

Risk Management and Perception of Coffee Growers

By

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Dedication

I specially dedicate this dissertation to Colombian coffee producing families, particularly all those coffee growers who dedicated their time to participate voluntarily and decidedly in supplying information. Also to my wife Nancy Liliana and my children María Paula and Juan Daniel, who constituted very important support through these years of dedication and effort to reach this new achievement in my professional life.



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Abstract

The current research studied the relationship between risk management by the institutions underlying the Colombian coffee sector and risk perceptions held by Colombian coffee growers from a neo-institutional approach, in order to explain the risk perceptions and individual behaviors of coffee growers and establishing the effect of institutions on risk perception and management of Colombian coffee growers. The research was performed through an explanatory study with a sequential mixed approach, formed by two phases: (a) a qualitative phase characterized by elaboration of taxonomies on the risks Colombian coffee growers are vulnerable to, and on risk management instruments offered by institutions, creating a coffee grower's profile, sociodemographic features and exploitation scale; and (b) a quantitative stage that developed a Structural Equation Model (SEM), through which the existing relationship between risk management offered by Colombian coffee sector institutions and risk perceptions of Colombian coffee growers was empirically evaluated, by studying risk perceptions from past experiences and the way coffee growers deal with the risk associated to situations they must face, risk attitudes and management strategies.

The study concluded that the set of risk management instruments offered by the institutions underlying the coffee sector lower risk exposure of Colombian coffee growers, and also determine their risk management strategies. In addition, the current study showed that adjusting the extended model proposed by Sitkin and Pablo (1992) showed its capacity to capture the relationships observed in the context of the Colombian coffee grower. Finally, the institutions underlying the coffee sectors affect risk perceptions of opportunity or threat situations faced by coffee growers; it is also validated through the existing relationship between the constructs.

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Chapter 1: Introduction

Given the social and economic importance associated to coffee production in Colombia, multiple studies addressing the subject from multiple economic and political perspectives have been developed; however, these works have not been centered on the risk coffee growers are exposed to, nor the possible effects institutions have on the way coffee growers perceive and deal with these risks (González & Gutiérrez, 2012; Guhl, 2008; Junguito & Pizano, 1993, 1997; Ramírez, Silva, Valenzuela, Villegas, & Villegas, 2002). The concept of coffee sector institutions comprises the interaction of organizational figures, such as: federations, associations, cooperatives, among others; as well as government and sector policies, action models and business rules regulating institution. According to Silva (2004), the set of institutions on which the coffee model is developed include social capital, in which both coffee growers and government are involved.

These organizational forms and rules determine the collaboration strategy in the sector but, in turn, can lead to collective action problems. According to Olson (1992) the particular interests of each individual prevent the sudden emergence of rational social results. Therefore, only certain institutions may promote collectively efficient outcomes in a Pareto optimal sense (Olson, 1992).

Also, it is possible to state that risk occurs when an individual faces an unknown situation, which impedes taking a sound decision; that is, when it acts based on incomplete information. In that sense, (Beck, 1998; Luhmann, 1998) defined risk as a modern element and a complex form for describing the uncertain environment, for which they developed a conceptual arrangement that allows social perception on threats and damage to nature.

Meanwhile, Harwood, Heifner, Coble, Perry, and Somwaru (1999) stated that risk is understood as the possibility of loss or adversity to which farmers are exposed. Following this, they developed a classification on risks: (a) production risk, (b) market price risk, (c)

financial risk, (d) contractual risk, (e) institutional risk, and (f) human risk. In that sense, Bielza (2004) included the “market risk” category, measured through contractual arrangements within the institutions of the sector, which might be affected by financial and environmental conditions considered to be potential fields of study for future research.

According to the above, the current study established that risk management through instruments offered by coffee sector institutions and risk perceptions of coffee growers show a significant relationship, and that institutions are fundamental for risk management and reducing risk perceptions among Colombian coffee growers. It represents a model that could be replicated in other sectors with similar features, sensitive to external shocks of a similar nature.

Background of the Problem

Uncertainty on prices and production levels of commodities increases vulnerability among small farmers in the world, leading to the decisions these producers take on how and what to grow to be subject to a higher risk (Antwi-Agyei, Peasey, Biran, Bruce, & Ensink, 2016). Populations with limited income observe how their purchasing power decreases and inequalities widen (Estrada, Gay, & Conde, 2012). For example, the lowest real external price for coffee in 180 years was registered in 2001. However, unlike past decades, the behavior of the coffee business did not cause a macroeconomic impact of great magnitude (Arango, Hernández, Ortiz, Perfetti del Corral, & Velásquez 2002). Likewise, the decline in coffee production between 2009 and 2012, together with lower international prices for this product, provoked the crisis faced by the coffee sector in Colombia in 2013; which led to the coffee strike (Federación Nacional de Cafeteros [Colombian Coffee Growers Federation] (FNC), 2013), and exposed the structural problems affecting the sector after the rupture of the International Coffee Agreement in 1989 (Fonseca, 2003).

Coffee is a product originally from Africa, specifically Ethiopia; Arabica variety (*Coffea arabica*) (Sadeghian, 2013) and the Atlantic region; Robusta variety (*Coffea canephora*) (International Coffee Organization [ICO], 2013), which as of today is widely cultivated in the African, Asian and Latin American tropics, where most of the worldwide coffee production is obtained. Production is concentrated in countries like Brazil, Colombia, Mexico, Vietnam and Indonesia (ICO, 2013). Coffee production is divided into 4 main groups according to their quality: (a) Colombian mild Arabica, (b) other mild Arabica, (c) Brazilian Arabica and other natural Arabica, and (d) Robusta.

According to Ramírez et al. (2002), coffee has a meaning beyond an agricultural export product, representing above all a social, cultural, institutional and political fabric that served as the basis for the democratic stability and national integration. Its impact reaches both social and economic ambits beyond coffee regions, and it stands out as a great demand creator over the other economic sectors, which turn the coffee social network into a strategic asset for national development.

Small farmers have been identified as a population that despite their knowledge on the land, the weather, soils and understanding the needs of the coffee plants, can be particularly vulnerable to different risks such as climate change, political - economic processes, market fluctuations and global economic changes. It must be noted that the impact of economic volatility is more harshly felt among the peasants and small farmers around the globe (Eakin, Tucker & Castellanos, 2006; Tucker, Eakin & Castellanos, 2010). Due to its importance in Colombian economic life and the vulnerability of coffee growers, the coffee sector and its institutions have been studied from multiple approaches, as a solid structure able to be replicated to all agricultural sectors worldwide (Eakin et al., 2006; Tucker et al., 2010), where it has been characterized by being composed mainly of small producers rooted in their livelihoods, with the capacity to support themselves and their

families on smallholdings, thus experiencing limited living conditions unimproved by trade (Cleland, 2010).

In turn, Guhl (2008) performed a study on the change in the landscape of the coffee-growing region during the 80s, 90s and the noughties, in which it was stated that the economic importance of coffee has been subject to studies from political and economic perspectives. However, there is little research on the social and environmental impacts of coffee production.

In Colombia, the sector is founded on a network of approximately 527 thousand smallholding coffee growers, who dedicate themselves to the collection, wet and dry processes using an artisanal process backing up the quality recognized for Colombian coffee around the globe. Around 94% of coffee growers possess less than five hectares of land, 92% of coffee growers inhabit remote rural zones and 46% of these belong to the socio-economic strata 1 and 2 (Muñoz, 2006), a situation that makes them more vulnerable to fluctuations at international markets. The former occurs despite the fact that, unlike other countries with the same characteristics, Colombian producers are organized in the FNC, which has represented them as an institution over 80 years, mitigating risk and vulnerability of coffee growers through its actions (Heshusius, 2010).

Multiple coffee varieties are produced throughout the world by different countries, with Table 1 showing coffee bean producing countries, as well as the quality and typing these are based upon. The average Colombian coffee grower is usually a small-scale producer, relying on scarce resources, limited land and makes a living out of the family business, in which the land is the support for their incomes, their working place and scenario for coexistence where home is located, and the source from which family food is obtained. Most coffee growers are older adults averaging 58 years old and a low average of schooling at 3.7 years. This puts in evidence the importance of a generational takeover in

order to ensure the sustainability of the Colombian coffee sector (Heshusius, 2010).

Table 1

Coffee producing countries classified by ICO quality group

Quality/Variety	Producing countries
Colombian mild Arabica	Colombia, Kenya, Tanzania.
Other mild Arabica	Bolivia, Burundi, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, India, Jamaica, Malawi, Mexico, Nicaragua, Panama, Papua New Guinea, Peru, Rwanda, Venezuela, Zambia, Zimbabwe.
Brazilian Arabica and other natural Arabica	Brazil, Ethiopia, Paraguay.
Robusta	Angola, Benin, Cameroon, Central African Republic, Congo, Côte d'Ivoire, Democratic Republic of Congo, Equatorial Guinea, Gabon, Ghana, Indonesia, Liberia, Madagascar, Nigeria, the Philippines, Sierra Leone, Sri Lanka, Thailand, Togo, Trinidad and Tobago, Uganda, Vietnam

Note. Adapted from “La guía del café, 2013. Países productores de café según el grupo de calidad de la OIC,” por La Guía del Café, 2013. Retrieved from <http://www.laguiaedelcafe.org/guia-del-cafe/el-comercio-mundial-del-cafe/Paises-productores-de-cafe-segun-el-Grupo-de-Calidad-de-la-OIC/>.

The coffee sector is vulnerable to climate change and its commodity nature leaves it highly exposed to volatility in international prices. In this sense, Amador et al. (2012) explained how financial factors have also contributed to the increase in food prices, and how expansionary monetary policies, adopted by developed countries as a countercyclical tool, generate the incentives for speculation in financial derivatives and future investments, which act as a refuge for investors in times of high uncertainty.

At the coffee sector, studies have focused primarily on productive behavior, industry development, as well as the problem represented by the crisis. This is how Pérez (1987) conducted a historical analysis since the beginning of the Colombian coffee industry, including the history behind constitution of the FNC, the conciliation between the coffee guild and the national government, and the creation of the Fondo Nacional del Café [National Coffee Fund] (FoNC).

Colombia has created institutions dedicated to strengthening the production and defending the sector, one of these being the FNC, which is one of the oldest private institutions on Earth, possessing an efficient institutional structure that looks after the welfare of federated coffee growers. It was founded on the coffee growers' initiative supported by the government of Marco Fidel Suárez in 1927, through the Act 76 of 1927, which created its legal personhood as a private non-profit organization with the objective of defending the Colombian coffee industry and its guild interests (Kalmanovitz & López 2002a, 2002b; Junguito & Pizano, 1993, 1997). Its main economic role consists of managing the FoNC, established in 1940 with contributions originated from two taxes specifically created for this purpose in order to gather the resources needed to smooth fluctuations in international prices.

The FoNC holds the following responsibilities: (a) intervening on the national coffee market in order to promote Colombian coffee consumption, regulate the coffee supply and demand and seek a stable regime for domestic prices; (b) use its resources for compliance of international agreements signed by the State; and (c) promote and fund scientific research, expansion, diversification, education, health, cooperativism and social welfare programs, among others, designed to favor the development, strengthening and protection for farming families (Fisher & Gravelet, 2013).

Junguito and Pizano (1993, 1997) analyzed coffee policy instruments and international coffee trade in the country, contributing with evidence to define production policy during the nineties and recommendations on the commercial policy management during both commodity booms and slumps. Ramírez et al. (2002) conducted an analysis on the industry and its organization, making several proposals to address the crisis such as financing of technical assistance programs and budget additions. Meanwhile, González and Gutiérrez (2012) analyzed the Colombian and Vietnamese markets, concluding that even

though both countries produce different types of coffee, both have implemented various strategies in order to become more competitive at national and international markets through product differentiation. These differences open an explicit space for cooperation between both countries in an international environment where strong competition is the norm (González & Gutiérrez, 2012).

