q(9a). [How much influence does your wife have on the farm?]

Q(9b). [Your sons/daughters/children?]

Data Analysis

The data were analyzed via phenomenological data analysis methods. The results and analysis of the data collected are discussed in detail in Chapter 4. However this section will provide background and context for the way in which the analysis methods align with phenomenological research.

Before analyzing the data, the researcher must set aside his/her own experience, perceptions, attitudes and beliefs as much as possible in order to approach the data with a completely fresh perspective. This is a part of transcendentalist phenomenology, which this first step allows for “everything [to be] perceived freshly, as if for the first time” (Moustakas, 1994, p 34). This first step derives from Husserl’s concept of *epoche* and is known as “bracketing” (Moustakas 1994). Thus the researcher’s previous experiences and suppositions regarding the phenomenon were bracketed out in order to maintain a fresh perspective when analyzing the data. However, it must be noted that a researcher cannot fully bracket out his or her position within the research context (Rose, 1997). While efforts are made to bracket out the researchers’ previous experiences in designing and conducting this study, the researcher must acknowledge her partiality in positionality as an outside member seeking answers (Rose, 1997).

This research will follow these steps based on interpretative phenomenological analysis (IPA) (Smith & Osborn, 2003). The aim of this analysis is to derive overall meaning from the complexities surrounding the individual’s perceptions and experience of the phenomenon, not to measure frequencies or provide interpretation (Smith & Osborn 2007). The data analysis procedures in IPA consist of (1) reducing data into significant statements of themes or groups of meaning and (2) connecting these themes into a textural description of the experiences. Steps (1) and (2) are completed for each of the interviews conducted. Step (3) involves connecting these

themes across all interviews. The final step (4) is to combine these textural descriptions to derive an overall essence of the experience (Smith & Osborn, 2003; Moustakas, 1994; Giorgi, 1985).

Step (1) involves what Moustakas (1994) refers to as “horizontalization” where significant statements, quotes, or sentences are highlighted and clustered into groups of meaning. These are then grouped into themes, used to develop the textural descriptions of the experiences in steps (2) and (3). The researcher also includes his/her experiences, notes, observations as well as supplementary secondary data to strengthen the narrative into this process. Finally, step (4) derives the overall essence to better understand and describe how the participants experienced that particular phenomenon (Smith & Osborn, 2003; Moustakas, 1994; Giorgi, 1985).

The 27 interviews conducted in Turrialba, Costa Rica were transcribed in Spanish. During the interviews, copious notes on participants’ responses, interactions and body language were taken as well. Following the phenomenological data analysis procedures described above, the transcriptions were analyzed using NVivo software. All four steps of phenomenological data analysis were conducted on the transcriptions and secondary quantitative data were woven in to frame the larger narrative. The final summary and conclusions reflects the overall essence of the experienced phenomenon, indicated as step (3). These are described in Chapter 5.

Limitations

As arises when conducting international field research, there were several limitations to this project that must be acknowledged and discussed. This research was conducted in rural Costa Rica, where a majority of the population speaks Spanish and little to no English. Thus, a use of a translator both fluent in Spanish and English was necessary to facilitate proper and effective communication with the various participants. Three translators (Rolando, Daniel and Karina) facilitated the conduction of interviews. The use of translators has the potential to invite

bias into the participants' responses as well as to reduce the richness and quality of the dialogue. There can be specific nuances or phrases spoken in Spanish that do not directly translate into English, and thus that quality of dialogue is lost in translation. Specific measures were taken so as to avoid this from occurring as much as possible. The interviews were transcribed in Spanish to maintain the exactness and quality of the participants' responses for analysis purposes. The translators were briefed prior to the interviews on the script and protocol. And the interview script was translated into Spanish and reviewed by local researchers before use.

Additionally, the small sample size of this research study (n=27) can be viewed as another limitation. However, the exploratory nature of this research must be stressed as it is rooted in a phenomenological theory approach to explore and describe, not to explain or predict or generalized to a wider population. Thus, the small sample size of 27 falls within the suggested sample size of phenomenological research by Gray (2009), Morse (1994), Polkinghorne (1989) and Patton (2002). The findings, descriptions and conclusions of this research can be applied in a localized context to the farmers interviewed in the Turrialba region. This research can provide a descriptive basis from which further and broader scoped studies can be conducted on the diffusion of innovations framework with smallholder coffee and other commodity crop farmers.

Chapter 4

Research Findings

This chapter will present the results of the Interpretative Phenomenological Analysis (IPA) from the transcribed recordings and researcher's observations, a process described in Chapter 3 (Smith & Osborn, 2003; Moustakas, 1994; Giorgi, 1985). IPA analysis attempts to explore personal experience by making sense of an individual's perception of a phenomenon, not to produce objective statements of the phenomenon itself (Moustakas, 1994). IPA analysis outlines the findings of this research. Chapter 5 will draw conclusions from the analysis and discuss areas for further research.

IPA analysis involves three major steps including horizontalization of collected data, building textural descriptions and highlighting emergent themes that form the basis of collectively experienced phenomena (Moustakas, 1994). Horizontalization is the process in which participant responses are distilled into significant themes, extracting non-overlapping responses organized around the five research concepts (Moustakas, 1994). These are then used to build textural descriptions, combining overlapping and non-overlapping responses to highlight emerging themes that form the basis of common experiences surrounding the lived phenomenon (Smith & Osborn, 2003; Moustakas, 1994; Giorgi, 1985).

The findings are organized around the central research concepts.

Participant Characteristics

Horizontalization

Representing the concept *participant characteristics*, participants were asked several questions to describe their household, farm, history growing coffee and necessary inputs. The responses for each participant are recorded in Table 3.

Participants were also asked to describe their history and motivations for growing coffee. The non-overlapping responses are recorded in Table 4.

Table 3: Horizontalization – Participant Characteristics

Participant	Marital Status	Years Growing Coffee	How Learned to Grow Coffee	Sources of Income (ranked)	Hired Labor	Education Level	Formal Education/ Training for Coffee	Children	Size of Coffee Farm
Male Farmer	married	30 years	neighbors	coffee, truck services	4 neighbors during harvest	primary	goes to every training he can attend	4	3.5 ha
Male Farmer	married	30 years	father & other farms	wage labor, coffee, dairy products	no	primary	none	4	4 ha
Male Farmer	married	30 years	father	pension, coffee	no	primary	coffee production course 15 years ago	4	1.5 ha
Male Farmer	single	15 years	father & ICAFE website	pension, wage labor, coffee	no	secondary	none	0	4 ha
Daughter of Farmer (6)	single	20 years	father		no	adult education - secondary	none	0	
Male Farmer	married	28 years	father	pension, coffee	no	primary	none	2	4 ha
Wife of Farmer	married	25 years	father	wage labor, sugar cane, coffee	no	primary	none	3	.4 ha
Female Farmer	divorced/ single	20 years	father	coffee	no	primary	none	4	.75 ha
Male Farmer	married	60 years	father & other farms	sugar cane, coffee, banana	used to need 10 workers, now none	primary (@ 55 years old)	none	4	1 ha
Female Farmer	widowed	38 years	parents	coffee	1 male worker, 3 days/week	primary	none	5	4 ha
Male Farmer	married	50 years	father & brother	construction business, coffee, sugar cane, vegetables	occasionally 1 male neighbor for maintenance or harvest	primary	ICAFE trainings 3 times per year	10	.5 ha
Male Farmer	married	60 years	father	savings from previous profession, coffee, pasture, banana	neighbors for harvest	secondary	none	3	1 ha
Male Farmer	married	40 years	grandparents	coffee, pension	no	primary	none	2	2 ha
Male Farmer	divorced/ single	30 years	father & other farms	wage labor, coffee	no	primary	none	2	1 ha
Male Farmer	married	30 years	father	coffee, sugar cane	no	primary	none	2	1.5 ha

Male Farmer	married	15 years	neighbors	coffee, sugar cane	no	primary	none	3	1.5 ha
Wife of Farmer (18)	married					primary			
Male Farmer	married	30 years	father	coffee, sugar cane, cows for dairy & meat	no	primary	none	1	1.5 ha
Male Farmer	married	25 years	father & uncle	landscape architecture business, bar, coffee	no	primary	ICAFE trainings every 2 years.	1	1 ha
Male Farmer	divorced/ single	45 years	father & other farms	coffee, selling coffee seedlings, truck services	1 male worker, 3 days/week	primary	none	4	2.75 ha
Male Farmer	married	40 years	father	coffee, fruit, truck services	1 male worker, 3 days/week	primary	none	5	2 ha
Male Farmer	married	80 years	father	pension, coffee	no	primary	none	9	.35 ha
Male Farmer	married	25 years	father	bar, coffee	no	primary	1 course 10 years ago on soil management	4	2 ha
Female Farmer	married	25 years	neighbors	coffee, husband's outside labor	occasionally for harvest	primary	none	4	1.5 ha

Table 4: Horizontalization – Why do you grow coffee?

Why do you grow coffee?	
<i>Tradition</i>	Because I've been growing coffee my whole life. It's what I know.
	I am retired and gave my coffee land to my kids. But I keep growing it because it is what I know and I want to be healthy and to exercise.
	I could never stop growing coffee. I was born between coffee plants.
	I can't imagine growing anything else other than coffee.
	It is a legacy; it is the only source of income I have ever had.
<i>Security</i>	It's a safe source of income. It's not much but it is always there.
	Sugar cane is not very profitable and hard work. Coffee is better work and better profits.
	I know I can sell my coffee to the <i>beneficios</i> .
	I like coffee. It's the most important crop here and gives us work.
	Because I like it. And it's like a little piggybank of money at the end of the year.
<i>Family</i>	It allows us to maintain the family unit because we all work together on the farm.
	Because the coffee income sends my kids to school and university. And I can stay at the house while working.
	I can work and support my family and stay very close to home.
	It is a family job.
	It's an activity that my entire family can participate in.
<i>Suitability</i>	It is a stable crop; the soil is more suitable for coffee than other crops I might want to grow.
	At the time, it was a great alternative to live. It gave great prices. But now, the prices aren't good, business is not good for coffee. Because of <i>la roya</i> and disease.
	It is the best crop for the land, even if it's not a lot of money right now.
	It is the only product for this soil; coffee is the best for the land. I would like to grow coffee forever, but it depends on how bad it gets if I have to stop.

Textural Description

Several questions were asked to gain a context of the participants' daily lives, history and experience growing coffee, and their personal characteristics. The sample of

participants in coffee farming households included 18 male farmers, three female farmers, two farmers' wives, and one daughter of a male farmer. The majority of the participants were married with children, while a few of them were widowed (previously married with children), divorced (previously married with children) or single. The average number of children for each participant in the sample is 3.48 children. Two participants did not have any children and both of these participants were single and never married. While all of the farmers had attended either primary or secondary level education, none of the farmers entered the tertiary level of education. Of the 24 participants, 21 had either completed or attended primary school and 3 had either completed or attended secondary school.

Participants reported a history growing coffee ranging from 15 years to 80 years. The majority of farmers learned how to grow coffee from his/her father as a child, while several learned from neighbor farmers. One farmer said he used the ICAFE website to learn best practices. One farmer learned from his grandparents. None of the farmers learned how to grow coffee through formal training or education, though some of the farmers said their experience working on large coffee farmers (>50 ha) taught them a significant amount about coffee farming. While none of the farmers formally learned how to grow coffee, some did mention attending formal trainings or education sessions to learn more about coffee production. These included regular ICAFE trainings and select one-time courses on coffee production and soil management.

While coffee was a major source of income for most of the participants, the majority of participants had several other sources of income besides coffee. Only two participants relied solely on coffee as their source of income. The other sources of

income included other crops (sugar cane, fruit, banana), pensions from the government, alternative professions (wage labor, business) or transportation services. All of the farmers produced on a smallholding land size for their coffee farm (<5ha). The average size of farm for this sample was 1.89 ha.

Participants were asked to describe why they grow coffee, what coffee means to them and why they continue to grow coffee despite significant challenges. The non-overlapping responses were clustered into four themes: *tradition*, *security*, *family* and *suitability*. The first theme *tradition* included responses that directly talked about personal history, personal connection or personal desires for why they are coffee farmers. Almost all respondents mentioned a deep personal connection to coffee and expressed genuine sadness over *la roya*'s effect on coffee production in Turrialba.

The second theme *security* included responses that directly addressed a sense of security and stability (economic and employment) for why they grow coffee. It was repeatedly noted that even though coffee producing is very challenging due to vastly fluctuating harvests each year, expensive necessary inputs, and the effects of external factors such as climate change and diseases/pests, coffee is a resilient crop that provides money, even if it is not a lot of money. The third theme *family* included responses that discussed coffee growing as a family activity or one directly supporting the family. Participants noted that coffee production is a job that allows the farmer to stay close to home while supporting his/her family, pays for children's education, and brings the family together to take care of the farm and collection during harvest. The fourth theme *suitability* included responses discussing how the coffee crop is a better crop for the land and at one time better for the lifestyle.

Access to Resources

Horizontalization

Under the research concept *access to resources*, participants were asked to list what inputs they used to produce coffee and from where they purchased or received these inputs. The non-overlapping responses are recorded in Table 5. It should be noted that the two columns of responses are not related; the non-overlapping responses under each question are recorded in no specific order.