Parting from the risk management offered by coffee sector institutions through instruments and the risk perceptions of Colombian coffee growers, who face risks of a magnitude greater than they could manage by themselves, thus making them vulnerable in a high volatility environment (FNC, 2013), the current research proposed that the institutions underlying the coffee sector have a positive effect on the daily lives of coffee growers, by representing their needs and managing their risks through multiple hedge instruments readily available, among which it is possible to find scientific research, purchase guarantees and guild promotion and representation.

The end of the International Coffee Agreement and its quota agreements in 1989 heralded a transformation of international coffee bean markets through the entry of new competitors and varieties (Sanz, Mejía, García, Torres, & Calderón, 2012). These events triggered a process of adjustment during the 1990s, which led to an average annual growth rate of only 2.2% for Colombian agriculture between 1990 and 2003, lower than the region (3%), and below successful countries such as Chile (4.8%), Paraguay (4.2%), Nicaragua (3.6%), Ecuador (3.6%), and Argentina (3.5%), among others (Echavarría, Esguerra, McAllister, & Robayo, 2014). Throughout this period, global market share for Colombian coffee bean exports decreased from approximately 15.5% to less than 10% in 2013.

Coffee production endured significant productivity losses in the early 1990s, and years after the Colombian economic opening were accompanied by an increase in the productivity of the land that remained under cultivation, but this process was followed by

virtual yield stagnation since the late 1990s. But even more so after the 2008 crisis, due to the surge of plant diseases and plagues on coffee plantations in the late 2000s. Such event spurred the renewal, since 2008, of plantations toward transition varieties resistant to rust, which boosted the number of hectares sown and led to increased production in 2013, thus showing a recovery in the sector.

Thus, the coffee plantation area increased between 2006 and 2011, from 873,500 hectares in 2006 to 914,400 hectares in 2010, and 921,100 in 2011 (Sanz et al., 2012). Also, while 48% of the cultivated area was concentrated in high-productivity areas inside the main coffee-growing departments (Antioquia, Caldas, Risaralda, Quindio, Valle) during the 1990s, the productive structure of the coffee sector was very different in 2014. Not only there was a redistribution of the production between different regions of the country, but also the average coffee-cultivated area was reduced and concentrated in small-scale coffee farms (Echavarría et al., 2014).

In terms of global exports, after having supplied more than a fifth of these between 1960 and 1980, Colombian coffee global market share reached 6.8% in 2008, decreasing to 6.3% in the period 2010-2011, when exports totaled 103.2 million (See Appendix I). Currently, Colombia is the third largest exporter in the world behind Brazil and Vietnam, although it is still the leading soft coffee producer (Sanz et al., 2012). In 2002, Colombia exported 200,000 bags of specialty coffees; this number rose to 700,000 bags in 2006, and exports of this kind of coffee bean remained close to one million bags between 2007 and 2011. Of the exports made directly by the FNC, which represent from 25% to 30% of total exports, 30% involved specialty coffees (Sanz et al., 2012).

On competitiveness, there were strong dynamics and increased volatility in global markets during the last twenty-five years, due to the accelerated growth of emerging countries and, in the case of coffee, also by the greater freedom that entailed the breakup of

the International Coffee Agreement and the emergence of new products (Echavarría et al., 2014) (See Appendix I). This made it difficult for coffee growers to respond to this new international reality. And since Colombia kept losing global export market share since the mid-1990s, domestic coffee consumption remained constant while market conditions displayed increases in both price levels and volatility; at the international level, due to increased production of countries such as Vietnam and Brazil, Robusta variety consumption has increased dramatically in detriment of Arabica variety consumption, which led to the development and consolidation of a market for specialty coffees that represents approximately 20% of global demand today (Ocampo, 2015).

In turn, the balance of the Colombian coffee sector in the social aspect during the last 25 years showed that the percentage of people living in poverty is higher in non-coffee farms (37.1%) than in coffee regions (29, 9%), but still higher than indicators for capitals and metropolitan areas (14.8%) (Echavarría et al., 2014). Regarding social security, Echavarría et al. (2014) identified that coverage in the coffee sector is high for health services, but very low in retirement savings. Accordingly, 85.8% of the coffee sector participants were enrolled to the social security system in 2013. In turn, among the enrollees, 69% were under the subsidized regime (See Appendix I). On the other hand, only 2% of coffee workers were enrolled in retirement saving schemes in 2012, the lowest participation for all economic sectors, as it reached 11.5% for other agricultural crops, and surpassing 35% for industry and services. Therefore, it could be stated that informality predominates in the coffee sector, which leads to low living standards for coffee growers, increasing labor risk and creating a barrier to enter international markets.

By 2013, the coffee sector faced a third crisis within the context of a wider agricultural sector crisis in Colombia. The dynamics of Colombian exports of agricultural products declined. In addition, it was found that in large areas of the national territory

suitable for cultivation, thousands of hectares were used for livestock. Thus, Colombian agriculture could not remain isolated from international competition and great global technological changes, and public spending on agriculture remained at levels that ranged between 1.5% and 2% of the national total, contrary to what happens in Colombia. Costa Rica, Nicaragua, Uruguay or Brazil, Colombia had a negative impact on long-term productivity. Spending on science and technology in the sector is proportionately much lower than in other Latin American countries (Ocampo, 2015). Among other causes, climate change had a negative impact on crop productivity, with events such as “La Niña” phenomenon, whose frequency has increased, promoting the spread of plagues and diseases and preventing adequate flowering of coffee trees. These disturbances are added to the causes of the lower production that coffee growers faced to finance the increase in the prices of fertilizers and pesticides, induced by the high international oil prices between 2012 and 2013 (Ocampo, 2015).

Meanwhile, the main challenge for the Colombian coffee sector in environmental issues consisted of incorporating Good Agricultural Practices (GPA) into the production processes of small, medium and large coffee growers in a timely, efficient and effective way, for these practices to have a positive impact on the soil (Echavarría et al., 2014). For this, the strengthening of Cenicafé and the Extension Services guarantee the effective implementation of strategies derived from generated knowledge. During the last decade, Cenicafé has led major initiatives on issues related to climate change, biodiversity and the availability of water and soils. However, there are large areas of research that need to be studied in order to deliver concrete solutions for the future sustainability of coffee production, which are currently unaddressed by this or another research institute and require a budget (Ocampo, 2015).

The institutional structure of the Colombian coffee sector is based on institutional agreements, which made it unique and an example to be followed throughout the world. The current coffee institutions originated partly from the union organization created in 1927, and partly from the commitments made by the country during its participation in the International Coffee Agreement (1940-1989). These institutional arrangements were useful to ensure a reliable and permanent supply of quality coffee in international markets, as well as for managing the surpluses derived from supply restriction pacts. Throughout most of the 20th century and the 21st century, the FNC continued to leverage its strength in research and technical assistance, its network of cooperatives, management and advertising in international markets; but it has not fully adapted its decision-making structures to the strong changes in the global coffee market and internal geographical distribution for production (Echavarría, et al., 2014).

Statement of the Problem

According to De Schutter (2010), there are periods of high commodity prices and volatility, usually followed by periods of relatively low and stable prices. However, persisting volatility and price levels during the first fifteen years of the 21st century have created a growing concern on their effects on production and coffee grower profitability. In this sense, Junguito and Pizano (1993) stated that commodity producing countries should adopt instruments to manage the risk inherent to price volatility. The same was proposed by Comisión de Ajuste de la Institucionalidad Cafetera [Coffee Institutional Adjustment Commission], formed by representatives from the Colombian government, the coffee sector and the national economy who, after analyzing the economic performance of the sector, concluded that the latest crises affecting the global coffee industry have been undoubtedly the most critical ever recorded in decades; which has damaged Colombian coffee growers

and those located in other developing countries (Ramírez et al., 2002).

González and Gutiérrez (2012) identified the links and dynamics at value chains developed in the coffee industries of Colombia and Vietnam in order to improve competitiveness, increase sustainability and respond to market demands. The authors showed that global coffee consumption is highly sensitive to available income in consumer countries. Also, Harwood et al. (1999) suggested that farmers are exposed to multiple risks, considered to be extensive and common to coffee growers around the world. Samper and Topik (2012) established that the growth in the coffee industry is critical for economic development in Latin America; however, it looks like coffee is still a survival crop for most of the small coffee growers, given the negative impact of trends and fluctuations in international trade.

Amador, Caicedo, Cano, Tique, and Vallejo (2012) declared that in order to address the efficiency and profitability problems of coffee, some elements must be incorporated, such as: research, technical management of the plantation, promotion of associations, training, improvements in working conditions, and association of stakeholders, as well as guaranteeing a minimum income for coffee growing families. To achieve this, the authors proposed stipulating, at least partially, domestic prices of sustaining and purchase guarantees obtainable through hedging and forward sales. This way, the farmer would be protected from sudden falls in international prices and from shocks associated to the exchange rate or climatic disturbances.

Due to the high sensibility of Colombian coffee growers and the social fabric created around coffee, it was important to establish the role played by the institutions underlying the coffee sector on risk management for coffee growers, and its relationship with the latter's risk perceptions, whose findings were able to be replicated in other sectors in similar conditions and low competitiveness, with reduced transfer costs.

Purpose of the Study

The main goal in this research consisted relationship between risk management by the institutions underlying the Colombian coffee sector and risk perceptions held by Colombian coffee growers from a neo-institutional approach. For this, a Structural Equation Model (SEM) was employed, following the latent construct design methodology of the model proposed by Sitkin and Weingart (1995). The global coffee sector, unlike others in agriculture, is mainly made up of small farmers, who are in turn completely dependent on coffee growth for sustenance (Castellanos et al., 2013). In Colombia, the small size of coffee farms exposes producers to different types of risk (market, interest rate, contractual, financial, etc.), besides being vulnerable to climate change and natural disasters. According to Ashan (2001), risk perceptions of farmers and their risk management strategies still receive little attention in agricultural research, while such vulnerability and risk faced by coffee growers has required the intervention of institutions offering instruments intended to mitigate and lower the risks to which they are exposed (Lozano, 2011). Carlton et al. (2016) suggested that policy design and the creation of institutions from this increase on risk perceptions must motivate actions on climate change and thus reduce vulnerability to risk.

Significance of the Problem

The current study allowed to establish if there was a significant relationship between risk management by the institutions underlying the Colombian coffee sector and risk perceptions held by Colombian coffee growers from a neo-institutional approach, in order to explain the risk perceptions and individual behaviors of coffee growers and establishing the effect of institutions on risk perception and management of Colombian coffee growers. A significant relationship was found between risk perception from past experiences, risk perceptions on situations coffee growers must face, and management

strategies adopted by coffee growers. This proved that institutions reduce risk perceptions and contribute to manage risks faced by coffee growers, as proposed by Fisher and Gravelet (2013); Garret, Lambin, and Naylor, (2013) and Ingenbleek and Reinders (2013). The existing correspondence between the inventory of risks and a variety of instruments offered by institutions to coffee growers was also evidenced, thus proving that for each type of risk perceived by the Colombian coffee grower, there is an associated risk management instrument offered by institutions, thus expanding upon the proposals of Fisher and Gravelet (2013) and Garret et al. (2013), who described the importance of institutions on risk management.

Also, the study concluded that 94% of coffee growers are small farmers who see coffee production as their sustenance activity, which means that the risks these small-scale coffee growers are exposed to hold a greater magnitude than the one these coffee growers are able to face on their own, thus needing institutions to lower their vulnerability, as exposed by Castellanos et al. (2013), Eakin et al. (2006), and Tucker et al. (2010). These results are consistent with those of Sitkin and Pablo (1992) and Sitkin and Weingart (1995), who found that past situations are related to risk propensity and the scenarios near the problem are related with risk perceptions. Thus, coffee growers that faced less favorable conditions are more likely to perceive risks, while those who have adopted risk management strategies that led to favorable results perceive less risks.

Nature of the Study

The current study showed a sequential mixed approach, comprising both a qualitative stage of explanatory, non-experimental and cross-sectional nature, and a quantitative stage of descriptive, non-experimental and cross-sectional nature; these allowed identifying a significant relationship between risk management instruments offered by the institutions underlying the coffee sector and risk perceptions of Colombian coffee

growers. The selected approach intended to identify the existing relationship between risk management offered by institutions and perceptions on the risks coffee growers are vulnerable to, in order to explain the individual risk perceptions and behaviors of coffee growers while outlining the effect of institutions on risk perception and management of Colombian coffee growers.

First, taxonomies for the risks identified in literature (Bielza, 2004; Tucker et al., 2010) were created, being validated through a panel of experts (Skjong & Wentworth, 2000; de Arquer, 1995). Through these, the inventory of risks to which Colombian coffee growers are exposed was identified, while taking into account the fact that most Colombian coffee growers are small-scale farmers, also identifying the inventory of risk management instruments offered by Colombian coffee institutions, from which taxonomies on risks, institutions and instruments were elaborated. Using the taxonomies as an input, a survey was designed and deployed, following Tucker, Eakin and Castellanos (2010), thus finishing the qualitative stage.

From the results of the previous stage, the quantitative stage was implemented through SEM, through the analysis of the relationships between the sets of indicators or observed variables, and one or more latent variables or factors. The estimated SEM was built following the latent construct design methodology followed by Sitkin and Weingart (1995), from which the existing relationship between risk management offered by coffee sector institutions through their instruments and the risk perceptions of coffee growers was empirically assessed, while also assessing risk perceptions from past experiences and the way coffee growers face risk on situations they must deal with, their risk attitudes and management strategies. The study showed that the set of risk management instruments offered by the institutions underlying the Colombian coffee sector reduced risk perceptions of coffee growers and determined their investment strategies, while also validating the

results of the taxonomies through the correlation of maximum likelihood estimators (Kanooni, 2009; López, Pérez, & Ramos, 2011; Sharpe, 2010; Won, 2010).

Research Questions

The research questions of the current study were:

To what extent do the results of past decisions relate with risk propensity of coffee growers?

To what extent are risk perceptions of coffee growers related with the assessment of a risky situation as an opportunity or a threat?

To what extent do the results of past decisions taken by coffee growers determine their perception on the institutions underlying the sector?

To what extent does risk propensity of coffee growers relate with their risk perceptions?

To what extent does risk propensity of coffee growers determine their risk management strategies?

Is there a significant relationship between the risk management services offered by the institutions underlying the coffee sector and risk perceptions of coffee growers?

Is there a significant relationship between the assessment of a risky situation as an opportunity or a threat by a coffee grower and its assessment of the institutions underlying the sector?

To what extent do the institutions underlying the coffee sector affect risk perceptions of an opportunity or threat situation faced by coffee growers?

To what extent is risk management affected by risk perceptions of coffee growers?

Hypotheses

Based on the aforementioned questions, the hypotheses for the current study were proposed. On the question: To what extent do the results of past decisions relate with risk propensity of coffee growers? the tested hypothesis was:

Hypothesis 1: The more successful the results of past decisions taken by the coffee grower are, the greater its risk propensity will be.

For the question: To what extent are risk perceptions of coffee growers related with by the assessment of a risky situation as an opportunity or a threat? the tested hypothesis was:

Hypothesis 2: The assessment of a risky situation as an opportunity or a threat by a coffee grower determines its risk perception.

For the question: To what extent do the results of past decisions taken by coffee growers determine their perception on the institutions underlying the sector? the tested hypothesis was:

Hypothesis 3: The results of risky past decisions taken by the coffee grower determine its assessment of the institutions underlying the sector.

For the question: To what extent does risk propensity of coffee growers affect their risk perceptions? the tested hypothesis was:

Hypothesis 4: The greater the risk perceptions of coffee growers are, the higher the number of risk management strategies is.

For the question: To what extent does risk propensity of coffee growers determine their risk management strategies? the tested hypothesis was:

Hypothesis 5: The risk propensity level of coffee growers determines their risk management approaches.

For the question: Is there a significant relationship between the risk management services offered by the institutions underlying the coffee sector and risk perceptions of coffee growers? the tested hypothesis was:

Hypothesis 6: The assessment of the institutions underlying the coffee sector is directly related to risk perceptions of coffee growers.

For the question: Is there a significant relationship between the assessment of a risky situation as an opportunity or a threat by a coffee grower and its assessment of the institutions underlying the sector? the tested hypothesis was:

Hypothesis 7: The assessment of risky situations as an opportunity or a threat by a coffee grower determine its assessment of the institutions underlying the sector.

For the question: ¿To what extent do the institutions underlying the coffee sector affect risk perceptions of an opportunity or threat situation faced by coffee growers? the tested hypothesis was:

Hypothesis 8: The institutions underlying the coffee sectors affect risk perceptions of opportunity or threat situations faced by coffee growers.

For the question: To what extent is risk management affected by risk perceptions of coffee growers? the tested hypothesis was:

Hypothesis 9: Risk perceptions of coffee growers determine their risk management approaches.

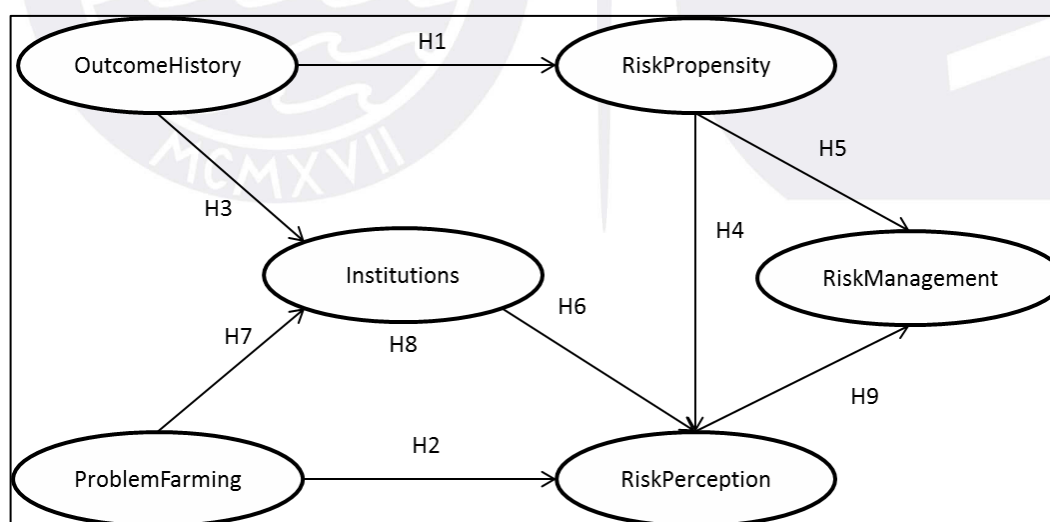


Figure 1 Theoretical structure of the research. The latent constructs represented in the structure were built following Sitkin and Pablo (1992); Sitkin and Weingart (1995)

Theoretical Framework

In order to identify the role of institutions underlying the Colombian coffee sector and the risk management and perceptions of Colombian coffee growers, it was important to review some theoretical contributions framed within the Neo-institutional and Risk Theories.

According to the so-called neo-institutional current started in by North (1990), institutions, understood as rules of the game, have evolved from being an informal set of rules to become formal standards established through the consensus of social groups.

Construction parting from a consensus facilitates the integration of people and establishing opportunities within societies. This new arrangement of formal rules argued there is a new reality in social sciences, denominated contemporary new institutionalism, which is inspired on the theorists of political science, sociology, and economics. Such reality appeared as a response to the link between institutions and economic performance, being characterized by a continuous process of institutional change, which creates complex bodies of behavior routines or rules of the game arising to lower the existing uncertainty in the interaction between social agents (Romero, 1999). The first institutions persisted and were the basis to configure the existing ones, which in turn became the base for the differences in the prosperity of nations, according to Acemoglu, Johnson, and Robinson (2001).

That is, the institutional theory was born as an alternative to the neoclassical paradigm, adding a dose of realism to the usual assumptions of economic and organizations theory (Powell & DiMaggio, 1999). In this theory, the individual seeks to maximize its welfare, through rational thought and complete information (Powell & DiMaggio, 1999). The market is an efficient allocation mechanism, even though it shows faults, negative externalities and asymmetric information that justify State intervention (Bandeira, 2009).

The former brings the purpose of promoting proper regulation via taxes, policies to reduce externalities, monopoly control and the efficient dissemination of information (Bandeira, 2009).

Since the works of Coase (1937, 1960), *The Nature of the Firm* and *The Problem of Social Cost*, respectively, it was exposed that any system of pricing has a cost (transaction costs) while deserving review and economic analysis of the rules, organizational models and the payment means and methods. To explain both horizontal and vertical integration and the origins of companies, Coase (1937) introduced the concept of transaction costs, understood as the cost of performing transactions through the market. That is, the costs of using the price mechanism: “the most obvious cost of “organizing” production through the price mechanism is that of discovering what the relevant prices are” (Coase, 1937, p.390). In his analysis, the author compared transaction costs with organizational costs, proposing that outside the company, transactions followed market rules, while cost management is an integral part of organizational decision within companies.

Meanwhile, Williamson (1979, 1981, 1985), who retook the principles of Coase, evidenced that transaction costs generate from economic transactions previous to its execution (finding information, market failure, prevention, corruption and opportunism among others), and others are incurred during execution and operation. Therefore, organizations are forced to seek institutional arrangements and partnerships in order to reduce costs and minimize risks. Therefore, through their performance, institutions can generate structural changes with positive effects on vulnerable sectors of developing economies (Prasad, 2003), said positive effect depending on the creation of a more efficient, effective and transparent state system (Coatsworth, 2008).

On the other hand, risk is defined as the vulnerability to a likely loss or damage for the agents, individuals, organizations and entities, that is, the greater the vulnerability

degree is, the greater the chances to be in danger are (Korstanje, 2010). Generally, risk and uncertainty are linked to decision making, being defined as the probability for the obtained result to be different than expected. But, risk is an effect of the uncertainty created by market fluctuations, which affect the results of operations in multiple sectors. In recent years, risk theory has been at the core of a discussion regarding which paradigm takes priority for framing individual decision making. These two paradigms are: (a) neoclassical, where individual and collective perfect, omniscient rationality is assumed, where calculations and self-interest are dominating elements; and (b) the paradigm where psychological, behavioral or emotional aspects take central stage. This approach refers to how psychological aspects impact financial decisions (Diz, 2004).

Within the first paradigm, decisions follow the expected utility theory of Von Neumann and Morgenstern (1944) on the uncertainty of risk distribution and statistical judgements on available data. In this sense, classical decision making is the most employed normative model for rational decision making, as it considers decision making under an objective risk, represented in probability distributions, as these are more easily quantifiable and identifiable (Pennings & Smidts, 2000). According to this theory, there are different procedures to determine risk attitude that should deliver identical results. However, empirical evidence indicates that results differ between methods (MacCrimmon & Wehrung, 1986).