Table 5: *Horizontalization – Inputs for Production*

What do you use/need for production?	Where do you get these inputs?
Hired labor	Other farmers in community
Tools like shovels, knife	Share with my brother [coffee producer]
Seedlings for plants	Agronomy store in Turrialba
Motor pump for spraying chemicals	Rent from a larger farm
Fertilizer	Agronomy store in La Suisa
Fungicides	Santa Rosa / Juan Viñas <i>beneficio</i>
Herbicides	ICAFE
Poró service trees	MAG
No inputs	Community

Participants were then asked if there were any inputs they would like to use on their farm but do not or cannot for a certain reason. The non-overlapping responses are recorded in Table 6.

Table 6: Horizontalization – Barriers to Accessing Inputs

Are there any inputs you would like to use? Why don't you use them?	
<i>Cost</i>	Fertilizer: It will make the plants strong. But it is too expensive. The costs of the expenses are more than the income of coffee.
	Motor Pump and Motor Saw: I want this for spraying the fungicides and application, and for cutting the poró tree. But coffee doesn't give enough money to buy it.
	Organics: They are better for the land and environment health. But they are hard to find and very expensive.
	Hired Labor: We want this to help while my husband has to leave for [his seasonal job]. But we don't have any money. We don't even have security money.
	I don't want a new product; I just need more of what I already have. But I can't afford it.
<i>Affluence</i>	I suggested to my neighbors to use four different fungicides against <i>la roya</i> . Some did and some didn't, because they are expensive. But I saw a difference between those that did and didn't.
<i>Community Support</i>	No, I have what I need for the farm. If I need something I buy it or borrow it.
<i>Awareness</i>	I want nematocides because they kill nematodes, letting the plants grow new roots and absorb more nutrients. But they're hard to find.
	I want to use the catimor variety but it is difficult to find. None of my neighbors have it. ICAFE might have it, but I haven't asked.
	I would like to use organics; they are better for the land and plants, but I don't know where to find them.

Participants were asked to describe their experience with formal or informal education or training on how to grow coffee. The non-overlapping responses are recorded in Table 7.

Table 7: Horizontalization – Experience with Education or Training

Education or Training	
<i>Formal</i>	I go to a training 3 times a year with Rono.
	Rono gave a training on how to fight <i>la roya</i> .
	I make time to go to the trainings because I want to learn more about diseases.
	I go to CATIE for meetings about coffee and share my experiences growing coffee. I listened to the others share their experiences too.
	I went to a coffee production course organized by the <i>beneficio</i> . It was very helpful, very basic but I learned a lot. Some neighbors went too.
	I go to all of the meetings and trainings I can. Though when I go, I am only one of a few producers there. There are many experts and engineers, but I'm not sure why there are not more producers there.
<i>Informal</i>	I never had formal training, but I worked on a hacienda. I was the head of this private farm and learned a lot from my boss and running experiments. I take this knowledge and apply it to my small farm.
	I don't have any formal education. I use the internet and ICAFE website to search for answers. My dad left our family and I am still learning.
<i>None</i>	None, I only learn from other farmers with experience from the community.
	No, I'm very stubborn. I don't like change and I don't like to use trainings.
	It is not common to go to courses; I went to one once 10 years ago. But [all coffee farmers in Santa Teresita] know how to grow; we grew up knowing and learning. We know from traditional knowledge and experience.
	I want trainings from ICAFE. I want to know about diseases and different varieties. But ICAFE doesn't offer them I don't think. I haven't asked for them though.

Throughout the course of the interview, participants described their experiences with ICAFE or the Government (MAG). The non-overlapping responses are recorded in Table 8.

Table 8: Horizontalization – Experience with Government and/or ICAFE

Experience with Government / ICAFE	
Positive	I call ICAFE for suggestions for products.
	ICAFE/MAG give talks and trainings in the communities every 2 years.
	ICAFE comes to the community to advertise for the chats through posters and propaganda.
	The government gave us fungicides when <i>la roya</i> hit.
	I pay for soil analysis from the MAG but I don't receive advices from them. Just the results of the soil analysis.
	I always rely on my own experience but ICAFE came when <i>roya</i> hit, they told us to use fungicides. They showed me the most affected plants and gave me a list of products. I took their word for it immediately and bought the products because it was an emergency.
Negative	They are never worried; look I am sure there are producers that know more than one person at ICAFE. But those at ICAFE have the power to do analysis, give support and tools and technology. But they don't worry or help the smaller farmers, because it's more work and less return. We don't produce as much as the big farms.
	When <i>la roya</i> hit, the government did not do anything to help our community.
	When <i>roya</i> fell, we were alone. The government set up a national trust to help small farmers but it was not a lot of money. They came and did soil analysis on some farms. But we still only saw bad prices.
	One time, an [ICAFE] agent told me to prune the total plant. But I didn't listen. I knew better and I'm the one that relies on this for an income.
	The government gave credits to the coffee farmers years ago when <i>roya</i> hit bad. But the management of those credits was horrible. All of the big farmers took the money and did not invest in rehabilitating their farm, like the credits were given for. They got new tools and technologies. There was no money left for us that needed to rehabilitate our farm, the small farms. The management was terrible.
	I don't trust extension or engineers. I trust my neighbors because we have ties to the community; we care what happens here. We also have knowledge about this land and our coffee.

Participants were asked whom they trusted most for advices and support in problem solving on their farm. The non-overlapping responses are recorded in Table 9.

Table 9: Horizontalization – Most Trusted Source of Support

Who do you trust more for advices or problem solving?	
<i>Small Farmer</i>	I call my brother because he has a lot of experience.
	I talk with my neighbors about what to do.
	I prefer and trust the opinions of my neighbors. Because I can see the results on their farms.
	I ask my family members. My brothers and nephews have a lot of experience with coffee. They teach me how to manage my farms better.
	I talk to my neighbors who know or who use different varieties. They know so I ask their advices.
	I trust my neighbors' advices because they know the community and land better.
<i>Self-Reliance</i>	No one, I solve my own problems.
	I don't have any close neighbors. Their houses are too far away from here to talk to. So I read on the internet on my cellphone to learn about coffee and what to do when I have problems or questions.
<i>Engineer</i>	I ask to my neighbors, but I trust Rono more. I don't trust the sellers at the stores because they want to make money. But Rono gives good advices. I talk to my coffee farmer friends from other communities too. Then I share what I know with other neighbors.
	I call Rono from ICAFE/CATIE.
	I trust ICAFE and MAG. See with neighbors, sometimes one is right and sometimes another is right. But over time, through managing coffee, they learn and adapt to the times.
	I know an engineer at Juan Viñas. He suggested a fungicide called Opera. Other people don't use it because it's not here in Turrialba. It is in Cartago.
	My good friend is a <i>tecnico</i> on a big commercial farm. I am always talking to him; we share advices all the time.
	We don't ask for help from anyone. Well, maybe we call the store in La Suisa.
	No one, we solve it ourselves. But when we saw <i>roya</i> , just a little bit, we were scared. We called the store in Turrialba and they suggested a fungicide. We acted early; we didn't get hit as bad.
<i>Faith</i>	I believe in God and put trust in God when there are problems.

Throughout the course of the interview, participants described the positives (boosters) and challenges (barriers) to being a coffee producer in their community. The non-overlapping responses are recorded in Tables 10 and 11, respectively.

Table 10: Horizontalization - Boosters to Producing Coffee

Boosters to Producing Coffee	
<i>Infrastructure</i>	The Juan Viñas truck picks up the harvest. The Santa Rosa truck comes right to my house to pick up the yield.
	The other farmers in the community and I try products and discuss which ones are better. It helps us figure out which ones work for our area.
	I can call Rono from ICAFE for suggestions or help.
	Juan Viñas pays better so I sell to Juan Viñas.
<i>Security</i>	Coffee is important activity for me and for my daughters. They can work on a coffee farm when their husbands work outside the house, and send their kids to school. That's what I am doing, and it allows me as a mother to stay home with my children but help provide for my family.
	I can pay my grandchildren to help with harvest. I want them to have an education, but I want them to be hard working. Coffee lets me keep the family together. Everyone can help on the farm.
	Coffee is a resilient crop. Maybe sometimes it's a very low production, but there is always a production.
<i>Support</i>	Many of my neighbors grow coffee so we can help each other with products and ideas.

Table 11: Horizontalization – Barriers to Producing Coffee

Barriers to Producing Coffee	
<i>Not Profitable</i>	Right now, with diseases, it is not profitable to grow coffee.
	Because coffee gives such low income, I have to work in other areas too.
	I almost stopped growing coffee a few years ago because of the bad prices.
	I always love growing coffee. But if the prices go so low, I will have to change to cilantro.
	Price and <i>roya</i> determine the future of coffee in Turrialba. There used to be 9 <i>beneficios</i> , now there are only 2.
<i>Climate Change</i>	I won't have a good harvest this year. Very bad. This year because of <i>roya</i> , last year because of <i>broca</i> .
	Last year, we lost a lot of harvest and plants because of the rain. The weather is presenting a problem for producing coffee.
	I don't like using insecticides or fungicides. I know they are bad for the environment and for all creatures. But there is no alternative. I have to use them if I want to keep coffee.
	The climate really affects coffee production. [Coffee producers] need to think about the climate and use climate-resistant varieties. We need climate resistant varieties.
<i>Dependence</i>	If Juan Viñas came to my farm, I would sell to them because they have better prices. But they don't come here, so I have to sell to Santa Rosa.
	Santa Rosa punished [coffee producers] for having any amount of <i>broca</i> in our harvest. Punished us with very low prices and fines. It was not easy. I switched to Juan Viñas.
	Juan Viñas charges high interest on their loans, so I have to pay in full every time. I can't afford the interest.
	The truck driver from Santa Rosa was irresponsible last year and did not come. We lost a lot of harvest because of that.
<i>Lack of Government Support</i>	The trainings are on Tuesdays when people can go so sometimes people don't go to these trainings because they do not have that time to go.
	The information and advice ICAFE gives is based on the growing practices in Central Valley. Turrialba is different climate, different harvest season, different needs. It's not correct for us.
	The roads to [San Vicente] are very, very bad. It's bad because if the bridge or road is blocked, the [<i>beneficio</i>] truck can't come to pick up the coffee. We lost so many yields when that happened. And there was nothing we could do about it. The coffee ferments. We couldn't sell it because it was too long.
<i>Unsustainable Practices</i>	When the government gave us credits to help with the production of coffee and <i>roya</i> , the problem is the community does not think about the future. They get the money and they spend it right away. It's hard to have long-term projects, because no one thinks ahead.

Textural Description

To gain a context for what is necessary for each participant's production, they were asked what inputs they used and where they bought or received these inputs (Table 5). Seedlings were the only input indicated by all participants as necessary for production, however the source for purchasing or receiving seedlings varied across responses. Not all participants reported using non-family labor, but for those that did, all non-family laborers were sourced from the community (i.e. all non-family laborers were neighbors). One farmer indicated he used no regular inputs on his farm and put his trust and faith in God to take care of his coffee plants. However in time of emergency (example: *la roya*), he shared chemical inputs with his brother, who is also a coffee farmer in the neighborhood. Farmers who worked on a larger farm or had connections to those working on a larger farm reported receiving the majority of their inputs from these larger farms. Farmers who did not report having access or connections to a larger farm often reported sharing inputs or tools with other farmers in the community. Or they reported pooling together money and resources with other farmers in the community to rent or purchase necessary inputs.

Table 6 identifies the potential barriers to accessing resources from participants' responses. The responses ranged as participants indicated that there were (positive) or were not (negative) barriers to accessing necessary resources. The responses cluster into four general themes: *cost*, *affluence*, *community support* and *awareness*. *Cost* was the most common theme across the positive responses. Participants that reported wanting to use different inputs could not due to the price of the inputs or not having enough savings to invest. Several times, the participants indicated that the income generated from coffee

production was not enough to cover the cost of the expenses. The second theme across the positive responses, *awareness*, included responses that indicated a lack of awareness as a barrier for accessing resources. Participants indicated they had heard of and desired to use certain inputs, but were not aware of where they could purchase these inputs.

The theme *community support* emerged under negative responses. Participants that indicated they had all of the necessary inputs for their production frequently cited their ability to borrow or share inputs with neighboring farmers or community members. However, if the neighboring farmers did not have access to the input, the farmer did not know where to access it (cross-clustered with theme of awareness). The theme *affluence* emerged across the negative responses. Some participants indicated that they had all necessary inputs for their farm and in the event they needed an input, they could purchase it. Several farmers indicated that there were no inputs they needed or wanted, and that they could afford their inputs.

Participants indicated their experience with education and training in producing coffee ranged from *formal*, *informal*, and *none* (Table 7). *Formal* education and trainings were organized and conducted by ICAFE, a *beneficio*, or CATIE. Participants noted their motivations for attending formal education and trainings because they want to learn as much as they can. *Informal* education or trainings involved direct work experience on a larger farm and learning from more experienced farmers of larger farms. Only one participant indicated they used the ICAFE website and the Internet to learn better practices. Many of the participants indicated they received *no* education or training for producing coffee, either indicating lack of awareness of trainings or traditional knowledge as a reason.

Participants' experiences with ICAFE and/or the government ranged from *positive* to *negative* (Table 8). Participants reported *positive* experiences with the government or ICAFE when they received a direct support from them, including trainings, fungicides, soil analyses or advices. Participants more frequently reported *negative* experiences with the government or ICAFE. They reported that the government does not help their community and particularly the small farmers, and that they don't trust the government advices.