The second paradigm emerges as a critique of the expected utility approach and is based on decision making over the basis that people do not behave according to preferences nor based on Bayesian principles, but through a variety of mental strategies known as heuristics (Kahneman & Tversky, 1979). This paradigm revolutionized the field of research on human judgment under uncertainty, based on a series of facilitating heuristics instead of algorithmic processing. Even though Kahneman and Tversky (1979) introduced the term

heuristics, which refers to principles on which people rely to reduce the complex tasks of assessing probabilities and predicting values to form simpler judgments (Kahneman & Tversky, 1979), Kahneman and Frederic (2005) were the ones who extended the word “heuristics” as a cognitive process that goes beyond judgment in conditions of uncertainty.

Definitions

The definitions of the main variables of the current research are associated to the Colombian coffee sector, risk perceptions of Colombian coffee growers, and risk management measures adopted by them.

Institutions. Refers to “the rules of the game in society or, more formally, are the humanly devised constraints that shape human interaction” (North, 1990, p.3). Specifically, institutions underlying the coffee sector are the organizational forms interacting on its operation, such as federations, associations and cooperatives, as well as government and industry policies involving not only coffee growers, but also the government (Kalmanovitz, 1997).

Institutional networks. It refers to “the way in which multiple social or institutional constructs interact between them while holding shared goals, parting from the structuration of common rules and functioning modes” (North, 1990, p.55).

Coffee institutions. It refers to “the group of institutions underlying the Colombian coffee sector in order to support coffee growers” (FNC, 2013, p.3., free translation from the original Spanish).

Risk management. Steinherr (1998) described risk management as one of the most important innovations of the 20th century, is defined as “the set of strategies that, parting from available human, financial or physical resources, seek to minimize the probability of loss” (McNeil, Frey, & Embrechts, 2010, p.637).

Risk management instruments are defined as “the set of instruments available to minimize losses” (McNeil et al., 2010, p.639). For the purposes of the current research, it refers to the inventory of “institutional agreements available to Colombian coffee sector institutions” (FNC, 2013, p.76, free translation from the original Spanish)

Risk. It was defined as the vulnerability to a likely loss or damage for the agents, individuals, organizations and entities, that is, the greater the vulnerability degree is, the greater the chances to be in danger are (Korstanje, 2010). Generally, risk and uncertainty are linked to decision making, usually being defined as the probability for the result to be different than expected. But in general, risk is an effect of the uncertainty caused by market fluctuations, affecting operational results in different sectors.

Risk perception. It has been recognized as a critical determinant of human response against environmental impacts and change. However, perception is a key variable that illustrates the influence of risk as an important determinant for human adaptation (Frank, Eakin, & López-Carr, 2011).

Vulnerability to risk refers to the “dynamic condition, existing whether or not climatic stresses are present, and embedded in complex relations of power, resource distribution, knowledge and technological development” (Eakin, 2005, p.1924), this being the case for Colombian coffee growers, who are not able to deal with the consequences of the risks inherent to the sector.

Risk propensity is defined as “an individual’s current tendency to take or avoid risks” (Sitkin & Weingart, 1995, p.1575).

Small-scale producer is defined as a small farmer involved in subsistence agriculture, of scarce resources, low income, low inputs or low technology, owning less than two hectares of cultivated soil and counting with a scarce asset base (Dirven, 2007).

Coffee grower is “the coffee bean agricultural producer, which is usually a small farmer who sees coffee production as its way of living” (Eakin et al., 2006, p.160). In Colombia, 94% of coffee growers possess less than five hectares of land, while 92% of coffee growers inhabit remote rural zones (FNC, 2013).

Assumptions

The following assumptions were adopted for the current research:

1. The studied phenomenon is the same in other coffee growing countries with similar contexts in the rest of the world.
2. Risk and risk perception theories adopted under the theoretical framework explain the studied phenomenon.
3. Coffee growers are exposed to economic risks that are common to small-scale farmers; for example, systemic risk and specific or industry risk. Moderation or damping of the latter ones shall indicate the level of effectiveness for the institutions underlying them.

Limitations

The current study identified the significant relationship between risk perception and risk management for Colombian coffee growers, and risk management instruments from Colombian coffee sector institutions, for which a SEM model was built following Sitkin and Weingart (1995). Therefore, the following limitations were identified: (a) some of these risks are not perceived by coffee growers, which implied the construction of a semi structured interview following Castellanos et al. (2013), in order to identify most of these perceived risks; and (b) the study had a cross-sectional nature and thus there was no analysis on the variations or changes of coffee sector institutions or the farmers.

Delimitation

The study was conducted in Colombia, within the Colombian coffee sector, taking

into account the federated coffee growers belonging to the 22 coffee producing departments in the country, namely: Antioquia, Bolívar, Boyacá, Caldas, Caquetá, Casanare, Cauca, Cesar, Chocó, Cundinamarca, Guajira, Huila, Magdalena, Meta, Nariño, Norte de Santander, Putumayo, Quindío, Risaralda, Santander, Tolima and Valle del Cauca (FNC, 2013). Likewise, private and public institutions underlying the coffee sector were analyzed, which have risk management instruments available for coffee growers in the aforementioned departments.

Summary

The importance of establishing the role of coffee institutions on the risk perception and management of Colombian coffee growers relied on explaining the features of these production units from the neo-institutional theory initiated by North (1990), until identifying the points where they are vulnerable, while determining how institutions underlying the coffee sector affect perceptions and management of the risks Colombian coffee growers are exposed to.

Specifically, the aim of this research was establishing the role played by institutions underlying the coffee sector on risk perceptions and management of these farmers. The findings could be replicated in other non-competitive productive sectors, with similar features. Methodological challenges demanded the application of mixed quantitative and qualitative research techniques, to find the relationship between the variables characterizing institutions underlying the Colombian coffee sector with risk management and perceptions by coffee growers, as well as assessing its significance.

Chapter 2: Review of the Literature

Next, the structure of the review of the literature is displayed, where the institutional and neo-institutional theories, public and private institutions, risk theory, risk perception and risk perceptions in the Colombian coffee sector are explored.

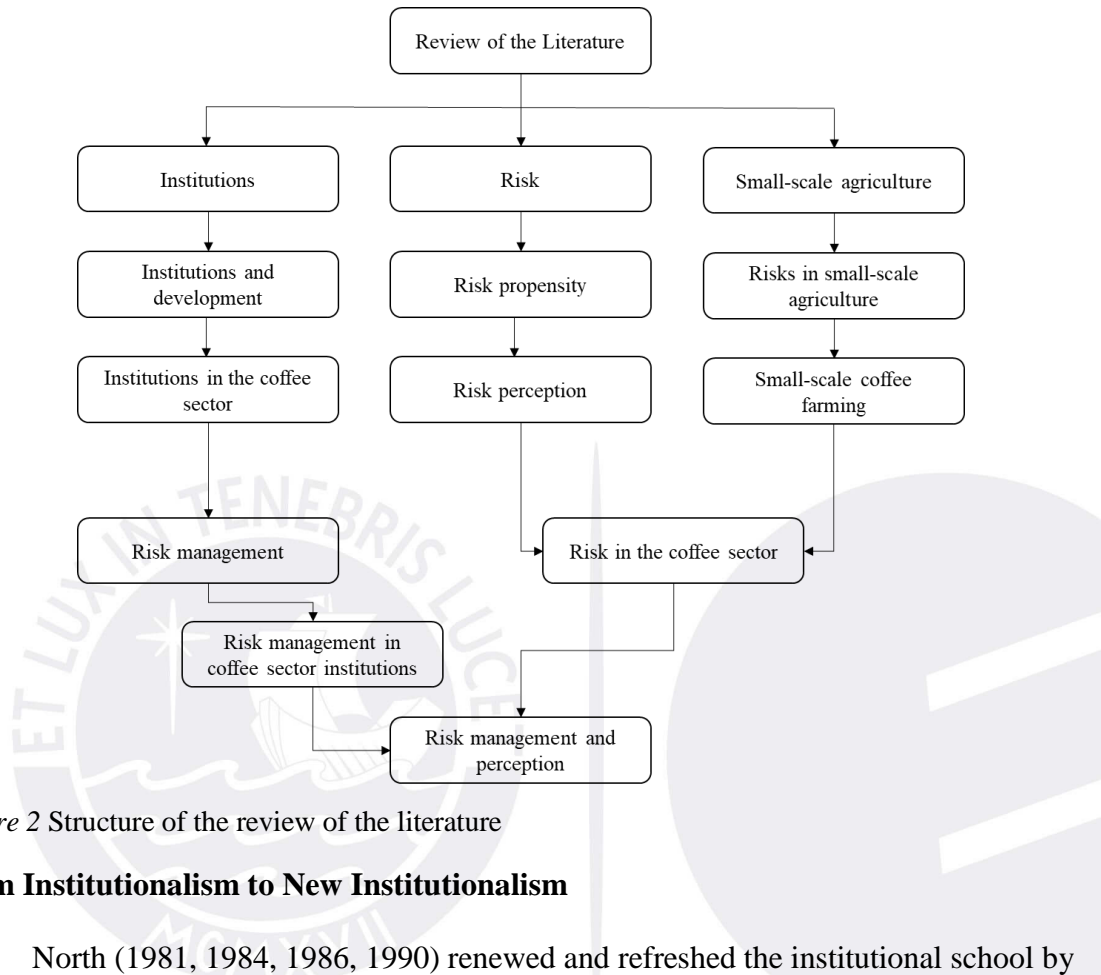


Figure 2 Structure of the review of the literature

From Institutionalism to New Institutionalism

North (1981, 1984, 1986, 1990) renewed and refreshed the institutional school by redefining institutions as “...the rules that determine the constraints and incentives in economic interaction and social policy.” (Bandeira, 2009, p. 356, free translation from the original Spanish). Institutions provide the infrastructure to reduce uncertainty and transaction costs (Kalmanovitz, 1997), “...considering them to be general maintenance expenditure in a property rights system, under conditions of increasing specialization and a complex division of labor.” (Powell and DiMaggio, 1999, p. 37, free translation from the original Spanish). In short, these approaches give way to a new institutionalism where institutions lower uncertainty by providing reliable and necessary structures for economic

exchange.

New institutionalism is not considered as a break, but as a continuation and evolution of old institutionalism (North, 1990). Unlike its predecessor, New Institutionalism considers two levels of analysis: a macro level, governed by an institutional framework and rules that indicate the actions of agents; and a micro level, involving markets and contracting hierarchy structures (Williamson, 2000). But it is the interaction of these two levels what allows organizational structures to reduce costs and minimize uncertainty. Institutions such as formal or informal sets of rules on the behavior of individual or collective agents, establish property rights and its limits and guarantee the contractual nature of public or private transactions, providing the necessary information on prices, terms and conditions creating the scenario that will lead to the development of a country or region (Kalmanovitz, 1997; North, 1983).

However, there is no defined feature that distinguishes old institutionalism from the new, with the latter permeating different areas such as sociology, politics and international relations, among others (Powell & DiMaggio, 1999). Thus, from the economics of the organization, new institutionalism is understood as governance structures able to adjust in order to minimize transaction costs, uncertainty and define property rights (Powell & DiMaggio, 1999). In this sense, the evolution of institutions in the New Institutionalism was clearly exposed by Portes (2006), who embarked on a conceptual exploration while wondering what institutions really are, and finds the response emerging from the economy, stating that: "...it is a set of different factors ranging from social norms to values, from the 'property rights' to complex organizations such as corporations and state agencies." (Portes, 2006, p. 16, free translation from the original Spanish). That is, institutionalism moves from being a set of laws seen as the game structure to complex organizations structured for specific purposes.