Across the responses, four groups were indicated as those to which participants turned and placed most trust for advices and problem solving on their farm (Table 9). These groups included fellow *small farmers*, themselves (*self-reliance*), an *engineer*, or *faith*. Many reported trusting the advices of their neighbors and other small farmers in the community with a lot of experience. Several reported trusting an engineer at either ICAFE, on a larger farm, at an agronomy store in Turrialba or La Suisa, or at the *beneficio*. Several farmers indicated that when problems arise on their farm, they first put their trust and faith in God and the problem in God's hands. However, each participant that reported this followed up with additional sources of trust for advices or problem solving (such as another farmer, their own experience or initiative, or an engineer).

Across the interviews, participants indicated several boosters and challenges to being a smallholder coffee producer in their community. The non-overlapping responses are recorded in Tables 8 and 9, respectively. The responses indicating boosters were clustered into three groups: *infrastructure*, *security* and *support*. Participants reported having an *infrastructure* in place, such as the *beneficios*, ICAFE and other farmers in the community as a reliable network through which production is made possible. Participants

reported that coffee was a favorable crop to produce because it meant *security* for them and their family, whether as income security, livelihood security, or family values security. And finally, participants indicated that growing coffee was a favorable activity because they have communal *support*.

The responses indicating barriers to producing coffee clustered into five groups: *not profitable, climate change, dependence, lack of government support, and unsustainable practices*. Under the group *not profitable*, participants frequently cited the low prices and unprofitability of coffee as a major barrier for producing coffee. Under *climate change*, participants indicated increased rainfall and increased incidence of diseases (*la roya* and *broca*) as a major barrier to producing coffee. Under *dependence*, participants indicated several situations over which they had no control yet seriously affected their harvest, yield or income. Under *lack of government support*, participants indicated poor assistance and extension services from the government that negatively affected their ability to produce coffee. Under *unsustainable practices*, participants indicated flaws within community decision-making that inhibited sustainable long-term success for coffee production and collective decision making.

Innovation Characteristics

Horizontalization

Under the research concept *innovation characteristics*, participants were asked if they had adopted an innovation (made a change) on their farm within the past five years. They were then asked a series of follow up questions regarding how they heard about the innovation, why they needed to make a change, why they adopted this innovation, and who they talked to before adopting the innovation. The non-overlapping responses are

reported in Tables 10-12. Three innovations were reported across the interviews. Each table will detail the information for each innovation, respectively.

Table 12: Horizontalization – Innovation: Pruning Method

Pruning Method			
<i>Where did you hear of this?</i>	<i>Reason for Change</i>	<i>Why did you adopt this innovation?</i>	<i>Who did you talk to before adopting?</i>
Neighbor producers	Rain	Rain has increased causing coffee to drop too early. I changed to <i>poda ciclo</i> . This is better against the rain. I did an experiment years ago with different rain patterns.	No one, I made the decision. But my brother and I talked about it and I trust him. He has more experience.
	Experiment	I like to experiment and try new things. I wanted to see if this makes a difference.	
Experience	Using a new variety, have to see what pruning works best for that variety.	I have to watch the effect of a change for 5-6 harvests before being convinced.	I talk to the MAG and my neighbors. Everyone recommends different things sometimes. So I hear what they say and make my own decision. I have my own experience.
	My nephew saw my farm and told me my method of pruning was very bad.	I trust my nephew. He has a very profitable coffee farm. Once I did what he told me, the results were incredible.	

Table 13: Horizontalization – Innovation: Fungicides

Fungicides			
<i>Where did you hear of this?</i>	<i>Reason for Change</i>	<i>Why did you adopt this innovation?</i>	<i>Who did you talk to before adopting?</i>
Rono from ICAFE	<i>La roya</i>	<i>Roya</i> affected my harvest and it is very bad. I have to protect my plants against <i>la roya</i> .	I mean here I talk to my neighbors a lot and I ask them if they have a lot of <i>roya</i> and they tell me a little or sometimes a lot. We decide we must spray the fungicides against <i>roya</i> .
Neighbor producers		I tried several of the recommended products, and Atemi was the best by far.	I called the engineer to talk about products, which ones to use.
		I know an engineer at Juan Viñas. He suggested a fungicide called Opera. Other people don't use it because it's not here in Turrialba. It is in Cartago.	I called the agronomy store in Turrialba because we saw <i>roya</i> and were scared. We asked for suggestions and they said use fungicides. We didn't want to take the risk, so we did.

Textural Description

Participants indicated three recent innovations they adopted on their farm within the past five years (Table 12). A few farmers indicated they change their pruning methods. They thought to make this change from hearing suggestions by neighbor farmers or from their own experience they thought to make an experiment with pruning methods. They changed pruning methods as a response to increased rainfall, changing a variety, as an experiment to test for better practices, and due to direct advice from another smallholder farmer. They indicated they adopted this innovation because they knew it worked from past experience, they trusted the advisor, or they had done their

Table 14: Horizontalization – Innovation: New Variety

New Plant Variety			
Where did you hear of this?	Reason for Change	Why did you adopt this innovation?	Who did you talk to before adopting?
ICAFE/ MAG	<i>la roya</i>	I want my plants strong against <i>la roya</i> and other diseases.	I talk to my neighbors and to ICAFE. I talk to them both before I invest in a new variety, they are expensive and I have to make sure it's the right decision.
		There was a farmer at one training that had 500 plants of Catuai rojo. I saw his success. That convinced me.	The varieties were recommended by ICAFE and MAG. It took five years since they told me to change. If I did it then, I would have been less fucked by <i>la roya</i> .
		I lose harvest from too much rainfall and need stronger plants to hold the fruit against the rain.	I talked to my neighbors but they didn't think [the new variety] was better. I changed anyway and now, everyone has changed. There is more Catuai rojo than Calturra in all the coffee that remains [in San Vicente].
Neighbor farmers	<i>broca</i>	I saw plantations elsewhere and saw their better harvests and more resistant plants.	Santa Rosa <i>beneficio</i> recommended Obata. They say it produces more fruit faster but requires more fertilizer. I see a lot of farmers now trying this variety, so I am going to try it.
		I bought a little bit of CR95 yellow and CR95 red. Someone told me red was better. I had to try myself. I did, and they were right, red was better. There were more fruit nodes. So I changed to CR95 red.	I used my own experience to make decisions. I take my experience and I look at what other farmers use. I then do my own experiments and make decisions from there. Other farmers ask me for advice. I don't ask anyone for advice.
		[My neighbors and I] we saw a neighbor use Catimor 20 years ago. We saw it was resistant to roya. During the crisis, we wanted to change to Catimor.	Most people like to make decisions on their own, but I like to consult everyone.
By accident	rain	I saw on my farm and on other farms, Calturra is not resistant to <i>roya</i> . It was very affected. So I needed to get rid of it, I cut it out of my farm.	My neighbors and I talk about different varieties, problems and diseases. We talk about what we've seen and make comparisons. Then I do experiments for myself.

	<p>My husband is an expert with coffee. I don't know much about the details but I know he is changing varieties because of the rain. We only had 2 <i>fanegas</i> last year because of the rain. [Increased rainfall] is really affecting everyone.</p>	<p>Whenever I hear of a new variety or listen to other farmers mention success, I ask questions to everyone I know connected to coffee: my family, neighbors, the workers at the store, the truck drivers. I listen to all advices and then decide if I want to experiment.</p>
better quality plant	<p>I know because in cold areas, Catuai and Caturra do better. But in hot places, that are vulnerable to <i>roya</i>, I need CR95. It is more resistant to <i>roya</i> but <i>roya</i> only hits in hot areas. I need it for hot areas.</p>	<p>Myself, I have a lot of experience. I watched and learned on a big farm. My neighbors come to me and ask for advices. I always share my advices with my neighbors and whoever asks me.</p>
	<p>By accident, I bought seedlings and some Catimor variety were in the group. They grow on their own and I did a small experiment with them. I saw they were more resistant and stronger fruits. So I bought more Catimor.</p>	<p>It's a big risk because I don't know if it will work. I can't take a big risk, so I listen to advices but then try a little bit and see for myself if it works.</p>

experiment. They indicated that they primarily rely on their own experience and knowledge before making the change, but did solicit advice and suggestions from other farmers or experts.

Almost all participants indicated they had never used fungicides until *la roya* had hit within the past five years. Participants indicated hearing about using fungicides in response to *la roya* mostly from ICAFE or MAG, but also from neighbor farmers. All participants started to use fungicides in response to *la roya*, however the product (type) of fungicides varied greatly across the responses. The participants discussed mostly with engineers from ICAFE or the agronomy stores in Turrialba or La Suisa before using fungicides, however did collaborate with their neighbors before using them.

The third innovation adoption reported by participants was adding or changing the variety of coffee on their farm. Participants indicated learning about a new or different variety either from MAG or ICAFE, a neighbor farmer, or by accident. Participants learned of them by accident because they would purchase seedlings of one variety, but there would be a few stray seedlings of another variety. The farmers reported then doing an experiment growing these few seedlings next to their plantation to see how the new seedlings grow. Participants indicated changing or adding a new variety due to *la roya*, *broca*, increased rainfall or because they wanted a better quality plant. Each participant adopted the specific variety they indicated for various reasons, however the most commonly reported reason was that they had seen its' success on a different farm. The farmer either saw the success of a variety on another farm, or they conducted their own experiment to determine the viability of the new variety. Participants indicated they talked to engineers from ICAFE/MAG, the engineers at the *beneficios*, their neighbors, or they rely on their own experience and experiments before making decisions. Many

farmers indicated they solicit advices and exchange ideas with many people, but rely on their own experience and knowledge to which decision to make.

Community

Horizontalization

Under the research concept *role of community*, participants were asked to describe their community. The non-overlapping responses for each community in the sample are reported in Table 15.

Table 15: Horizontalization – Community Descriptions

Can you describe your community?			
Community	Description		
			I was born here, it is very important to me.
San Gerardo	Excellent people, and strong solidarity.	Chitaria	This community relies on cilantro first and then coffee.
	It is a very peaceful community. I like it here; I want to stay.		It is very peaceful here with very nice people. We see each other every day and support each other. Everyone works here.
	We help each other every week. Everyone knows everyone. If someone needs help, we help.	San Rafael	It is a very nice and calm community. I grew up here; I like it.
Pacayitas	Very nice people, we all help each other.		We support each other here.
	There is much friendship, solidarity and see, our community is like one big family.	Alta Varyas	We don't communicate much but we all have very strong relationship and support for each other. We sporadically see each other.
San Vicente	Really nice people, we always see each other and support each other.	San Martin	The community is like a family. We have a very strong connection to each other.
Simaron	They are very nice people, it is a very calm place here.		We have many informal parties.
Guyabo	We all have a good relationship. But we don't talk about coffee, only when <i>roya</i> hits.	Santa Teresita	Interactions are very good here, it is very important. We don't see each other much but we have a very good relationship.
Silencio	Excellent people, the community is calm and innocent.	Maquina	It is very calm and peaceful here, tranquil.
	We don't communicate much but we all have very strong relationship and support for each other.	Las Colonias	It is a nice community but no longer very peaceful. The government is building subsidized housing and there has been an increase in theft and dangerous people in the community.
Very nice people here and very inclusive. Everyone is always invited to every party.	It used to be very safe, but now there are a lot of thieves. It is not very safe.		
Tres Equis	It is a very quiet town. I don't know if they are nice people because I don't talk to them much.		It is a peaceful community with hard working people. Everyone has different kinds of socioeconomic problems here.
	I know it is a very poor community. It relies a lot on cilantro.	It is a very social community.	

Participants were asked to describe how they interact with their community. The non-overlapping responses are presented in Table 16.

Table 16: Horizontalization – Community Interactions

How do you interact with your community?	
<i>Frequency</i>	We see each other everyday. In the town center, at the bank, at church, on the bus, walking, parties.
	My daughter is always playing with the other kids.
	Sometimes all week, once a week, every day. I have a truck and everyone comes to me for favors to transport things and to shop and go to town.
	We don't see each other much, maybe on the weekends, because we work all day.
<i>Support</i>	We share problems and support each other. If someone dies, no one works. We go to the funeral and help. That's what you do.
	We don't see each other much because we are working. But when my father had a heart attack, everyone helped with money.
	We meet a lot to talk about religion, God and problems we have every day.

Participants were asked to describe how important it was to them to be a part of the community. The non-overlapping responses are presented in Table 17.

Table 17: Horizontalization – Importance of Being a Part of Community

How important is it to you to be a part of this community?	
<i>Support</i>	Even though everyone here [in San Gerardo] is in poor conditions, we always help each other. When my father had a heart attack, the community helped him and us with money.
	All of the land users share advice, mostly it's about coffee, but all land users share advice to each other about practices, products, problems and solutions.
	I receive the most support for coffee and daily life from my neighbors.
<i>Trust</i>	It is very, very important to be a part of the community. There is a big trust between all of us and we help each other in emergencies. I like being a friend to everyone.
	Very important. When I need help or advice, I go to my neighbors. We trust each other.

Participants were asked to describe how coffee was or was not important to their community. The non-overlapping responses are recorded in Table 18.