With that said, new institutionalism can be differentiated of the old one, in the way Powell and DiMaggio (1999) showed, as a departure in aspects such as: conflicts of interest, sources of inertia, structural emphasis and organizational dynamics. This way, the new institutionalism is presented in a broader sense, where institutions offer a diverse nature while reflecting historical changes and organizational capacity to carry small local elites to macro levels (Powell & DiMaggio, 1999). In general terms, the new institutionalism focuses on the rules and governance systems developed to regulate and streamline economic exchanges, with a special emphasis on the firm level and the hierarchical organizational structure, where the relationships and exchanges move in the market for the organizational frameworks scenario (North, 1983, 1990; Powell & DiMaggio, 1999).

Institutions and Development

Since North (1983; 1990) linked institutions to the economic development of nations, there has been an upsurge in the number of investigations and theses pretending to prove the importance of institutions on development. In developing economies, institutions are characterized by: (a) favoring redistributive and non-productive activities; (b) creating monopolies and non-competitive conditions; (c) the lack of enough investment in education, interrupting systematic productivity increases and (d) high levels of corruption in political systems and public order. These features, and the inability of societies to develop the mechanisms needed to ensure effective compliance of the contracts at low cost, remain the cause of historical stagnation and underdevelopment (North, 1990).

According to Bandeira (2009), studies that claim formal institutions are the cause of economic development can be divided in two groups. In the first group, it is argued that the establishment of formal institutions such as taxes and regulations that promote good governance is the cause of development. The second one says formal economic institutions

that protect private property rights are the cause of economic growth. Even though there is a general consensus, no specification is made in the type of institutions involved in the development nor in the ideal set for every country or under what criteria should the role played by informal institutions and policies be decided.

In this sense, the new current of the institutionalism known as New Contemporary Institutionalism, inspired in theorists of political science, sociology and economics inherently raised three approaches that allow to understand the reach these institutions possess as fundamental pieces for the economies to achieve economic development, namely, New Economic Institutionalism, New Sociological Institutionalism and New Political Institutionalism (Powell & DiMaggio 1999; Romero, 1999).

New Economic Institutionalism

New institutionalism mainly represented by North (1981, 1983, 1984, 1986, 1990) and Williamson (1979, 1981, 1985) emphasizes the microeconomic aspects of the neoclassical theory and migrates them from the production stage to the exchange of economic goods, leading the economy to think on the transaction. That is, it focuses on government systems developed to regulate markets through the firm and structure approaches (Williamson, 1981, 1985). For Williamson (1985) both limited rationality and opportunism are two behavioral assumptions implying imperfect contracts and asymmetric information that any of the participants (contractor or contracting) can leverage to its favor in case of an unexpected event or economic contingency, thus increasing transaction costs.

This justifies the creation of institutional hiring structures for the purpose of decreasing the negative effects of limited rationality, while defending transactions from the dangers of opportunism (Prasad, 2003). Thus, the study of the firm is not far from economic assumptions (individualism, egoism and rationality), but the notion of the firm as a production function disappears as it approximates a holistic view, with increased

importance of attributes such as assets, uncertainty, rules of the game, transactions and environment, leading to the origin of specific classes of financial institutions (Powell and DiMaggio, 1999; Prasad, 2003). In short, institutions are seen as the rules that govern a society and determine the development of the activities in an economy (North, 1981, 1984, 1986, 1990).

Government or Public Institutions

These are understood as the playing field and refer to the mechanisms available to the State when rectifying market failures, protecting and regulating the economic agents, and ensuring proper economic performance (Kalmanovitz, 1997). So, these lay the formal rules of agent behavior; establish property rights and its boundaries; facilitate and guarantee public and private contracts; and provide information on prices, terms and circumstances (Kalmanovitz, 1997). According to Kalmanovitz (1997), some of the most relevant governmental institutions are: (a) the Constitution; (b) organic statutes (for labor, financial, contractual, etc.); (c) educational systems, (d) healthcare, (e) security, (f) information systems and (g) executive regulatory agencies such as departments, ministries and institutes attached to the State.

Private Institutions

According to Kalmanovitz (1997), private institutions are those underlying the economic sectors and promote the protection of individual and collective economic agents. Also, "... they provide the structure that men impose on human interaction to reduce uncertainty" North (as cited in Kalmanovitz, 1997, p. 3, free translation from the original Spanish). According to Kalmanovitz (1997), these were born to correct or intervene in instances where government institutions are limited, or as an extension of these when necessary. For Powell and DiMaggio (1999), some of these institutions are: (a) worker cooperatives, (b) unions, (c) federations, (d) associations, (e) financial system, (f) guilds,

(g) federations or associations and (h) institutional arrangements. The institutional nature of this organization type lies on interconnected relational network structures that tend to reduce the uncertainty and transferring risk along the structure or productive chain (Powell & DiMaggio, 1999).

Institutions in Agriculture

Institutions are present in every single economic sector, but it is the primary sector where these really take a higher relevance as an instrument of support and protection for small producers (Kalmanovitz & López, 2002a). The importance of the structural transformation experienced by Colombian agricultural institutions during the 20th century lies on labor condition improvements parting from a change in the State and its performance on the economic realm which increased productivity (Kalmanovitz & López, 2002a; 2002b). This evolution influenced the development of internal markets and served as the support for the export of some products to the international market, accompanied by the structuring of financial supports and organizations articulating the production and the commerce which gave greater dynamism to the agriculture.

Empirical studies confirmed the importance of agricultural institutions in other regions. Taylor and Van Grieken (2014) analyzed the influence of local institutions associated with agricultural subcultures such as cooperative harvesting groups or practice norms, and the local institutions introduced to facilitate delivery under decentralized government schemes such as regional extension networks. They examined an Australian Government program known as *Reef Rescue*, which was studied parting from conducting interviews on focal groups such as sugar cane farmers and agricultural extension agents. Taylor and Van Grieken (2014) found that participation of farmers in these national programs increases economic and cultural benefits for farmers.

Similar studies in Brazil showed that institutions such as land use policies,

cooperatives and access to credit for the production of soy, were strongly influenced by land tenure (Mussoi, 2011). Garrett et al. (2013) provided statistical evidence to affirm that the extension and yields of land cultivated with soy are higher wherever enrolment levels and credit cooperatives are greater and cheap credit sources are more accessible. This result suggests that both production and profitability of soy increase as institutions help improve supply chain infrastructure.

Like Colombia, Brazilian agriculture used to be defined by the presence of unproductive large estates; however, through the incursion of the institutions and the change in the agrarian structure, it is now well known for its high level of competitiveness and praised for its potential to help meet the growing demand for food, agricultural commodities and biofuels (Buainain & García, 2013). The former was achieved, specifically, through four basic instruments of intervention available to the Brazilian government, namely: the expropriation of unproductive large estates for land reform, land acquisition through funding to organized farmers, direct acquisition of land for distribution, conducted by INCRA and State institutions in special cases (Decree 433, 1992) and the settlement in public lands by the Brazilian government (Buainain & García, 2013).

In the same way land tenure does, livelihood explicitly determines the relationship of institutions to the local availability of resources and access to decision making processes resulting from local levels (Kalmanovitz & López, 2002b). Thus, Eakin et al. (2006) explained how livelihood-based approaches have provided important insights into the process of local development in Central America, and the dynamics of social and environmental change, determining how farmers are responding to the global market restructuring. As a consequence, and parting from the research developed by Buainain and García (2013); Eakin et al. (2006); Garrett et al. (2012); and Kalmanovitz and Lopez (2002a; 2002b), formal institutions and public policies are crucial in the adaptation process,

taking into account how politics can influence both access and distribution of resources. For which these expose the range of options available to farmers, and therefore individuals' strategies in response to risk.

Small-Scale Agriculture

Small-scale agriculture has received recent attention from emerging economies. It leads to analyses on the crises befalling the sector, as a result of high production costs, and the impact of climate change on these farmers in particular. In some countries where economic aperture processes have been radical, the effect of competition against imported goods on this sector has been dramatic as well (Herrador-Valencia & Paredes, 2016). Also, Dirven (2007) emphasized the feasibility of small farms and stresses that self-agriculture is once again the subject of debate in academic circles, because there is renewed interest in the role of agricultural development on growth and poverty reduction.

Acosta and Rodríguez (2005) proposed four criteria to distinguish small-scale agriculture from subsistence farms and commercial farms, namely: (a) the fact of living from farming; (b) the absence of permanent workers, as they would be considered commercial if they had them; (c) land sufficiency to meet basic needs, being considered subsistence farming otherwise; and (d) the sale of products to the market since, if they did not sell these, they would be classified as subsistence farmers.

Herrador-Valencia and Paredes (2016) evaluated the perceptions these units had regarding the causes of climate change and the risk levels farmers believe to be exposed, besides exploring the different strategies that individual or collective farmers developed to cope and adapt to change. The authors found that perceptions regarding changes in climate variables are consistent with available meteorological information, however, farmers in both analyzed zones had greater difficulty in forecasting changes, thus concluding they could not be prepared beforehand, being limited to react against unforeseen changes.

Risk

From a temporal perspective, Quintana, Stagg and Martínez (2009) defined two contexts for risk analysis: *ex-ante* and *ex-post*. In the first, risk is understood as exposure to non obtention of the expected goals for the activity; in the second approach, it is related with the degree these goals were not met.

But in general, risk is an effect of the uncertainty created by market fluctuations, which affects operational results in multiple sectors (Wolgin, 1975). In this sense, according to Katchova and Barry (2005) risk at an economic environment can be classified as (a) credit risk, the probability of default; (b) market risk, probability of price changes; (c) interest rate risk, probability of alterations in the interest rate; (d) foreign exchange risk, probability of volatile exchange rates; (e) liquidity risk, probability of not being able to cover debts in time; (f) systemic risk, probability of contagion when faced to international turbulences; (g) sovereign risk, the probability of a sovereign debt default and (h) environmental risk, the probability of losses due to changes in the environment (Katchova & Barry, 2005; Tucker et al., 2010; Wolgin, 1975).

In addition to this classification, there is also a taxonomy to describe agent behavior. The taxonomy is developed according to the risk exposure they prefer to assume according to a level of profitability, where the return is directly related to the risk. These are classified as: (a) risk averse, it is the economic agent that prefers to assume a lower degree of risk despite lower profitability; (b) risk neutral, which is the agent who takes the risk associated to market returns (benchmark), and (c) risk lover, defined as the agent who takes high risks expecting to obtain a higher return than the one offered by the market (Tucker et al., 2010).

Risks in Agriculture

Risk is generally associated to the financial sector and risk coverage instruments; however, it is present on all economy sectors and levels (Wolgin, 1975). One of the most

vulnerable sectors is the primary one, which shows as main features being formed by small owning producers, which are exposed to risks associated to particular events influenced by sociocultural, regional, institutional and economic events that cannot be avoided individually (Bielza, 2004; Tucker et al., 2010).

The progressive evolution of agriculture in developed countries and the increasing competitiveness that drives international markets significantly increase the risk exposure of farmers in developing countries (De Schutter, 2010). In turn, the variability that has characterized weather and price volatility in recent years amplify the vulnerability of the farmer before the uncertainty on the economic outcomes (Capitanio, Adinolfi, Di Pasquale, & Contó, 2013). In this context, according to Capitanio et al. (2013) risks for farmers and enterprises and related institutions, increase considerably, because it increases the potential danger from each of the different types of risk: production, market, financial and institutional.

Farmers are exposed to risks derived from natural conditions (earthquakes, droughts, floods, health, etc.) and other risks associated to business activity as classified by Bielza (2004): (a) production risk (production cycles), (b) market risk (price volatility and variations), (c) financial Risk (funding and financial derivatives), (d) contractual risks (disagreements and breaches of contract), (e) institutional risks (changes in regulatory framework and institutional relations), and (f) operational risk (human factor).

However, given the wide plurality on the types of risk, there is a similar variety of tools to manage income risk available to farmers (Capitanio et al., 2013), among which are included: (a) diversification of production, (b) insurance, (c) protection of financial risks through the stock market and financial derivatives and (d) the management of savings and credit. These public and private instruments offered by various institutions in the primary sector are mainly combined with public policies, both in the agricultural sector (price

support for products or direct income subsidies) and the State (macroeconomic policies) (Capitano et al., 2013).

The literature around risks in agriculture and risk management instruments focuses on the implementation of insurance (Capitano et al., 2013; Doherty & Dionne, 1993; Glauber & Miranda, 1997), asymmetric information (Bourgeon & Chambers, 2003; Mahul, 1999) and risk perceptions and classifications (Bielza, 2004; Tucker et al., 2010). Said literature clearly shows the trend for multiple countries to support farmers through public intervention, channeled through insurance and farm subsidies (Castellanos et al., 2013). The use of this instrument helps researchers and public policy makers to develop a research line on the causes of market failures in agricultural insurance, insufficient tools and the need to explore ways to broaden public and private intervention in this sector (Capitano et al., 2013).

Risks in Small-Scale Agriculture

Athukorala, Wilson, and Managi (in press) made an empirical study on the risks of onion farmers in Sri Lanka, who use groundwater for cultivation. They found an important social welfare loss both in terms of available quantities of groundwater and quality deterioration costs, which have implications on their mid-term production. On the other hand, Herrador-Valencia and Paredes (2016) analyzed climate changes on small-scale farmers in the Ecuadorian Andes, and the risk levels they believe to be exposed. The authors identified and assessed the different actions these farmers are individually or collectively developing to cope with and adapt to climate change, underlining the weak local organization as a result, despite being a key aspect in the design of adaptive strategies

Likewise, Fernández, Ponce, Blanco, Rivera, and Vásquez (2016) inquired about the effects of water variability on small farmers, who operate with narrow profit margins and lack access to both financial resources and technological knowledge. The authors

identified the economic impact of changes in water availability on small-scale agriculture. They found that at the aggregate level, climate change would have a lower economic impact on small-scale agriculture in the basin, with small expected utility and wealth decreases, but large differences between poor and rich farmers in economic impact.

Institutions and Risk in the Coffee Sector

According to Bacon (2010), the fall in the coffee prices after the global coffee crisis during the late nineties affected thousands of production and commercial networks, including these that were organized in institutions and international agreements such as organic coffee sales and fair trade. There was an evident response coming from public and private institutions such as NGOs, coffee companies, cooperatives, federations and organizations of producers, who spearheaded the efforts to widen the market for certified sustainable coffee and create consumer awareness regarding matters of quality, taste, health and environment. These actions created a growing demand for specialties and products with ecological labels, including bird-friendly coffees or those of fair, organic trade (Bacon, 2010; Barham & Weber, 2012). The goal of such actions was improving the conditions for and reduce the risk of small producers

Following Neilson (2008), global private regulation and environmental norms hold multiple implications on value chain structures and institutions at the smallholder coffee grower system, where worldwide private regulation is encouraging changes on organizational modes of farmers and the relationships between traders and farmers. These changes are leading to an unexpected increase of the penetration of multinational commercial companies in coffee producing zones around the globe, increased transaction costs throughout the value chain and overall pressure to decrease prices paid to producers.

According to Barham and Weber (2012), institutions such as fair trade allow for coffee yields to increase and, therefore, net cash profits for coffee growing households.

Given the relationship between net profit and participation of coffee growers in certified coffee schemes, the results suggested that certification norms that allow improving yields are essential to increase the producers' welfare and attract and greatly diminishing the market price risk (Barham & Weber, 2012; Neilson, 2008).

Risk in the Coffee Sector

The concept of risk in the coffee sector is based upon multiple fields, such as climate change, natural disasters, food security and political ecology, where it has multiple meanings and interpretations (Antwi-Agyei et al., 2016). However, social vulnerability usually considers the status of human systems, influenced by political, economic and social factors that might put people at risk and lower their ability to adapt against these risks. Literature has identified examples of such factors, including access to institutional service providers, resources, poverty and food insecurity (Eakin, et al., 2014; Frank et al., 2011; Quiroga, Suárez, & Solís, 2015).

Risks coffee growers are exposed to affect economic sustainability of the coffee sector. Unfavorable combinations of price and performance, volatility, low household savings, climate change, disease, plague and operational risks, among others, put coffee growers in a vulnerable position (Giovannucci & Potts, 2008). This way, production risks at the Colombian coffee sector can be classified into: (a) agroclimatic; (b) biological, which might manifest itself as plagues, diseases or natural inhabitants; and (c) climatic (Cenicafé, 2013). Agroclimatic risk is defined as the probability that a weather hazard negatively affects a coffee production system, reducing its productive capacity (Cenicafé-FNC, 2013). This category includes: (a) hydric erosion, (b) wind erosion, (c) natural disasters and phenomena, (d) hydric excess, (e) hydric deficit, (f) solar brightness reduction, and (g) temperature changes. Also, biological risk can be divided into three important groups, namely: (a) diseases, (b) natural inhabitants, and (c) plagues. Finally, one of the production

risks most worrying to coffee growers, FNC and the agrarian sector in general, is climatic risk, as it causes great damage on yearly coffee production. It is possible to find inside this risk category: (a) climate change, (b) weather volatility, (c) greenhouse effect, and (d) global warming (Cenicafé-FNC, 2013; IPCC, 2014).

Meanwhile, economic risk is defined as vulnerability against a potential damage or injury to agents, individuals, organizations or entities where, the greater the vulnerability, the greater the probability to be in danger (Korstanje, 2010). In the coffee sector, economic risk is an effect of the uncertainty caused by market fluctuations, which affects coffee bean operational results in national and international markets (Katchova & Barry, 2005).

In this sense, risk in an economic environment can be classified into two categories, namely: (a) economic risks and (b) financial risks. On economic risks, five individual risks affecting the coffee sector can be identified, with the first of these being (a) demographic risk, which comprises changes in population density due to public order issues, little or no high-quality educational offer, developmental constraints originating from unmet basic needs, and scarce formal employment offers. Together, these factors decrease qualified labor supply and increase production costs, thus lowering coffee growers' profits (Bielza, 2004). The second subgroup is (b) market risk, defined as international coffee price volatility, caused by variations in global coffee prices due to supply and demand effects, which might bring economic losses to producers, thus discouraging labor supply in the long term (Bielza, 2004).

The third subgroup of economic risk is (c) commercialization risk, defined as the probability of scarce buyers in the supply chain, caused by inexistent competition on coffee demand or coffee oversupply, leading to a decrease on income perceived per sold coffee load and a potential economic loss. The fourth subgroup is (d) interest rate risk, an interest rate variation that makes coffee growers' loans more expensive, affecting supply, or

affecting demand from the real sector, caused by variations in restrictive monetary stabilization policies of rate increases, which make credits more expensive and in turn increase production costs. Finally, the fifth subgroup of economic risks is (e) exchange rate risk, which is the probability of foreign exchange volatility, caused by volatility in external factors and commodity dependence on exchange rates (Heshusius, 2010; 2013; Tucker et al., 2010).

Finally, health risks are those associated to the probability a worker suffers an injury, at or as a consequence of, its work, particularly due to environmental exposure, that is, physical, chemical and biological agents, where a potential consequence of said exposition would be labor diseases, or workers' health decay (Carvajal, 2008). This type of risks, in the specific case of the coffee sector, can be divided into two categories: (a) public health risk and (b) toxicological risk.

On public health risk, three types were found: (a) ergonomic risks, which are injuries caused by incorrect positions and motions, due to lack of knowledge on best practices and lack of care on procedures, thus increasing the chance of a work accident; (b) physical risks, defined as the presence of glasses, rocks, wood or metal shards affecting beans, due to inadequate waste management and improper harvesting and post-harvesting practices, which increase the probability of suffering a work accident; and (c) infectious disease risk, referring to infectious diseases in communities hit by a disaster, proportional to the endemicity degree of a region, caused by epidemics, lack of social security, lack of prevention, or no access to public healthcare, among others. Consequently, these risks bring low productivity, higher mortality rates, and labor scarcity (Cenicafé-FNC, 2013).

This risk typology is related to coffee sector reliance on processes, people and products. Operational risk holds a strong impact on sector productivity, while also related to hiring, deficiency or rupture at internal control or control proceedings, as well as with

quality and process control systems (Cenicafé-FNC, 2013). Four operational risks were identified for the Colombian coffee sector, namely: (a) bad post-harvesting practices, which are related to inadequate management of procedures corresponding to post-harvesting (depulping, washing, drying, storage and transport), and it occurs when there is no knowledge or bad process applications, affecting quality and delivery time of the final product; (b) bad harvesting practices, which refer to inadequate handling of the procedures corresponding to harvest (tool use, planting processes, etc.) which, just like the former, is caused by no knowledge or bad process applications, leading to quality losses and final product delivery delays (Cenicafé-FNC, 2013).

Also, (c) labor scarcity is a phenomenon caused by migration of rural inhabitants, by motives such as the armed conflict, lack of opportunities and informality at the coffee sector (lack of social security), among others, which leads to increases on direct manpower cost, lower production volumes and harvest quality decay; and finally (d) human error, understood as human mistakes during coffee harvesting and post-harvesting processes, caused by no knowledge on practices or lack of care on processes, thus causing lower bean quality, and production damages or delays (Cenicafé-FNC, 2013).

Risk Management and Perception

Starting from the study of Sitkin and Pablo (1992), who proposed a conceptual model focused on specific risk behavior predictors from the individual, organizational and problematic perspectives, and the work of Sitkin and Weingart (1995), who examined the utility of putting risk propensity and risk perceptions in a central role; these have been references studies linking risk management and risk perception. In this sense, Van Winsen, De Mey, Lauwers, Pasel, Vancauteran and Wauters (2016) developed a theoretical model to understand risk behavior in terms of risk attitude and perceived risks. Empirical evidence of this model is provided using an SEM model on data obtained from a survey deployed on

a large representative sample of farmers in Flanders, Belgium. The authors found that farmers who were more willing to take risks were proactively managing risk, by trying to reduce the impact and occurrence of risk by: (a) relying on external risk management tools, such as insurance and future markets; (b) additional production and income sources on the farm or (c) business optimization.

Tjemkes, Furrer, and Henseler, (2015) followed the same methodology of Sitkin and Weingart (1995) in order to show that unraveling the relationships between risk propensity, risk perception and risk behavior provides knowledge that are not available for decision making. The authors found that only when social dissatisfaction is low, risk-loving decision-makers are less likely to act opportunistically, and only when it is high decision-makers are more likely to engage in opportunism. When decision makers are risk averse, social dissatisfaction does not have a significant effect on their destructive behavior.

Risk Perception in the Coffee Sector

Tucker et al. (2010) examined risk perceptions of small Central American coffee growers, where they found that coffee growers feel more vulnerable to environmental risks and price changes, albeit they widely associated those perceived risks in the sector to their condition of small land owners and their family business scheme. According to Frank et al. (2011), risk perception has been recognized as a critical determinant of human response against environmental impacts and change.

However, perception is a key variable that illustrates the influence of risk as a determinant component of adaptation. So, Antwi-Agyei et al., (2016); Eakin et al., (2014); Frank et al., (2016); and Tucker et al., (2010) explored risk perceptions at the coffee sector and found that risk perception is a determinant factor in the lives of coffee growers.

According to Eakin et al. (2014), perception is one of the determinants behind adaptation of Central American coffee growers to risk situations. In the same vein, Frank et al. (2011)

proposed that risk perception should be introduced as a cognitive variable, that greatly influences risk aversion of Central American coffee growers.