Table 18: Importance of Coffee to Community

Can you describe how important coffee is to the community?	
<i>Income</i>	Very important, the majority of people here grow coffee.
	Coffee represents the main source of income for this community.
	It's important because many of us rely on coffee. But once we send our kids to university, they do not come back to coffee. They get other professions.
<i>Work</i>	I don't like using chemicals on the farm because it is bad for the land but more importantly, bad for the community. The chemicals take away jobs, like weeding. This labor is a source of work on big farms for the community.
	It's very important because it's a source of work for everyone in the community.
<i>Disappearing</i>	It is very important because it means work and money for the community. But many people are changing from coffee to cilantro, cilantro is now number one. Coffee used to be number one.
	[The community], we always talk. But now, less about coffee. It's very important to the community, but not so much anymore. I sell more beer than coffee now. Many people had to stop growing coffee because of <i>la roya</i> . Almost 80% stopped. It's really sad. Also bad prices and the road.
	We were really affected by <i>la roya</i> . Before, 5 trucks would come every day during harvest to pick up all of the coffee. Now, only 1 comes.
	We don't share ideas because there are not many coffee farmers in this community.
	I don't think it's very important because there aren't many coffee producers here. This community relies on cilantro.
	It generally is really important here, but no longer not so much. Sugar cane is now the big crop here, because it is profitable. I am afraid that coffee will disappear. I don't want it to, but I will have to stop when I don't have the support of my family.

Participants were asked to describe how they interact with other coffee farmers in their community. The non-overlapping responses are recorded in Table 19.

Table 19: Horizontalization – Interactions with Other Coffee Farmers

How do you interact with other coffee farmers?	
<i>Adapt</i>	We listen to advice from Rono [ICAFE] but then we talk from our experience about if that is good advice for our farms or not.
	We debate about the information provided from ICAFE. It is not correct for Turrialba region, but we know how to grow. So we debate about what applies to us and if we should listen.
<i>Exchange Ideas</i>	We talk about <i>roya</i> and why it happens and if to spray and why to spray. And if spraying really helps.
	The only way to seek advice and solve problems with the coffee farm is to talk to neighbors. They know the land, the community and me. We help each other and solve problems together.
	We exchange ideas about how to grow coffee and do better practices, like pruning.
	We talk about prices, diseases, varieties and different changes.
<i>Collective Action</i>	During the harvest season is when we talk the most about coffee. We talk about how heavy the rain is, how to help each other, how the road is bad.
	We only shared ideas for practice and producing coffee when <i>roya</i> hit. We never shared ideas before or now after, since we have our practices against <i>roya</i> .
	We talk about our problems to grow coffee and how we can fix them. Right now, we need to improve our roads to transport coffee and water and tools. It will make it easier for us to make it to meetings too.
	We needed a motor pump but it was very expensive. So [a group of community farmers] split the cost to rent a motor pump to spray chemicals against <i>la roya</i> .
<i>Trust</i>	I trust my neighbors more than the ICAFE engineer because we see each other more. We are more. The engineer is farther away and more distant.
	Sometimes the other producers in the community call me to ask advice on products and practices. They see how good my farm looks and follow my instructions.
<i>Individualism</i>	We talk to each other to complain about coffee, but we do not work together to solve problems. I did not tell my neighbors about <i>la roya</i> when I first saw it. I just took care of my own farm. If they were smart, they would have taken care of their farm.
	We all talk about coffee and problems, but mostly to complain. We never ask each other for advice on how to grow. We all know how to solve our own problems.

Textural Description

Participants were asked to describe their community and the responses are recorded in Table 15. Participants hailed from 15 different communities throughout the Turrialba coffee-

growing region. While descriptions of each respective community slightly varied across participants, the communities overall were described as peaceful and calm places with good hardworking people that support each other. The only exception to this description was from participants in Las Colonias, who mentioned the increase of crime and feelings of insecurity. Each participant that reported this description attributed them to the recent development of government-subsidized housing projects located right outside the community.

Participants were asked to describe their interactions with their community (Table 16). The responses were clustered into two themes: *support* and *frequency*. Under the theme *frequency*, participants reported various levels of interaction with their community from at least every week and at most several times a day. Venues for interaction included church, school, walking through the community, informal parties, taking the bus to either Turrialba or La Suisa town center, in the respective community town center, or sports. Under the theme *support*, participants reported having strong relationships with one another and a strong support system within their community, regardless of the frequency of their interactions. Table 17 displays responses from participants regarding the importance they placed on being a part of the community. Two main themes emerged from these responses: *trust* and *support*. Participants reported feeling that it was very important to be a part of their community because of the various supports they received as a community member including: help in time of emergency or need, exchange of ideas, advice and practices, and for daily life. Participants also reported feeling that it was very important to be a part of their community because of the trust they had with their community members.

Participants were then asked to describe their community in respect to coffee and coffee production: how coffee was important to the community and how they interacted with other

coffee farmers. The non-overlapping responses are reported in Tables 18 and 19, respectively. The responses as to how coffee was important to the community were clustered into three themes: *income*, *work* and *disappearing*. Under the theme *income*, participants reported coffee being important to the community as it represented a source of money to support livelihoods. In some communities, participants reported that the majority of people in those respective communities relied on coffee to support their livelihoods. It was also frequently reported that coffee allowed participants to send their children to higher levels of education to acquire a different profession than coffee. Under the theme of *work*, participants reported that coffee production represented a source of employment for many members of the community. This source of work was described as either producing one's own coffee or working on a larger coffee farm in the surrounding area. Finally, the third theme *disappearing*, participants in certain communities reported the significantly diminishing importance of coffee to that community. These participants noted that coffee used to be very important to the community for the aforementioned reasons, but recently, the importance of coffee has diminished.

Participant responses for how they interact with other coffee farmers were clustered into five themes: *adapt*, *exchange ideas*, *collective action*, *trust*, and *individualism* (Table 19). Under the theme *adapt*, participants reported interactions with other coffee farmers in their community that involved debating how to adapt the information provided by ICAFE and MAG to the Turrialba region, and if they should even use the information at all. Under *exchange ideas*, participants reported interacting with other coffee farmers in the community to exchange ideas about best practices, new technologies, or seek advices. Under *collective action*, participants reported interacting with other coffee farmers in the community to work together to take action in solving problems, like *la roya*, bad roads and lack of individual resources. It was frequently

highlighted that coffee farmers who previously did not work together to solve problems, worked together once *la roya* hit because it was an emergency. Under *trust*, participants reported interacting with other coffee producers in their community because they trust their neighbors and their neighbors' advices over those of ICAFE or other non-community members. Under *individualism*, participants reported interacting with other coffee farmers in their community solely to complain or talk about their lives, not to exchange ideas or practices, or to solve problems. It was a common response from participants to indicate that they don't solve problems or seek advices from other coffee producers in the community because everyone already knows how to solve their own problems. However, the majority of participants would indicate a situation, particularly in response to *la roya*, where they worked together with other farmers to solve a problem. Only two farmers maintained they never sought advices or collective action with other farmers to solve problems.

Gender

Horizontalization

Under the research concept *role of gender*, participants were asked who was responsible for what tasks on the coffee farm. The non-overlapping responses are reported in Table 20.

Table 20: Horizontalization – Tasks On the Coffee Farm

Household members involved in coffee farming	Tasks
Male Farmer	Planting, pruning, weeding, fertilizer
	Harvesting
	Spraying of chemicals
Husband to Female Farmer	Harvesting
	Spraying of chemicals
Female Farmer	Harvesting
	Spraying of chemicals
	Planting, pruning, weeding, fertilizer
Wife to Male Farmer	Harvesting
	Pruning, weeding
Sons	Harvesting
	Planting, pruning, weeding
Daughters	Harvesting
	Fertilizer
Full Time Hired Labor (all male)	Planting, pruning, weeding, fertilizer
	Harvesting
	Spraying of chemicals
Part-Time Hired Labor (all male)	Harvesting

Participants were asked, other than working or helping on the farm, what are the daily tasks for each member of the household. The non-overlapping responses are reported in Table 21.

Table 21: Horizontalization – Tasks Off the Coffee Farm

Household members not primarily involved with coffee farming	Daily tasks
Husband	Outside labor: business, wage labor on larger farm
Wife	Takes care of the household (<i>domestica</i>)
	Helps collect sugar cane
	Helps work in the bar
Sons	School (levels: primary, secondary, tertiary)
	Did not finish degree; helps in family business or farm
	Work in other farms
	Work in profession
Daughters	School (levels: primary, secondary, tertiary)
	Help in the household
	Work in profession
Grandchildren	School (levels: primary, secondary)

Participants were asked who were the primary decision-makers for changes on the coffee farm and how females were involved with decision-making (wives, daughters, mothers). The non-overlapping responses are reported in Table 22.

Table 22: Horizontalization – Primary Decision-Makers and Female Role

Participant	Primary Decision-Maker for Coffee Farm	Female Role
Farmer (Male)	Male farmer	I decide everything for the coffee farm. [My wife] decides for everything else.
		I mean I tell [my wife] I am going to that [a change], if I am going to tell her.
		Only me.
		Yes, [my wife and I] make sure to agree and consult on everything. Two brains thinking is better than one.
Wife of Farmer	Husband (male farmer)	He will tell me just to communicate, but I take care of the household. I don't take care of coffee.
		I don't know about the practices. I know la roya affects the economics of production
Daughter of Male Farmer	Father (male farmer)	[My father] makes all of the decisions. He tells me because I work on the farm just so I know. But no, no he makes all decisions.
Farmer (Female)	Female farmer	I make the final decision, but it is always a decision between me and my husband. For example, my husband wants to intercrop, but I won't allow it. We will only do full sun.
		Only me. I have experience and operate my farm by myself. I seek advice, but I make the decision.
	Hired Labor	I rely on him and his experience. If I see something, I call him. He is a neighbor, I trust him. He tells me what I need to buy.
		Before I buy any recommendations from the store, I always consult with my worker.
		Before my husband died, he made all of the decisions on the farm. My worker worked with my husband. I trust his experience and decision-making.

Textural Description

The role of gender was organized into two themes: *role of females on the coffee farm* and *the role of females as decision-makers*. At the beginning of the interview, participants were

asked to describe the daily tasks involved for producing coffee and who was involved or responsible for those tasks (Table 20). They were also asked to describe every individual in the household's daily tasks (Table 21). Towards the end of the interview, participants were asked who was the primary decision-maker for making changes on the coffee farm (Table 22). This question was generally followed by a probe question asking if the identified decision-maker consulted with others and/or his/her spouse or children.

When the farmer was male, females (either wives or daughters) participated on the coffee farm primarily only to help with the harvest. Occasionally, a daughter or wife would help with pruning, weeding or fertilizing on the farm. When the farmer was female, she would participate in full management of the coffee farm (including weeding, pruning, planting). Except for one female farmer, females did not participate in the spraying of chemicals on the farm. If the farmer were male, he or hired labor would spray chemicals. If the farmer were female, either hired labor or her husband would spray chemicals on the farm. When the female did spray on the farm, she could not afford hired labor and her sons lived far away to help with the spraying. Regardless if the farmer was male or female, daughters were only reported to help during harvest and one daughter helped with fertilizing, while sons would help during harvest as well as with management. Frequently, only males were reported to work on the coffee farm, while females did not participate on the farm at all. Females' main reported tasks were to manage the household (*domestica*).

When the farmer was male, he was also identified as the primary decision-maker for the coffee farm. Primarily, the male farmer said he made all decisions himself and never consulted with his wife or another female. Occasionally, the farmer would say he communicates information about the coffee farm with his wife, but only for communication purposes. He didn't

consult his wife or ask her opinion or advice. Only once did a male farmer say that he consulted and discussed with his wife.

When the wife of a male farmer was asked about decision-making, the wives would echo the male farmers' comments about decision-making, saying they took care of the household and were not involved on the coffee farm. Occasionally the husband would tell them about the farm or changes, but only for communication purposes. The wives did not know the answer to many questions about the coffee farms (such as what size it was, if there were shade or other crops on the farm, what varieties used). The wives did know that *la roya* impacted the yield and income for that harvest season.

When the farmer was female and she had fulltime-hired labor, she identified the hired labor as the primary decision-maker regarding making changes on the farm. Her role was to assist in the management and to pay for the necessary inputs. When the farmer was female, single and did not have fulltime-hired labor, she identified herself as the primary decision-maker. When the farmer was female, married and did not have fulltime-hired labor, she identified herself as the primary decision-maker but noted that each decision was made with her husband.

The findings are reported here in Chapter 4 as outlined by IPA. Chapter 5 will describe the overall essence of each concept area and draw conclusions regarding how each concept area relates to the smallholder farmers' decision-making process.

Chapter 5

Conclusions, Implications and Further Investigation

This research ultimately sought to understand from a smallholder coffee farmer's perspective the influential factors leading to the decision to adopt an innovation on his or her farm. It reflects the results of key informant and expert interviews, secondary data and observational fieldwork gathered to understand Costa Rican smallholder coffee producers behaviors, perceptions, knowledge and factors influencing their decision to adopt innovations on their farm. Decision-making is a dynamic and complex process that is ultimately best explained through the individual's descriptive experiences. Chapter five presents the conclusions, implications and recommendations for the five different research questions from the collected data presented in chapter four.

Findings and Implications for Applied Usage and Policy Development

In testing the research questions of this study and exploring the innovation adoption process among Costa Rican coffee farmers, numerous characteristics were found to be consistently evident. Main factors influencing farmers' decision-making process in adopting an innovation include the importance of tradition and family history with coffee production, access to community support, sense of government neglect, high emphasis placed on trialability, observability and relative advantage of an innovation, the importance of interpersonal communication, strong sense of community support and engagement, and cultural gender divide in coffee production. The findings of this research can be best explored in relation to the original research questions that guided this study.

Research Question 1

How do the participants' characteristics influence their decision-making process in adopting an innovation?

Findings & Implications Research question #1 aimed to understand how the participants' characteristics influencing their decision-making process to adopt an innovation on their farm. Personal characteristics as well as personal history and motivations to grow coffee were identified to provide a context of each participant in the sample. Sociodemographic characteristics, perceptions and motivations have been consistently used in diffusion of innovation research as key factors influencing a participants' decision or ability to adopt an innovation (Rogers, 2005; Fuglie & Kascak, 2001; Greiner & Gregg, 2011; Greiner, Patterson, & Miller, 2009). Smallholder farmers are generally categorized as late majority or laggards in diffusion and adoption research (Rogers, 2003; Stephenson, 2003; Rodriguez *et al.*, 2008). The characteristics identified from this sample align with those in the literature (Rogers, 2003; Feder *et al.*, 1985). This research expands upon the literature to gain a deeper understanding of each participant's personal context of coffee production.

Overwhelmingly, coffee production is a male dominant profession in Costa Rica. Women remain in the household while males maintain the coffee farm. Females (wives and daughters) generally only help during harvest, unless the family does not have access to hired labor and thus the women will help with certain maintenance activities. If the farmer is a female, then males are also involved on the farm and will generally take care of maintenance or at the very least, will be responsible for spraying chemicals.

Participants' deep traditional connection to coffee production influenced their decision-making process when choosing to adopt innovations on their farm. Smallholder coffee

production in Turrialba is a family-oriented activity that relies on traditional knowledge and community support for best practices (Sick, 1998). Most frequently, participants described that while coffee represents a stable and secure source of income that allows them to provide for themselves and their households, it holds a much deeper connection to their personal and national history. One participant described this connection when he described his reasoning for growing coffee: “Because I’ve been growing coffee my whole life. It’s what I know.” As opposed to other coffee producing countries, Costa Rica holds a deep national pride for their high quality coffee production. Coffee production is a national activity; it symbolizes much more than a source of income to Costa Rica as a nation (ICAFFE, 2015).

This tradition and personal connection are reflected in the fact that all learned to grow coffee from their parents, grandparents or occasionally from neighbor producers. They rely on traditional knowledge for best practices and infrequently attended trainings or formal education regarding coffee production. Most frequently, farmers reported their reliance on traditional knowledge as inhibiting their desire to seek out formal means of training or education, or assistance and advices from other farmers or experts because they already knew how to solve their own problems, as do the other farmers in the community. One participant described this reasoning when he explained, “It is not common to go to courses; I went to one once 10 years ago. But [all coffee farmers from Santa Teresita] know how to grow; we grew up knowing and learning. We know from traditional knowledge and experience.”

Farmers frequently indicated they grow coffee because it is a part of their culture and identity, and that coffee represents much more than an income. Most of the participants returned to the family coffee farm after leaving primary level or early in their secondary level education. The majority of participants only had primary level education and cited leaving primary school

to work on the family farm. However, the majority of participants indicated that their children have continued in school as appropriate for their age. Several participants indicated their children continued on to university (tertiary) level education. Farmers indicated that education was important for their children to receive better qualities of life and better professions upon completion of their education. Only one farmer indicated his desire to have his children continue in coffee production because he saw it as a family tradition. Even though all participants indicated that coffee production held deep personal and familial connections, all but one emphasized their desire for their children to not continue in coffee. This phenomenon is seen across many rural areas throughout the world, as rural children remain in school and leave agriculture as a way of life in search of better qualities of life (FAO, IFAD & CTA, 2014; Leavy & Smith, 2010; Juma, 2007). The participants' desire to have their children continue in school rather than return home to the family farm can be a reflection of this global phenomenon.

Participants reported that they continue to grow coffee because it is a family unifying activity; everyone in the household helps during harvest and it allows the farmer, female or male, to earn an income while remaining close to the home. All of the participants' smallholding farms were located either on the household property or very close by. Participants indicated that remaining close to the home allowed the parents to be more engaged within the household and keep the family unit tight. They also indicated that it made the children participate in family activities that provided for the family and taught them a sense of responsibility. Participants explained that, "[Coffee] allows us to maintain the family unit because we all work together on the farm," and that "[a farmer] can work and support [his] family and stay very close to home."

In conclusion, the personal and traditional connection participants' held with coffee production influences their decision-making regarding the coffee farm. Unlike other sources of

income, coffee production has a greater significance to farmers in Turrialba. This is reflected in the fact participants generally relied on their own traditional knowledge to determine best practices, rarely sought outside assistance and advices regarding best practices, and for why they did not abandon coffee production even when its production became incredibly challenging and costly. Participants sought extra sources of work in addition to coffee production rather than abandon coffee production for other sources of work. When *la roya* hit, coffee's economic and cultural significance diminished greatly in the communities because farmers were increasingly abandoning or significantly decreasing their coffee production. Since *la roya*, all of the *beneficios* in Turrialba closed, bottlenecking all of the producers in Turrialba to sell to either Juan Viñas or Santa Rosa. Frequently, participants expressed sadness and genuine grief regarding the reduced significance of coffee in the community due to *la roya*, not because of reduced wages as some farmers would turn to different crops, but because coffee is a source of national and community pride.

One implication for application from this research question regards how smallholders in Turrialba make decisions about crops that hold greater significance outside just being a source of income. It is recommended that program and policy makers focus on the importance of culture, tradition, and national pride as a way to link innovation diffusion methods to the values of the target population. Program and policy makers must gather the context of the target populations' personal motivations, history and reasons for growing the given crop. It is imperative to solicity and incorporate the target populations perspective and contributions in order to facilitate effective diffusion and adoption of innovations that will holistically benefit the target population.

Participants indicated investing greater amounts of energy in caring for their coffee farms and maintaining them despite recent significant challenges (*la roya*, climate change, low prices)

due to their personal connection to coffee production. In terms of understanding patterns of decision-making, a future research question might ask similar questions regarding influential factors between two crops: one that holds a national and personal traditional connection (i.e. coffee) and another that only represents a source of income (i.e. cilantro).

Research Question 2

How do the participants' access to resources influence their decision-making process in adopting an innovation?

Findings & Implications Research question 2 sought to understand how participants' access to resources influenced their decision-making process in adopting an innovation. The literature widely cites the participants' access to resources as a key factor influencing a farmer's decision or ability to adopt an innovation (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Knowler & Bradshaw, 2007). Common resources needed on the farm for best management and production include access to scarce inputs (use of inputs, ability to get inputs), access to information (trainings attended, exposure to media, relationship with extension agents), access to labor (non-family labor employment), access to technology (technology use), access to assistance (support network, infrastructure) (Rogers, 2003; Feder & Umali, 1993; Feder *et al.*, 1985; Knowler & Bradshaw, 2007). The findings of this research question support previous research in that participants with greater access to resources were more aware and willing to readily adopt an innovation on their farm.

Across responses, participants universally had access to assistance via support systems through their community, but access to other types of resources varied greatly. All participants except one indicated their ability to rely on fellow coffee producing neighbors and most

participants indicated their ability to call the ICAFE expert [Rono] for assistance. The only participant who stated not having a strong community support indicated he would like to be closer with his community members because that social support was important. He explained, “I don’t have any close neighbors. Their houses are too far away from here to talk to.” Having a strong community support allowed farmers to have greater access to necessary inputs.

The most affluent farmers had additional businesses, highly diversified sources of incomes or connections to larger farms; they would have higher access to resources but would often share information and advices with other farmers within the community when solicited. The most affluent farmers would attend trainings or consult frequently with ICAFE experts, but reported that they did not hesitate to share this information with neighbor producers.

Only a few participants would attend formal trainings to learn more regarding coffee production, yet most did not attend formal trainings because they do not trust ICAFE, only relying on their traditional knowledge or experience of neighbor producers for best practices. Farmers indicated they did not trust ICAFE because they felt general neglect from the government and indicated that the advices given from ICAFE experts were tailored to higher quality and higher producing coffee areas in Costa Rica. This information was not tailored to Turrialba region and most farmers felt it was a waste of time to discuss with ICAFE experts because of this. One farmer explained that “the information and advice ICAFE gives is based on the growing practices in Central Valley. Turrialba is a different climate, different harvest season, different needs. It’s not correct for us.” Most farmers that did seek out formal education or trainings had more direct access to information and support from engineers.

Although several participants indicated positive experiences with asking for advice or help from ICAFE, there was a general negative attitude towards ICAFE and the government

regarding their lack of support to smallholders, especially after *la roya*. Overall, participants reported a strong sense of neglect from the government due to unequal treatment compared to larger farms.

If the farmer had no children in the household and access to appropriate resources, he or she would hire outside labor. Yet most participants were not able to hire outside labor and relied solely on family labor to maintain and produce coffee. Family labor was an asset for production. If there were children in the household, they helped during harvest season.

Participants indicated their ability to access most of the necessary inputs for production, citing their affluence or reliance on community support to get inputs that they otherwise would not be able. However participants indicated several barriers to accessing desired inputs, including unaffordable costs associated with the inputs and lack of awareness of the input or source of access. Additional barriers to successful production included uncontrollable effects of low market prices and climate change posing extra challenges, their dependence on the *beneficios* to sell their harvest, the lack of government support and unsustainable practices. One farmer explained that “the climate really affects coffee production. [Coffee producers] need to think about the climate and use climate resistant varieties. We need climate resistant varieties.” Another farmer indicated his community’s dependence on the *beneficios* to sell their coffee, describing a time then “the truck driver from Santa Rosa was irresponsible last year and did not come. [The community] lost a lot of harvest because of that.” While strong community support and the infrastructure were present for smallholder coffee farmers to continue their production, these barriers posed significant challenges for successful production.

One suggestion for application from these findings is to build trust between smallholder farmers in Turrialba and ICAFE agents. ICAFE agents can hold community forums to solicit

feedback from farmers about how to better support them and identify problems areas. This can begin to build trust and foster a positive relationship between ICAFE agents and smallholder farmers within the communities.

One suggestion for improvement is to incorporate participatory demonstrations and work shops in formal training and education. Participants frequently cited that they actively do not pursue formal training or education, or share advices with neighbors because there is a sense of individualism when it comes to knowing best practices. Participants trusted their own knowledge and expertise and that of their neighbor producers over the experts who provide the trainings, thus incorporating community led demonstrations and trainings can draw a greater audience and facilitate community-based learning for best practices and input exchange. This will also promote community engagement between farmers, helping farmers that have no access to hired labor. If farmers work together, they can increasingly share resources.

Another suggestion for improvement would be to set up informal coffee farmer associations within and between the communities within the Turrialba region to meet regularly and discuss the issues plaguing coffee farmers and coffee producing households within the community. These associations can be open to any coffee producer in the community and will be an informal place to openly discuss issues, challenges and opportunities. This will provide a space to facilitate collective action within the coffee producing community. ICAFE agents can attend these meetings to openly discuss potential solutions to these challenges.

Research Question 3

How do the innovations' characteristics influence smallholder farmers' decision-making process in adopting an innovation?

Findings & Implications Research question 3 sought to understand how the selected innovations' characteristics influenced the participants' decision to adopt the innovation. Participants were asked to identify a change they had made on their farm in the past five years and they were asked open-ended questions about the process they took to adopt the respective innovation. Literature indicates that innovations have five perceived qualities that influence an adopter's decision: comparative advantage, compatibility, complexity, trialability and observability (Rogers, 2003). Rogers (2003) indicates that the information channels through which innovations are diffused also affect the adopters' ability to know and choose the innovation. The findings from this research support findings found in previous literature.

Participants identified three main innovations: change in pruning methods, adding fungicides to their inputs, and changing the variety of their coffee plants. Across the responses, participants most frequently indicated examples of trialability, observability and comparative advantage that influenced their decision-making process before adopting the innovation (Rogers, 2003). For trialability, participants frequently indicated that they would experiment with different pruning methods, varieties or different types of fungicides to test which one worked best for them and their farm. This was the most reported influential factor on the participants' decision-making process. For observability, participants indicated that they would see the success or failure of another farm and base their decision from the varieties, products or methods that farmer would use. For example, one farmer explained that "I saw on my farm and other farms, Calturra is not resistant to *roya*. It was very affected. So I needed to get rid of it, I cut it

out of my farm.” This was mostly reported regarding changing a type of variety on their farm. For comparative advantage, several farmers indicated they would change their pruning method, amount and type of fungicides used, and amount and type of varieties used based on the increase of yields and productivity the respective innovation would provide the farm. Participants did not mention examples of assessing an innovation’s compatibility or complexity as influential factors in their decision-making process.

When first asked about recent changes on the farm, participants would frequently cite that they maintain the same practices and do not adopt innovations. However when prompted to discuss the inputs, practices or varieties used, farmers would identify that they had indeed made a change on their farm (i.e. adopted a new innovation).

Participants indicated that effects of climate change (*la roya, broca*, increased rainfall) forced them to adopt a new innovation on their farm to maintain the quality of the farm and their yields. The alternative motivation for making a change on the farm was to experiment with new methods or varieties that would produce the best yields. Only the more affluent (i.e. had concurrent businesses with the coffee farm) and better-connected farmers would make a change on their farm just to experiment. Less affluent farmers with no direct connection to larger farms or experts would not make changes just to experiment, but would in light of necessity (i.e. loss of yield due to *la roya, broca*, climate change, poor practices). One farmer explained that “*roya* affected [his] harvest and it is very bad. [He] has to protect [his] plants against *la roya*,” thus he adopted the use of fungicides on his farm out of necessity.