Institutions in the Coffee Sector

The variety of risks to which small coffee growers are exposed require both public and private participation on the design of hedge instruments (Bacon, 2010; Bielza, 2004; Fisher & Gravelet, 2013; Garret, Lambin, & Naylor, 2013; Ingenbleek & Reinders, 2013; Tucker et al., 2010). Following economic crises like the one in 1929, international events such as both World Wars, natural phenomena such as climate change and speculation with commodity prices and production (Kalmanovitz & López, 2002a, 2002b) both vulnerability and sensitivity of the sector to external shocks were left clear, as well as the limitations of public institutions as a support for coffee growers.

During the 20th century, the development of institutions gave a boost to trade and sectorial performance (Ingenbleek & Reinders, 2013). On a broader scale, the adaptive capacity of a system is related to the institutional structures, the flexibility in the rules and legal frameworks, the degree and magnitude of inequalities in the poverty and resource distribution, physical infrastructure and investment (Eakin et al, 2006). In this sense, formal institutions, informal ones, institutional arrangements and public policies are the cornerstone in the adaptation process, considering how politics can influence access and distribution of resources, the range of available options to actors, and therefore individual strategies in response to risk (Bates & Da Hsiang, 1987; Eakin et al., 2006; Ponte, 2002, 2004).

Even though the features of population and coffee-growing families are similar for all of the coffee producing countries, there might be very different relationships with organizations, public and private institutions. The differences in the ways for relationing with institutions might cause significant contrasts in adaptability and choices regarding risk

management institutions and instruments (Avellaneda & González, 2003; Bilder, 1963; Eakin et al., 2006; Fisher & Victor, 2012; Paige, 1993; Fernández, Potts, & Wunderlich, 2007).

Thus, studies developed in producing countries such as Mexico (Eakin et al., 2006), Guatemala (Eakin et al., 2006; Fisher & Victor, 2012), El Salvador (Paige, 1993), Vietnam (Avellaneda & González, 2003), Brazil (Mussoi, 2011) and Colombia (Fernández, 2010; Kalmanovitz & López, 2002a, 2002b; Ocampo, 1981; Posada, 2011) among others, showed the important role possessed by institutions when developing trade and negotiations.

Recent years have seen a process of incorporation for international institutions supporting coffee growers associated to fair trade and alternative sustainability standards in the coffee industry. These are the dynamics underlying the market that were developed to favor sustainability. Ingenbleek and Reinders (2012) examined the evolution of the certified coffee market in the Netherlands and evidenced that the creation of a market for sustainable coffee, significantly influence in the creation of markets surrounding the sector such as retailers and coffee toasters (Ingenbleek & Reinders, 2012; Jaffee, 2012).

Given the preference for a more fair and sustainable world through the acquisition of certified agricultural products, Barham and Weber (2012) explored the economic sustainability of certified coffee in Mexico and Peru. The authors analyzed institutions such as fair trade, organic farming and alliances with conventional certified producers. Barham and Weber (2012) revealed that yields, more than high prices, are the most relevant factors to increase the net cash profits for coffee growing households. Given the relationship between net profit and coffee growers' participation in certified coffee schemes, the results suggested that certification norms that allow improving yields are essential to increase the producers' welfare and attract and keep farmers.

Institutions in the Colombian Coffee Sector

The FNC is the most important representative of Colombian coffee institutions, as it is one of the oldest private coffee sector institutions on Earth. It was founded in 1927 through the Act 76 of 1927, which defined a nonprofit trade organization, being formed by 15 departmental coffee committees and 364 municipal ones, whose members are chosen among producers themselves, who form the political instances at the Federation.

Management, headed by the general manager, is the one in charge of designing and executing programs demanded by producers. This way, Colombian coffee growers ensure interlocution with their multiple groups of interest (Echavarría, Esguerra, McAllister, & Robayo; 2015; FNC, 2011; Kalmanovitz & López, 2002a, 2002b).

At the year following its creation, the FNC began offering technical assistance services through which best practices were promoted among producers, creating the base for the formation of the extension service that was formalized in 1960. Logistics services were implemented back in 1929, which led to the beginnings of the largest logistics company in Colombia, ALMACAFÉ, created in 1965 (FNC, 2011). In order to promote research and technological development of the Colombian coffee sector, CENICAFÉ was born in 1938, as a scientific research institute to develop enhanced coffee varieties and sustainable, environmentally friendly agricultural practices (Fisher & Gravelet, 2013; Junguito & Pizano, 1993; 1997; Pérez, 1987).

The FoNC was established in 1940 with the backing of the Colombian government, created as a parafiscal account fed by coffee grower contributions, intended to strengthen the sector and stabilize coffee growers' incomes. FNC has turned into one of the main coffee policy instruments, an example of the capability of creating, around agricultural economy, functional legal and financial instruments; and whose norms have become inspirational sources for other parafiscal agreements in global agriculture (Fisher &

Gravelet, 2013; FNC, 2011). Purchase guarantees were implemented first in 1958, as a mechanism that ensures Colombian coffee growers the sale of their coffee at a transparent price, paid upfront and in locations near to their production centers. Purchase guarantees are one of the public goods most esteemed by coffee growers, as these allow them to sell their coffee at a transparent price, receiving upfront payment, and in accordance to Colombian coffee prices in international markets at the transaction date (FNC, 2011; 2013).

In order to strengthen coffee institutions, coffee grower cooperatives appeared in 1959, followed by Juan Valdez and Fundación Manuel Mejía (Manuel Mejía Foundation) in 1960. Juan Valdez is a character that creates consumer awareness on Colombian coffee quality and promotes its consumption around the world; Fundación Manuel Mejía is an institution whose main objective is offering training opportunities to coffee growers, their families and rural communities; finally, coffee grower cooperatives were created as a private initiative supported by the FNC, to promote a shopping network that facilitates small producers to sell their coffee to FNC and other exporters.

The 36 coffee grower cooperatives involved in their internal commercialization network are social economy organizations, owned by coffee growers, whose main function is guaranteeing the acquisition of coffee harvests at the maximum number of attention points, paying the highest market price available to producers (FNC, 2011). The social basis of coffee grower cooperatives is formed by approximately 80 thousand associates. Besides purchase guarantees, coffee grower cooperatives deliver social services to their members such as fertilizer sales, agricultural procurement inputs, food and grocery, transportation and credit, among others (FNC, 2011; 2013).

Buencafé was founded in 1974, which is one of the largest and most sophisticated lyophilized coffee processors in the world (FNC, 2011), allowing FNC to export one of the best soluble coffees to tens of countries. This way, Buencafé encourages Colombian coffee

growers to conquer new markets and to benefit from additional value added in industrial activities (FNC, 2011). Procafecol was founded in 2002, at the beginning of the 21st century, created as a partnership between FNC and Colombian coffee growers intending to improve their position at the coffee value chain, generating more income for the sector. Up to 2015, it is owned by individual coffee growers and the International Finance Corporation (IFC) of the World Bank among others, its main activity being commercializing Colombian coffee in multiple presentations, and opening Juan Valdez coffee stores in Colombia and overseas through their direct management branch or using third parties (FNC, 2011).

Coffee institutions are complemented by a social fabric of Colombian coffee growing families; besides, public goods offered by FNC help coffee growers and their families to avoid being too vulnerable to local and global market dynamics (FNC, 2011; 2013). With the creation of FNC, the required conditions to develop competitive advantages impossible to create on an individual basis were established. It is precisely from this union that important public goods originate from, such as: (a) purchase guarantee; (b) knowledge creation and diffusion; (c) brand strategies and commercialization; (d) quality controls; and (e) social investment, favoring welfare and life quality of coffee producing communities.

In order to ensure its efficiency, legitimacy and democratic nature, the FNC displays a particular structure, different to that of any other type of organization. It has a participative structure, centered on productive and social development of coffee producing families, seeking to guarantee coffee production sustainability and global leadership of Colombian coffee. At the foundations of the structure, it is possible to find associated coffee growers identified with a *cédula cafetera inteligente* (Coffee ID), which serves as both identification and payment method (FNC, 2011).

Up to 2015, there were 383,978 federated coffee growers representing above 80% of Colombian coffee growers that fulfill the established requirements to obtain a coffee ID (FNC, 2015). The participation system gives the possibility of exerting voting rights or being elected, but programs and benefits offered by FNC are available to all producers. The maximum instance at the organization is the Congreso Nacional de Cafeteros (National Coffee Grower Congress), which gathers annually in Bogotá late in the year. The congress is the one in charge of naming the general manager and the Directive Committee, which acts as a management board and meets twice per month (FNC, 2011). The congress also approves the statutes, budgets and strategic priorities of the FNC. Also, municipal and departmental coffee grower committees gather regularly to discuss their local and regional priorities, and to propose programs and initiatives; finally, the national committee, where government representatives go to, is the one in charge of reviewing policies and resource execution at FoNC (FNC, 2011).

Likewise, Asociación Nacional de Exportadores de Café [National Coffee Exporters Association] (Asoexport) is a nonprofit organization intended to contribute to coffee industry defense and offer collaboration to the FNC and other entities. So, Asoexport's functions include: (a) promoting continued exporting activity performance within the boundaries of common good and subject to the conditions laid out by the State; (b) promoting a collaboration spirit among its associates; (c) contributing to the defense of the Colombian coffee producing industry, especially on matters related to production, commercialization and coffee exports; (d) collaborating with FNC, Ministerio de Comercio, Industria y Turismo (Ministry of Trade, Industry and Tourism) and other economic authorities on the solution of the problems affecting the industry; and (e) serving as a as an advisory organ to their associates, in subjects related to coffee activities (Asoexport, 2013).

Other institutional arrangements that have been established are coffee grower cooperatives, which are important for coffee bean commercialization. These count with their own exporting agency (Expocafé). According to Silva (2004), among the coffee grower cooperatives participating in their internal commercialization networks, some are capable of employing hedge instruments that allow them to get anticipate sales, price fixation and security on quotations. These activities seek to lower the risk small coffee growers are exposed to.

Summary

This chapter provides a broad panorama on the development of the neo-institutional theory using the approaches of Coase (1937, 1960), North (1990), and Williamson (1979, 1981, 1985), in which the importance of institutions in the relations between economic agents was established, and their influence on the economic development of countries, regions and economic sectors. Institutions understood as the rules of game (North, 1990) surged as the needs of legal and organizational structures to correct market failures, as well as its applications in the small-scale agricultural sector to minimize transaction costs, uncertainty and defining property rights.

On the other hand, an exposition was delivered on the evolution on the analysis of risks in agriculture, small-scale agriculture and, specially, those risks Colombian small-scale coffee growers are exposed to. It is possible to highlight environmental and economic risks, although in fact their condition of smallholders makes them vulnerable to all risks. Thus, it becomes necessary to ensure the presence of institutions, institutional structures and institutional arrangements such as those existing in the Colombian coffee sector, which is differentiated by having an institutional structure surrounding small coffee growers to represent them in international markets, and offering them the relevant hedging instruments correspondent to the risks they are vulnerable to.

Conclusions

The importance of institutions lies in the legal or organizational structure offered to economic agents to ensure the smooth performance on transactions and the allocation of resources in an economy, in order to reduce transaction costs and to define property rights.

It has been evidenced that the risks to which small farmers are exposed display a magnitude greater than the one they are able to cope with, for which require institutions to resist changes and fluctuations in international markets. This institutional arrangement allows them to negotiate in international markets, make trade agreements, and promote their products.