Participants indicated they received information regarding the respective innovation adopted mostly from informal communication channels (neighbor producers), occasionally from formal channels (experts at MAG or ICAFE) and never from media channels. This aligns with

information diffusion patterns as indicated in the literature (Rogers, 2003). When presented with an emergency situation (i.e. *la roya*), participants indicated they did not experiment with fungicides before using them, but rather adopted their use immediately from the advice of the experts. Thus in emergency situations, participants would openly heed the advice of experts. One farmer explained: “I called the agronomy store in Turrialba because we saw *roya* and were scared. We asked for suggestions and they said use fungicides. We didn’t want to take the risk, so we did.” However most frequently, participants indicated they would hear about innovations from their neighbors and would first assess the innovation for themselves and rely on their own expertise before adopting the innovation.

One suggestion for further research is to better identify these informal communication channels to track how information regarding new innovations (best practices, tools, products or varieties) is diffused throughout these communities. This type of research would require significant amount of time spent in the community to fully understand community dynamics and how and when farmers interact with each other and in which way. Better understanding community dynamics and informal interpersonal communication channels will help policy and program makers better target the smallholder population and diffuse useful and effective innovations to them.

One suggestion for improvement is to incorporate community test plots that allow ICAFE, experts or community farmers to test new products, methods or varieties within the community that will allow neighborhood farmers to observe and test innovations on an outside plot before adopting it on their own. It will provide a platform for community sharing of knowledge, practices and innovations, for ICAFE to easily distribute and demonstrate new innovations, and for reducing the risk for the most vulnerable and marginalized of community

farmers. Test plots can be a small piece of land with various coffee varieties planted, located in the center of the community to which every community producer has access. ICAFE can use this plot to demonstrate different varieties, pruning methods, inputs, or new technologies, and offer training modules to community members. ICAFE should make an effort to meet and encourage every farmer within the community to utilize and participate with the community plot.

Research Question 4

How does community engagement influence the smallholder's decision-making process in adopting an innovation?

Findings & Implications Research question 4 sought to understand the context of the communities in which each participant lived and how their community engagement influenced their decision-making process before adopting an innovation. Rogers (2003) accounts for the importance of social systems in understanding diffusion and adoption of innovations, however the literature does not further explore how community engagement influences decision-making in smallholder farmers. Community and community engagement literature discusses community as a process built upon interactions between individuals in a given place (Wilkinson, 1970, 1991; Granovetter, 1973). The findings of this research assess the role in which community plays in the participants' decision-making process to adopt an innovation on their farm. These findings are split between the participants' engagement with the community in regards to everyday life and in regards to coffee production. The findings from this research support that participants feel they have a strong sense of community and this strong sense of community does influence their decision-making process to adopt an innovation on their farm.

The participants represented fifteen different communities throughout the Turrialba coffee-growing region. Across the responses, participants described their respective communities as peaceful places, with good and hard-working people that all have very strong and positive relationships with each other. They also indicated that regardless of the frequency of their interactions, community members would always help each other in the event of an emergency or need. One example to demonstrate this type of support is relayed by the wife of a farmer,

“For example, people here are poor and even though we don’t see each other very often because everyone has to spend their time working, when my father had a heart attack last year, they helped. They gave money because I had to take care of my father, and we are poor. The community understood and gave us money to help.”

Participants indicated they played sports with each other, frequently interacted at church on Sundays or at church groups, at the bar, on the bus into town, or in the community center. Every single interview was interrupted when a neighbor walked by the house and the participant had to either say hello or hold a brief conversation to discuss how the neighbor was. The only exception to this description was Las Colonias, where recent government housing projects were developed next to the community and participants reported that they caused an increase in thievery and danger in the community. Outside of coffee production, participants felt it was important to be involved in their respective communities because the community represented a strong support system and they trusted the other community members.

In regards to coffee and the community, participants indicated that coffee was very important to the community because it represented a source of income and work for the community members, yet its importance was disappearing as *la roya* and poor prices were negatively affecting farmers’ yields, forcing them to seek diversified sources of income or

abandon coffee altogether. For example, one farmer explained that “[coffee] is very important because it means work and money for the community. But many people are changing from coffee to cilantro, cilantro is now number one. Coffee used to be number one.”

Finally, coffee production in these communities relied on community support for best practices and success. While the participants indicated they would sometimes go to trainings or listen to advices from the agronomy store, ICAFE or experts, they would generally always discuss with their neighbors and community producers. Most often, participants indicated they would trust the advices of their neighbors over those of experts because they had a personal connection with their neighbors, they could see the success (or failure) of their neighbors’ farm, and their neighbors knew the land better than experts. Community farmers would work together to solve issues that plagued the community, however participants frequently cited they did not work together with other coffee farmers to solve problems that only affected their own farms. The only times farmers indicated that they would exchange ideas or advices regarding problems on their farms were when those problems also affected the greater coffee producing community. For example, farmers would share advices regarding how to combat *la roya*, increased rainfall, or poor infrastructure. One farmer explained that “we talk to each other to complain about coffee, but we do not work together to solve problems. I did not tell my neighbors about *la roya* when I first saw it. I just took care of my own farm. If they were smart, they would have taken care of their farm.” Participants indicated that although they generally do not actively seek help, they openly give advices and opinions to anyone that asks for their help.

The more participants were involved and engaged with other producers in their community, the more they were influenced and exposed to different practices, tools or inputs to use to combat community-faced problems. Only one farmer indicated he did not ever interact

with his community as he was very far away from the community center on a poorly maintained dirt road. Thus he rarely went into town and rarely interacted with his community; he relied on traditional knowledge and the ICAFE website for best practices, yet indicated he would greatly desire to be better acquainted with fellow coffee producers to exchange ideas.

In conclusion, smallholder coffee production in Turrialba is very reliant on community support for best practices and success. Although the effects of *la roya* and low prices has diminished coffee's significance in these communities, coffee is still very important to many of the communities in the Turrialba region. Many of the community members rely on coffee to support their livelihoods and the participants indicated that they feel a strong sense of support from their fellow community members. Before participants adopted an innovation, they observed the innovation at a community member's farm, discussed the innovation with other community members, or learned about the innovation from another community member. The participants interacted with their community in some facet before deciding to adopt the innovation.

One implication from this research is the importance of community and community-based support for smallholder commodity producers. Future research can further explore the direct implications and effects of community supports for information and innovation diffusion throughout strongly-tied and weakly-tied smallholder producing communities.

Research Question 5

How do gender roles influence the smallholder farmers' decision-making process in adopting an innovation?

Findings & Implications Research question 5 aimed to identify the gender roles in small-scale coffee producing households in Turrialba, Costa Rica, and then how those gender roles influence decision-making. Previous research indicated that small-scale coffee production in Costa Rica is a gender-divided occupation (Sick, 1998; Reinhardt, 1988; Ortiz, 1973). The findings from this research support those in previous literature indicating the gender divisions in coffee production.

The conclusions are split between identifying gender roles in small-scale coffee producing households in Turrialba, Costa Rica and how these identified gender roles influence decision-making on the farm. Overwhelmingly, the maintenance and care of a small-scale coffee farm is a male responsibility. Women are primarily responsible for taking care of the household. Occasionally, due to lack of resources to hire outside labor, a daughter or wife to a male farmer will assist with some maintenance activities. But the main task in which a female will participate on the coffee farm, if she is not the farmer, is the collection during harvest season. If the farmer is a female, she will actively participate in the maintenance, either by herself, with her sons or hired labor, and this is because her husband has work outside of the household. However, in this case, the husband or hired male labor will be responsible for spraying chemicals. The only time a female farmer reported spraying chemicals was due to the fact she had no sons, husband or resources to hire labor to do so for her. However, this is limited to coffee production. Women remained in the household as a *domestica* and daughters were in all levels of school, helped take care of the household or worked in an outside profession. Sons would help on the farm and also

were in all levels of school or working in an outside profession. All of the hired labor, either part-time or full-time, was male.

Regardless of their role on the farm, females have little to no influence on the decision-making for any changes on the coffee farm. The male farmers, except for one, did not consult or integrate their wives or any other females' opinions, advice or thoughts before making a change on their coffee farm. When the wives were asked simple questions regarding the farm, they did not know the answers (questions about the size of the farm, varieties used, required activities for maintenance), indicating that they are not involved on the farm and that it is their husbands' responsibility. For example, one daughter farmer – whose main activities were helping her father on the coffee farm – did not know the answer to how many hectares the farm was nor what varieties the farm had. However the females were informed on aspects of coffee production that significantly affected the income from coffee (i.e. *la roya*, rainfall). Female farmers always consult with their husbands, hired labor (male) or brothers/fathers before making a change on the farm. One female farmer did not have a husband, sons or hired labor, but she did have a brother. He lived too far away to help with spraying chemicals and other maintenance, but he would consult with her over the phone before she made any changes on her farm.

Both male and female participants reported the strong influence that males had over decision-making regarding changes on the coffee farm. This finding aligns with previous literature (Sick, 1998). Yet even though males hold stronger overall influence in coffee production, female farmers demonstrated they were able to maintain a coffee farm and bring in an additional income while their husbands worked outside of the farm and/or household. As one female farmer had described, “[Working on the coffee farm] allows me to stay at home to take

care of the kids but also earn enough money to pay for my kids' education while my husband works outside [the household].”

One suggestion for improvement is to increase direct support for female farmers in the Turrialba region. As Sick (1998), Budowski & Bixby (2003) and Ruben & Ruiter (2002) describe, females in Costa Rica are either discouraged from participating in coffee production activities or receive little to no support when they do. However involving women on the farm and increasing the available support for women farmers would provide an opportunity for *domesticas* to remain in the household while also earning an income for the family. Or at the very least, it would allow the family to not have to hire nonfamily labor and save that income while the husband works outside the farm. Increasing support for female activity on the coffee farm will help to dismantle stigmas against female involvement on coffee farms and open opportunities to increase household incomes.

Increasing female involvement on the coffee farm in the Turrialba region would also allow males to seek outside labor while still maintaining a coffee farm, generating more household income and continuing a family tradition in an era where coffee production is increasingly diminishing. Coffee is an important cultural crop in Costa Rica; thus increasing female participation on the farm will help to maintain coffee's presence and viability as an income crop in Costa Rica after the devastating effects of *la roya*. Available support for women could derive from the creation of female cooperatives or associations that not only increased female participation on the coffee farm with available technical support, but would also encourage cultural acceptance and support with female participation on the coffee farm.

Conclusions

This research ultimately sought to understand factors influencing smallholder coffee producers in Costa Rica's decision-making process when adopting an innovation on their farm. Previous research has shown that while the diffusion of innovations theory can be effective and useful when diffusing innovations and identifying target populations, it can be damaging to smallholder populations due to its inherent limitations. This research utilized the diffusion of innovations theory to direct research questions to identify how the theory aligns with practice in smallholder coffee communities. Gaps in the theory were also addressed, looking at community engagement and gender roles, to understand if the diffusion of innovations theory could be improved by incorporating these concepts.

Small-scale coffee production is a family-oriented activity in the Turrialba region of Costa Rica that relies on traditional knowledge and communal support, and has deep roots in national and personal tradition. Women are not encouraged in coffee producing activities as it is traditionally a male-dominated activity, however women on the coffee farm provides opportunity to increase household income levels. Unless they are of higher affluence with connections to larger farms or experts, participants do not adopt innovations to experiment. However due to effects of climate change as in *la roya, broca* and increased intensity of rainfall, farmers are forced to make changes to maintain the quality and productivity of their yields.

The findings of this research support the literature regarding the influence of personal characteristics, motivations and perceptions on decision-making process; the influence of having higher access to resources has on the decision-making process and ability to adopt an innovation; the role social supports and interpersonal connections have in information diffusion; the lack of government support towards smallholder farmers and its negative effect on smallholders ability

to adopt an innovation; the influence of the innovations' trialability, observability and comparative advantage of the decision-making process; and gender division and lack of female representation on the coffee farm. This research further explored the role of community engagement and community supports regarding its influence on smallholders' decision-making process to adopt an innovation.

This research concludes that understanding community dynamics is crucial in deciphering how smallholder commodity producing communities rely on each other for support, access and resources. The participants in this research felt more supported from their neighbor producers than from the government, which influenced their decision to seek support from the government through soliciting direct advice or attending trainings or education.

This research seeks to add to the existing body of literature by exploring the diffusion of innovations and decision-making process to adopt an innovation with smallholder farmers in a coffee producing region of Costa Rica. Specifically, this research utilizes a participatory approach to solicit the participants' perspective and incorporates the role of community and community engagement as potential influential factors on the decision-making process. The research findings have the potential to be applied beyond the scope of coffee production to other community-based managed commodities or natural resources. The conclusions, implications and areas of future research are put forth to be applied by community members, researchers, practitioners and ICAFE agents for the Turrialba region specifically. It is the researcher's hope that these findings will ultimately benefit the smallholder producers in the Turrialba coffee-growing region of Costa Rica.

References

- Abbay, R. (1876) Coffee in Ceylon. *Nature*, 14(357): 375-378.
- Adadi Ghadim, A.K., & Pannel, D.J. (1999). A conceptual framework of adoption of an agricultural innovation. *Agricultural Economics*, 21:145-154.
- Agarwal, B. (1994). *A Field of One's Own: Gender and Land Rights in South Asia*. Cambridge University Press, Cambridge.
- Agarwal, B. (1992). Gender relations & food security: Coping with seasonality, drought & famine in South Asia. In Beneriie, L., and Feldman, S. (eds.), *Unequal Burden: Economic Crisis, Persistent Poverty and Women's Work*. Westview Press, Boulder.
- Agarwal, B. (1989). Women, land and ideology in India. In *Women, Poverty and Ideology in Asia: Contradictory Pressures, Uneasy Resolutions*. McMillan, Basingstoke.
- Argyris, C. (1976). Single-Loop and Double-Loop Models in Research on Decision Making. *Administrative Science Quarterly*, 21(3): 363-375.
- Arnold, J.E., & Dewees, P.A. (1999). Trees in Managed Landscapes: Factors in Farmer Decision Making. In *Agriculture in Sustainable Agricultural Systems*, pp. 277-294, L.E. Buck, J.P. Lassoie, E.C.M. Fernandes (eds.), CRC Press.
- Avelino, J., Willocquet, L., & Savary, S., (2004). Effects of crop management patterns on coffee rust epidemics. *Plant Pathology*, 53(5): 541-547.
- Avelino, J., Zelaya, H., Merlo, A., Pineda, A., Ordonez, M., & Savary, S. (2006) The intensity of a coffee rust epidemic is dependent on production situations. *Ecological Modelling*, 197(3-4): 431-447.
- Belch, G. E., Ceresino, G., & Belch, M.A. (1985). Parental and teenage child influences in family decision making. *Journal of Business Research*, 13(2): 163-176.
- Bokemeier, J.L. (1997). *Rediscovering Families and Households: Restructuring Rural Society*

- and Rural Sociology. *Rural Sociology*, 62(1): 1 – 20.
- Bolwig, S. (2012). Gender Effects of Smallholder Organic Contract Farming in Uganda. *Uganda Strategy Support Program, Working Paper No. 8.*
- Brennan, M.A. (2004b). *IFAS community development: Enhancing community through interaction.* University of Florida Extension.
- Brennan, M.A. (2005). *IFAS community development: The importance of local community in shaping development.* University of Florida Extension.
- Brennan, M., & Dodd, A., (2009). Exploring Citizen Involvement in the restoration of the Florida Everglades. *Society & Natural Resources*, 22(4): 324-338.
- Brennan, M.A., & Luloff, A.E. (2007). Exploring rural community agency differences in Ireland and Pennsylvania. *Journal of Rural Studies*, 23: 52-61.
- Bridger, J.C., Brennan, M.A., & Luloff, A.E. (2011). The interactional approach to community. In Robinson, Jr. & Green (Eds.), *Introduction to community development theory, practice, and service-learning* (pp. 85-100). Thousand Oaks, CA: SAGE Publications, Inc.
- Budowski, M., & Bixby, L.R. (2003). Fatherless Costa Rica: Child Acknowledgement and Support Among Lone Mothers. *Journal of Comparative Family Studies*, 34 (2): 229-254.
- Butterfield, R.P. (1994). Forestry in Costa Rica: status, research priorities, and the role of La Selva Biological Station. In McDade, L.A., Bawa, K.S., Hespdenheide, H.A., & Hartshorn, G.S. (eds.), *La Selva: ecology and natural history of a neotropical rainforest.* University of Chicago Press, Chicago. Pp. 317-328.
- Buvinic, M., & Gupta, G. (1997) Female-Headed Households and Female-Maintained Families: Are They Worth Targeting to Reduce Poverty in Developing Countries? *Economic Development and Cultural Change*, 45(2): 259-80.
- Cardoso, C.F.S. (1977). The formation of the coffee estate in nineteenth-century Costa Rica. In Deas, M., Smith, C.T. and Street, J. (Eds.), *Land Labour in Latin*

- America*. Cambridge University Press, Cambridge.
- Caswell, M., Mendez, V.E., & Bacon, C.M. (2012). *Food security and smallholder coffee Production: current issues and future directions*. Agroecology and Rural Livelihoods Group, University of Vermont, Burlington, Vermont, USA.
- Central America Overview. 19 April 2014. The World Bank. Accessed 16 January 2015. Online.
- Chipande, G. H. (1987). Innovation adoption among female-headed households. *Development and Change*, 18(2): 315-327.
- Costa Rica. CIA World Fact Book. Accessed 16 January 2015. Online.
- Costa Rica Overview. 19 April 2014. The World Bank. Accessed 16 January 2015. Online.
- Cole, S.M, van Koppen, B., Puskur, R., Estrada, N., DeClerck, F., Baidu-Forson, J., Remans, R., Mapedza, E., Longley, C., Muyaule, C., & Zulu, F. (2014). Collaborative Effort to Operationalize the Gender Transformative Approach in the Barotse Floodplain. Penang, Malaysia: CGIAR Research Program on Aquatic Agricultural Systems. Program Brief: AAS-2014-38.
- Creswell, J.W. (2009). *Quantitative & Qualitative Research*. Thousand Oaks, CA: Sage Publications Inc.
- Dams, T. & Hunt, K.E. (1976). Decision-Making and Agriculture. *Paper prepared for the 16th International Conference of Agricultural Economists*. Nairobi, Kenya.
- Denscombe, M. (2004). *The Good Research Guide for small scale social research projects* (2nd ed.). Berkshire: Open University Press.
- Dijksterhuis, A., & van Knippenberg, A. (1998). The Relation Between Perception and Behavior, or How to Win a Game of Trivial Pursuit. *Journal of Personality and Social Psychology*, 74 (4): 865-877.
- Dukes, S. (1984). Phenomenological methodology in the human sciences. *Journal of Religion and Health*, 23: 197-203.

- Eakin, H., Tucker, C., & Castellanos, E. (2006) The Coffee Crisis: A Pilot Study of Farmers' Adaptions in Mexico, Guatemala and Honduras. *The Geographical Journal*, 172: 156-171.
- Eakin, H., Winkels, A., & Sendzimir, J. (2009). Nested vulnerability: exploring cross-scale linkages and vulnerability teleconnections in Mexican and Vietnamese coffee systems. *Environmental Science & Policy*, 12(4): 398-412.
- Elmendorf, W., & Luloff, A.E. (2001). Using qualitative data collection methods when planning for community forests. *Journal of Arboriculture*, 27(3): 139-151.
- End Poverty 2015. (2015). End Poverty 2015 home page. *United Nations Millennium Campaign*. Retrieved from <http://endpoverty.2015.org>.
- Feder, G., Just, R.E., & Zilberman, D. (1985). Adoption of Agricultural Innovations in Developing Countries: A Survey. *Economic Development and Cultural Change*, 33(2): 255-298.
- Feder, G. & Umali, D. (1993) The Adoption of Agricultural Innovations: A Review. *Technological Forecasting and Social Change*, 43: 215-239.
- Fuglie, K.O., & Kascak, C.A. (2001). Adoption and Diffusion of Natural-Resource-Conserving Agricultural Technology. *Review of Agricultural Economics*, 23(2): 386-403.
- Ghadim, A.K.A. & Pannell, D. J. (1999). A Conceptual framework of adoption of an agricultural innovation. *Agricultural Economics*, 21: 145-154.
- Giorgi, A. (Ed.). (1985). *Phenomenology and psychological research*. Pittsburgh, PA: Duquesne University Press.
- Granovetter, M.S. (1973). The Strength of Weak Ties. *American Journal of Sociology*, 78(6): 1360-1380.
- Gray, D.E. (2014). *Doing Research in the Real World* (3rd ed.). Thousand Oaks, CA: Sage Publications Inc.
- Greiner, R., & Gregg, D. (2011). Farmers' intrinsic motivations, barriers to the adoption

- of conservation practices and effectiveness of policy instruments: Empirical evidence from northern Australia. *Land Use Policy*, 28: 257-265.
- Greiner, R., Patterson, L., & Miller, O. (2009). Motivations, risk perceptions and adoption of conservation practices by farmers. *Agricultural Systems*, 99: 86-104.
- Gudmundson, L. (1989). Peasant, Farmer, Proletarian: Class Formation in a Smallholder Coffee Economy, 1850-1950. *The Hispanic American Historical Review*, 69(2): 222-257.
- Hofferth, S.L. & Iceland, J. (1998). Social capital in rural and urban communities. *Rural Sociology*, 63(4): 574 – 598.
- Holden, S.T., & Binswanger, H. P. (1998). Small-farmer Decision making, Market imperfections, and Natural Resource Management in Developing Countries. In *Agriculture and the Environment: Perspectives on Sustainable Rural Development*, pp. 50-70, Lutz, E. (ed.), World Bank Publications.
- International Coffee Organization. (2014). Information retrieved from Trade Statistics via www.ico.org.
- ICO. (2009). The world economic crisis and the coffee sector. Report prepared for the International Coffee Organization, 9 February 2009. Report no. 2059.
- Jha, S., Bacon, C., Philpott, S., Rice, R., Mendez, V., & Laderach, P. (2011). A review of ecosystem services, farmer livelihoods, and value chains in shade coffee agroecosystems. 141-208 in B.W. Campbell and S. Lopez-Ortiz (Eds.) *Integrating agriculture, conservation, and ecotourism: examples from the field*. Springer Academic Publishers: New York & Berlin.
- Joshi, D. (2012). Review of Gender and Knowledge Management at IFAD: Operationalizing good intent: untangling the knowledge around gender. Rome, Italy: IFAD. 43 pages.
- Katz, E. (2003). “The changing role of women in the rural economics of Latin America.” In Benjamin D. (ed.), *Food, Agriculture and Rural Development: Current and*

- Emerging Issues for Economic Analysis and Policy Research – II. Vol. 1: Latin America and the Caribbean. FAO, Rome.
- Kaufman, H.F. (1959). Toward an interactional conception of community. *Social Forces*, 38(1), 8-17.
- Klein, G. A., Orasanu, J., Calderwood, R., & Zsombok, C. (1993). *Decision making in action: Models and methods*. Westport, CT: Ablex Publishing.
- Knowler, D., & Bradshaw, B. (2007). Farmers' adoption of conservation agriculture: A review and synthesis of recent research. *Food Policy*, 32: 25-48.
- Krannich, R. & Humphrey, C. (1986). Using key informant data in comparative community research: An empirical assessment. *Sociological Methods Res.*, 14: 473-493.
- Leonard, H.J. (1987). *Natural resources and economic development in Central America: a regional environmental profile*. International Institute for Environment and Development, Washington, D.C. Transaction Books, New Brunswick, NJ. 269 pages.
- Lichter, D. & Eggebeen, D. (1992). Child Poverty and the Changing Rural Family. *Rural Sociology*, 57(2): 151-172.
- Lichter, D., Cornwell, G. & Eggebeen, D. (1993). Harvesting Human Capital: Family Structure and Education Among Rural Youth. *Rural Sociology*, 58 (1): 53-75.
- Lindsey, B. (2003) Grounds for Complaints? Understanding the "Coffee Crisis". *Center for Trade Policy Studies, CATO Institute*.
- Little, J. (2006). *Gender and sexuality in rural communities*, In Handbook of Rural Studies. Cloke, P.J., Marsden, T. & Mooney, P. (eds). Thousand Oaks, CA: SAGE Publications, Inc.
- Mallen, P.R. (2014). *Coffee Rust Has Claimed \$1B in Losses and 250k Jobs in Central America, US Fears Increase of Migration*, International Business Times.
- Marra, M., Pannell, D. & Ghadim, A.A. (2003). The economics of risk, uncertainty and

- learning in the adoption of new agricultural technologies: where are we on the learning curve? *Agricultural Systems*, 75: 215-234.
- Monaco, L.C. (1977). Consequences of the Introduction of Coffee Rust into Brazil. *Annals of the New York Academy of Sciences*, 287(1): 57-71.
- Monthly Coffee Market Report. March 2013. International Coffee Organization.
Retrieved from: <http://dev.ico.org/documents/cy2012-13/cmr-0313-e.pdf>.
- Morse, J. M. (1994). *Designing funded qualitative research*. N.K. Denzin, & Y.S. Lincoln (Eds.). Thousand Oaks, CA: Sage Publications Inc.
- Moustakas, C. (1994). *Phenomenological research methods*. Thousand Oaks, CA: Northwestern University Press.
- Natanson, M. (Ed.). (1973). *Phenomenology and the social sciences*. Evanston, IL: Northwestern University Press.
- Newman, L. (2012). *Basics of Social Research: Qualitative and Quantitative Approaches* (3rd ed.). Upper Saddle River, NJ: Pearson Publishing.
- Nutman, F.J., Roberts, F.M., & Clarke, R.T. (1963). Studies on the biology of *Hemileia vastatrix*. *Berk. & Br. Transactions of the British Mycological Society*, 46(1): 27-44.
- OIRSA. (2000). *Manual Tecnico Buenas Practicas de Cultivo en Café Organico (para productores)*. Organismo International Regional de Sanidad Agropecuaria. San Salvador, El Salvador. 26 March 2015. Retrieved from: <http://www.oirsa.org/aplicaciones/subidoarchivos/bibliotecavirtual/manualcafeorganico.pdf>
- Olson, M.B., Morris, K.S., & Mendez, V.E. (2012). Cultivation of maize landraces by small-scale shade coffee farmers in western El Salvador. *Agricultural Systems*, 111: 63-74.
- Onwuegbuzie, A.J., & Leech, N. L. (2007). Sampling Designs in Qualitative Research: Making the Sampling Process More Public. *The Qualitative Report*, 12(2): 238-

254.

- Oppermann, M., & Chon, K.S. (1997). Convention participation decision-making process. *Annals of Tourism Research*, 24(1): 178-191.
- Ortiz, S. (1973). *Uncertainties in Peasant Farming: A Colombian Case*. Humanities Press, New York.
- Osorio, N. (2002) The Global Coffee Crisis: A Threat to Sustainable Development. *Presented at the World Summit on Sustainable Development, Johannesburg, 2002.*
- Patton, M.Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications Inc.
- Polkinghorne, D.E. (1989). Phenomenological research methods. In R.S. Valle & S. Halling (Eds.), *Existential-phenomenological perspectives in psychology* (p. 41-60). New York: Plenum.
- Ponte, S. (2001) Behind the Coffee Crisis. *Economic and Political Weekly*, 36: 4410-4417.
- Reinhardt, N. (1998). *Our Daily Bread: The Peasant Question and Family Farming in the Colombian Andes*. University of California Press, Berkeley.
- Rice, R. (2003) Coffee Production in a Time of Crisis: Social and Environmental Connections. *SAIS Review*, 23: 221-245.
- Rice, P. & McLean, J. Sustainable Coffee at the Crossroads. Paper prepared for Consumer's Choice Council, October 15, 1999.
- Rodriguez, J., Molnar, J., Fazio, R., Sydnor, E. & Lowe, M. (2008). Barriers to adoption of sustainable agriculture practices: Change agent perspectives. *Renewable Agriculture and Food Systems*, 24(1): 60-71.
- Rogers, E. (2004). A Prospective and Retrospective Look at the Diffusion Model. *Journal of Health Communication: International Perspectives*, 9: 13-19.
- Rogers, E. (2003). *Diffusion of Innovations*, 5th edition. New York: Free Press.

- Rogers, E. (1995). *Diffusion of Innovations*, 4th edition. New York: Free Press.
- Rose, G. (1997). Situating knowledges: positionality, reflexivities and other tactics. *Human Geography*, 21(3): 305-320.
- Ruben, R., & de Ruiter, A. (2002). Labor, Leisure and Household Income in Rural Settlements: An Empirical Assessment in the Atlantic Zone of Costa Rica. *Leisure Studies*, 21: 201-220.
- Ruttan, V. (1996). What Happened to Technology Adoption-Diffusion Research? *Sociologia Ruralis*, 36(1): 51-73.
- Saaty, T.L. (1990). How to make a decision: The Analytic Hierarchy Process. *European Journal of Operational Research*, 48: 9-26.
- Sachs, C. & Alston, M. (2010). Global Shifts, Sedimentations, and Imaginaries: An Introduction to the Special Issue on Women and Agriculture. *Signs*, 35(2): 277 – 287.
- Schalatek, L., & Burns, K. (2013). Operationalizing a Gender-Sensitive Approach in the Green Climate Fund. Karlsson, G., & Rojas, A. (Eds.). Prepared for the *United Nations Framework Convention on Climate Change*, Bonn, Germany. 43 pages.
- Schwartz, M., Bridger, J., & Hyman, D. (2001) A validity assessment of aggregation methods for multiple key informant survey. *Journal of Community Development and Society*, 32(2): 226-237.
- Sen, A.K. (1990). Gender and cooperative conflicts. In Tinker, I. (ed.), *Persistent Inequalities: Women and World Development*. Oxford University Press, New York.
- Sick, D. (1998). Property, Power, and the Political Economy of Farming Households in Costa Rica. *Human Ecology*, 26(2): 189-212.
- Smith, J.A. & Osborn, M. (2003). Interpretative phenomenological analysis. In J.A. Smith (Ed.), *Qualitative Psychology: A Practice Guide to Research Methods*. London: Sage.

- Stephenson, G. (2003). The Somewhat Flawed Theoretical Foundation of the Extension Service. *Journal of Extension*, 41 (4).
- Stewart, D., & Mickunas, A. (1990). *Exploring phenomenology: A guide to the field and its literature* (2nd ed.). Athens: Ohio University Press.
- Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks, CA: Sage Publications Inc.
- Tornatzky, L.G. & Klein, K.J. (1982). Innovation Characteristics and Innovation Adoption-Implementation: A Meta-Analysis of Findings. *IEEE Transactions on Engineering Management*, 29 (1): 28-43.
- Uphoff, N. (1998). Community-based natural resource management: connecting micro and macro processes, and people with their environments. *Plenary presentation, International CBNRM Workshop*. Washington, DC.
- UN General Assembly. (2000). *United Nations Millennium declaration, Resolution Adopted by the General Assembly, 18 September 2000, A/RES/55/2*. Available at: <http://www.un.org/millennium/declaration/ares552e.pdf>.
- Utting, P. (1991). *The social origins and impact of deforestation in Central America*. United Nations Research Institute for Social Development. Geneva, Switzerland. 43 pages.
- Van de Fliert, E., Tien Dung, N., Henriksen, O., & Tang Salsgaard, J.P. (2007). From Collectives to Collective Decision-making and Action: Farmer Field Schools in Vietnam. *Journal of Agricultural Education and Extension*, 13(3): 245-256.
- van Manen, M. (1990). *Researching lived experience: Human science for an action sensitive pedagogy*. Albany: State University of New York Press.
- Varangis, P., Lewin, B., & Giovannucci, D. (2002) Central America, Dealing with the Coffee Crisis – Impacts and Strategies. *World Bank, Policy Research Working Paper No. 2993*.
- Vroom, V.H. & Jago, A.G. (1974). Decision Making as a Social Process. *Decision*

Sciences, 5: 743-755.

- Walpole, M., Smith, J., Rosser, A. Brown, C., Schulte-Herbruggen, B., Booth, H., Sassen, M., Mapendembe, A., Fancourt, M., Bieri, M., Glaser, S., Corrigan, C., Narloch, U., Runsten, L., Jenkins, M., Gomera, M., & Hutton, J. (2013) Smallholders, Food Security, and the Environment. Document prepared by the United Nations Environment Program's World Conservation Monitoring Centre for the International Fund for Agricultural Development. 53 pgs.
- Wilkinson, K. P. (1991). *The community in rural America*. New York, NY: Greenwood Press.
- Wilkinson, K.P. (1972). A field-theory perspective for community development research. *Rural Sociology*, 37(1): 43-52.
- Wilkinson, K.P. (1970). The community as a social field. *Social Forces*, 48(3): 311-322.
- Yin, R. (2009). *Case study research: Design and Methods* (4th ed.). Thousand Oaks, CA: Sage Publications Inc.
- Yitzhaki, S. (1979). Relative deprivation and the Gini coefficient. *The Quarterly Journal of Economics*, 93 (2): 321-324.
- Zhang, H.Q., Leung, V., & Qu, H. (2007). A refined model of factors affecting convention participation decision-making. *Tourism Management*, 28 (4): 1123-1127.
- Ziervogel, G. (2004). Targeting seasonal climate forecasts for integration into household level decisions: the case of smallholder farmers in Lesotho. *The Geographical Journal*, 170(1): 6-21.
- Zoomers, A. (2006). Three Decades of Rural Development Projects in Asia, Latin America, and Africa: Learning from Successes and Failures. *United Nations University – World Institute for Development Economics Research*. Research Paper No. 2006/33. 27 pages.

Appendix A: Key Informant Protocol

Turrialba, Costa Rica 2015

PI: Sarah Eissler

MS Candidate in Rural Sociology and International Agriculture and Development

Introduction: Buenos dias! My name is Sarah Eissler and I am a student at Penn State University. I wanted to talk to you today about your coffee farm, your experiences growing coffee and your community as part of my research for my masters thesis. The purpose of my research is to better understand why and how farmers decide to change practices or adopt new innovations on their farm. Since you grow coffee as a smallholder, I wanted to ask you questions about your farm, how you grow your coffee and more importantly, how you make decisions to change a practice or adopt a new technique on your farm. This interview should take no longer than one hour.

If you or a local organization is interested, the results of this research can be provided.

Is it OK with you if I record our conversation today?

If you have any questions, please don't hesitate to ask me. Do you have any questions before we begin?

Farmer & Farming system: context

1. Can you tell me about your history growing coffee...
 - a. How long have you been growing coffee?
 - b. Where did you learn how to grow coffee?
 - c. Why do you grow coffee?
 - d. How important is coffee to your farm? To you and your family?

2. Can you tell me about your household?
 - a. Spouse? What do they do? Level of education?
 - b. Kids? How many? Ages? What do they do? Level of education?
 - c. What are your primary sources of income?
 - d. What family members are involved in coffee harvesting?

3. Can you tell me about your farm here?
 - a. What type of shade do you use?
 - i. Have you always used this type of shade? If not, what was it before and when/why was it switched?
 - ii. If multiple crops/sources of income, why these?
 - b. How many hectares is the total farm? How many hectares are for coffee?

4. I know coffee plantation management schedules are varied throughout the year, depending on the season. But what are the most common activities you do on your coffee plantation?
 - a. Can you explain the importance/purpose that task
 - b. Who does what tasks and why do they do it?
 - i. What do the other members of your family do?
 - ii. If non-family members mentioned, how long have they been working for you? / who are they?
5. What inputs are necessary for your farm?
 - a. Where do you get your seedlings / fertilizer / tools?
 - b. Do you receive any education/training for coffee production? If so, where do you get education/training on coffee production?
 - c. Are there any types of technologies or tools that you would like to use on your farm that you don't?
 - i. If asked for an example...organic inputs, agrochemicals, and certain type of shade tree, machinery or equipment?
 - ii. Why don't you use these?
 - iii. What would enable you to use these?
6. To whom do you sell your coffee cherries?
 - a. Have you ever experienced difficulty in selling your coffee?
7. When you have problems on your farm, what do you do/to whom do you go for help/information/support?
 - a. Why them?
 - b. How are they supportive?
 - c. Can you give an example of a recent challenge you experienced – what did you do?

Innovations

8. My research is focusing on adopting innovations. I define “innovation” as any new practice, tool, technique or change you made in how you harvest your coffee.

In the past 5 years, have you changed any of your farming practices with coffee or adopted a new technique or tool to use on the farm?

- a. Approximately how many? Which ones? {If multiple, pick 1 to discuss with following questions...}
- b. How did you hear about this innovation?
- c. What had you used/done before adopting this innovation?
- d. How did it change from what you were doing before?
- e. How were you taught to use this innovation?
- f. Why did you change/start using this new technique?
- g. How has it worked out since you started using this technique? Good? Bad?

- h. Why wouldn't someone use this technique?
 - i. Do you know of anyone who rejected this?
 - i. Have you told anyone else about this?
 - i. Has anyone else started using this new technique? Who?
9. Who makes the decision to change a technique or practice?
- a. How much influence does your wife have on the farm?
 - b. Your sons/daughters/children?
 - c. Nonfamily workers?
10. Do you work with extension agents?
- a. What has been your experience working with them?
 - i. Ask to elaborate... positives / negatives

Community Engagement

11. Now I would like to talk about your community. Can you describe who/what you consider to be your community?
- a. How often do you interact with these members?
 - b. In what capacity?
 - c. How do you support each other?
12. Are you a part of a coffee co-op? If so, which one?
- a. What are the benefits/challenges in being in a co-op?
 - b. What is it like being a part of a co-op?
 - c. Why did you join the co-op?
13. Other than being in a co-op, do you participate in any community activities that involve coffee or coffee production? Which ones?
- a. How were these activities started? Who is involved in them?
 - b. How does the community support coffee production?
 - c. Do restaurants buy the coffee? If so who?
14. How is coffee important to the local community? To what extent is coffee important here?
- a. Are there any secondary businesses made from coffee production?
 - i. [For example, value added products made locally, mills, secondary processing, locally sourced coffee, agro-coffee tourism] Can you tell me about them?
 - b. How much of the coffee produced here is exported? How much is sold locally?
15. How important is it to you to socialize/interact/engage with other community members?
- a. Do you feel like you have a strong tie to your community? [Why/why not]
 - b. Do you feel like there is a strong sense of community here? [why/why not]

Conclusion

1. Do you have anything else you'd like to share with me? Questions?
2. I'll be going over these later, if I have any questions would be okay if I come talk to you again?
3. Can you think of anyone else that grows coffee that I should talk to?

Thank you so much for your time!

Appendix B: IRB Approval

PENNSTATE



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EXEMPTION DETERMINATION

Date: February 11, 2015

From: Tracie Kahler, IRB Analyst

To: Sarah Eissler

Type of Submission:	Initial Study
Title of Study:	Understanding Diffusion of Innovations with Smallholder Coffee Farmers in Costa Rica
Principal Investigator:	Sarah Eissler
Study ID:	STUDY00001865
Submission ID:	STUDY00001865
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Documents Approved:	<ul style="list-style-type: none">• Demographic Questions (0.01), Category: Data Collection Instrument• Protocol (2/09/2015), Category: IRB Protocol• KI_Questionnaire_CR.docx (0.01), Category: Data Collection Instrument• Grant Proposal (0.01), Category: Sponsor Attachment

The Office for Research Protections determined that the proposed activity, as described in the above-referenced submission, does not require formal IRB review because the research met the criteria for exempt research according to the policies of this institution and the provisions of applicable federal regulations.

Continuing Progress Reports are **not** required for exempt research. Record of this research determined to be exempt will be maintained for five years from the date of this notification. If your research will continue beyond five years, please contact the Office for Research Protections closer to the determination end date.

Changes to exempt research only need to be submitted to the Office for Research Protections in limited circumstances described in the below-referenced Investigator Manual. If changes are being considered and there are questions about whether IRB review is needed, please contact the Office for Research Protections.

Penn State researchers are required to follow the requirements listed in the Investigator Manual ([HRP-103](#)), which can be found by navigating to the IRB Library within CATS IRB (<http://irb.psu.edu>).

This correspondence should be maintained with your records.

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