The review of the literature shows that although it is common knowledge that institutions mitigate risks, reduce losses, minimize costs and guarantee property rights and fair trade; the magnitude of the impact these institutions have over economic, social and living conditions of small coffee growers is not yet documented or quantified. Even less is known on the boost these give to regional development nor in what is the risk transfer mechanism through each of the institutions in the sector. In this context, the current research took relevance as an attempt to close said gaps and becoming a contribution for the government and other stakeholders in improving both the coffee industry and the conditions of living for coffee growers in Colombia.

Chapter 3: Method

Research Design

A sequential mixed research approach was employed for the current study, comprising both a qualitative stage of descriptive, non-experimental and cross-sectional nature, and a quantitative stage of descriptive, non-experimental and cross-sectional nature. The second stage sought to identify if there was a significant relationship between risk management instruments offered by the institutions underlying the coffee sector and risk perceptions of Colombian coffee growers. During the qualitative stage, taxonomies that eased the analysis of the dimensions existing within risk management for Colombian coffee producers were built. The first taxonomy grouped the types of risk faced by Colombian coffee growers into four categories, while the second one delivered a taxonomy on the institutions according to their accessibility to the needs of coffee growers, with four groups of instruments offered by institutions available to coffee growers for risk management services being built as a result of the third taxonomy. This phase was developed through four stages: (a) identification of the risks Colombian coffee growers are vulnerable to; (b) identification of the risk perceptions held by coffee growers; (c) identification of the risk management instruments available from each of the institutions underlying the coffee sector and (d) classification of the risks, institutions and instruments in categories through a taxonomy.

Initially, the risks to which Colombian coffee growers are vulnerable were identified through enquiries on secondary data held by Cenicafé-FNC (2013). In order to increase the validity of the constructs analyzed in the current study, which were defined through the survey on coffee growers, a panel of experts usually employed to validate taxonomies (Gasca & Manrique, 2011) was summoned, which included directors, researchers and representatives of Colombian coffee sector institutions. Expert judgment is

used in multiple areas, from measuring the reliability of mental health professionals to assess the competence of psychiatric patients up to informed consent (Kitamura & Kitamura, 2000), as well as for validating the content of standardized tests of high specifications.

Following Skjong and Wentworth (2000), and de Arquer (1995), the next steps were followed for summoning the panel of experts: (a) preparing instructions and worksheets with the identified risks and risk management instruments, (b) selecting the experts and training them, (c) explaining the context, (d) enabling the discussion, and (e) establishing the agreement among the experts by means of the calculation of consistency. By using the methodology for the validation of taxonomies employed in the panel of experts, 39 participants responded a semi structured interview of 30 questions, centered on identification of the risks coffee growers are vulnerable to, and risk management instruments available to Colombian coffee growers. The participants that were interviewed went as follows: (a) the FNC was represented by the general manager, the technical manager, the commercial manager, the administrative manager, the communications and marketing manager, and ten executive directors; (b) Cenicafé was represented by its director and three researchers; (c) Expocafé was represented by its director; (d) coffee cooperatives were represented by twelve managers; (e) two representatives from public banks; (f) two representatives from commercial banks; (g) and three representatives from private exporters. As a result of the panel of experts, the inventory of risks to which coffee growers are exposed and the list of risk management instruments offered by institutions were obtained.

Following Tucker et al. (2010) who examined the risk perceptions held by small coffee growers in Central America, the inventory of risks Colombian coffee growers are exposed to was obtained, parting from their own perceptions, needs and the experience of

the FNC executives. These executives, through their decisions, build and modify both Colombian coffee institutions and risk management instruments (Carr, Konda, Monarch, Ulrich, & Walker, 1993; Clavijo, Leibovich, & Jaramillo, 1994; Gasca & Manrique, 2011; Junguito & Pizano, 1997).

Finally, the SEM used in Sitkin and Weingart (1995), based on the model laid out by Sitkin and Pablo (1992), was used. They created a model with five latent factors, namely: *Outcome History*, *Problem Framing*, *Risk Propensity*, *Risk Perception* and *Risky Decision Making*, in which it was established that risk propensity and risk perception mediated the effects of problem features and result history in decision making behavior under risk; two innovations were introduced on the aforementioned model, the first one referring to the grouping of risk perception into four dimensions: climate, biological, financial and operational, defined from the discussion in the panel of experts. This definition overcomes the criticism that may arise from the construction of theoretical categories resulting from multidimensional reduction offered by statistical techniques.

The second innovation is the introduction of the latent construct *Institutions*, also introduced by Van Winsen et al. (2014), who empirically evaluated the farmers' intention to implement different common risk management strategies on their farms through a structural equation model using a conceptual model, based on the findings of the model proposed by Sitkin and Weingart (1995). This matched the findings of Tucker et al. (2010), Eakin et al. (2013) and Castellanos et al. (2013) who, in an analysis of risk perception and the adaptation ways of some coffee growing populations in Central America and Mexico, Tucker et al. (2010) concluded that the farmers' response is mainly idiosyncratic and restricted by external conditions.

Table 2

Construct Definition

Construct	Definition	Context	Source
<i>Outcome History</i>	Effect of success or failure resulting from past decisions taken by the agents	Experience and results of past decision of the 459 surveyed coffee growers	Sitkin and Weingart (1995)
<i>Problem Framing</i>	Influence of problem features on risk perceptions of agents	Characteristics of the problems faced by the 459 surveyed coffee growers during the last 10 years	Kahneman and Tversky (1979)
<i>Risk Propensity</i>	Agent tendency to take or avoid risks	Characterization of the tendency to take or avoid risks among coffee growers during the last 10 years	Sitkin and Pablo (1992)
<i>Risk Perception</i>	Individual assessment by the agents on how risky a situation is, and their trust in said assessment	Risk perception assessment of the 459 surveyed coffee growers, according to a Likert scale	Sitkin and Weingart (1995)
<i>Risk Management</i>	Set of strategies and alternatives faced by a decision-making agent	Set of strategies that could be taken by the coffee grower to manage risk	Sitkin and Pablo (1992)
<i>Institutions</i>	Set of risk management instruments offered to coffee growers by the institutions underlying the coffee sector	Set of risk management instruments, classified according to the risk type they manage	FNC (2013)

Note. Adapted from “Supply Chain Managers and Risk Behavior: Testing the Sitkin and Pablo Model” by, W. F. Thompson, 2015, (Doctoral Dissertation) Retrieved from Digitalcommons Database N. 10

Eakin et al. (2013) found that the environment could modify coffee grower behaviors and expand its capacity to face the risks, while Castellanos et al. (2013) suggested that association mechanisms could contribute to reduce them. The current research, following Sitkin and Weingart (1995) and Sitkin and Pablo (1992), synthesized these results into six latent constructs: *Outcome History*, *Problem Framing*, *Risk Propensity*, *Risk Perception*, *Risk Management* and *Institutions*, shown in Table 2.

The latent construct *Outcome History* captured the effect of successes or failures resulting from past decisions. According to Sitkin and Weingart (1995), prior success in risk-taking might increase the risk propensity, which matches the findings of March and Shapira (1987), Osborn and Jackson (1988), and Thaler and Johnson (1990), who found that decision makers would persist in assuming risks if previous risk-related actions were successful.

The latent construct *Problem Framing* captured the influence of the problem features on coffee growers' risk perceptions. That is, if situations are positively conceived, these would lead to risk-averse decisions, while negatively conceived situations lead to the pursuit of risk, as described by Kahneman and Tversky (1979) in their "prospect theory". Thus, the coffee grower features associated to perceiving different types of risks to which it might be exposed are idiosyncratic characteristics, according to Tucker et al (2010).

The latent construct *Risk Propensity* captured the tendency of the coffee grower to take or avoid risks. It influences the relative importance of the situational threat or opportunity and, therefore, leads to biased risk perceptions (Sitkin & Weingart, 1995). In this context, it is a feature that can change over time and it is an emerging feature of the coffee grower.

On the other hand, the latent construct *Risk Perception* captured the individual assessment of how risky a situation is and the confidence in that assessment. According to Sitkin and Weingart (1995), risk prevention is greater when high risks are perceived compared to when the agent perceives little risk, because there is nothing to lose. That is, higher levels of perceived risk would be negatively related to risky decision making, because the agent tends to associate risk with negative outcomes more strongly than with variability of results.

The latent construct *Risk Management* characterizes the alternatives faced by a decision maker. Sitkin and Pablo (1992, p.10) understood it as "the extent to which uncertainty on whether potentially significant and/or disappointing outcomes will result from decisions to be made". That is, to some extent, the risk component of the strategies available to the decision maker, thus being a latent factor to the set of strategic alternatives.

Finally, the latent construct *Institutions* captured the trust that exists in each of the risk management instruments, with these being grouped according to their nature, the

public and private institutions offering them, and the risks these manage into four categories, namely: climatic, biological, financial and operational, which allow coffee growers to manage these risks through their institutions

Appropriateness of Design

In the search for truth, scientists and all those interested in Science created the methods acting as guidelines to discover, or at least to move closer to know, both the ways in which nature operates and the essence of man as social being and its constructions. In the latter case, a series of discussions, debates and controversies have been generated about the potential scope of social and administrative sciences which, at the dawn of modernity, had two options: to imitate the natural sciences or to create an identity of their own. This debate led to the creation of the quantitative and qualitative paradigms (Corbetta, 2007).

According to Denzin and Lincoln (as cited by Creswell, Plano Clark, Gutmann & Hanson, 2003), the four paradigm alternatives for our inquiries: (a) positivism, (b) post-positivism, (c) interpretativism, (d) participatory/advocacy perspectives. Given the nature of the current research, it was required to describe the phenomenon from constructivism and quantifying the impact of factors using the positivist quantitative approach.

Constructivism proposes solutions to social problems from a subjective perspective, defining reality as too complex to be expressed in numbers only (Creswell et al., 2003).

In this sense, and according to Bonilla and Rodríguez (2005), “qualitative technique” refers to all research technique other than survey and experiment, which means an epistemological break with the positivist paradigm; mainly due to the manner knowledge is conceived, in the way such knowledge is acquired, and on the way of knowledge, moving from perceptions as a reflection for reality to knowledge on reality itself (Lakatos & Zapatero, 2007). That is, a technique that based on open interviews, discussion groups or observation and participating observation techniques, then takes care of collecting full

speeches from their subjects, followed by interpretation, analyzing relationships of meaning produced under such idiosyncrasy (Bonilla & Rodríguez, 2005). Thus, the importance of the qualitative approach for the current research lies on the possibility of capturing the experience of respondents for the optimal construction of taxonomies on risk management and risk management instruments.

Qualitative techniques to create taxonomies have been employed under multiple analysis contexts. Pérez, Molina and Lechuga (2013) used the qualitative method during the construction of a taxonomy that encompasses processing levels and knowledge domains to examine the executive training process. Mendoza, Zermeño and Zermeño (2013) proposed the use of the qualitative method to structure the taxonomy that allowed them to examine the relationship between cognitive abilities and mobile learning technologies. Finally, Sánchez, Borrell-Carrió, Parra, Danés and Gallego (2013) applied the qualitative method in the construction of taxonomies on risk studies in clinical security analysis for primary attention centers, managing to incorporate events usually unobserved by quantitative methods.

On the other hand, the quantitative paradigm attributes itself a world vision that is positivist, particularist, objective worldview, where according to Rand (1962), it is stated that reality exists as an absolute and objective subject where reason is the only means available to mankind for perceiving the reality where man is an end by itself that must exist for its own benefit, its existence being oriented towards results and abstraction. That is, it consists of a strong composition of elements and techniques, the measurement of these and the need of empirical testing on social facts, imitating natural sciences (Bonilla & Rodríguez, 2005).

Risk management has been also studied from quantitative methodological approaches. For example, Bielza (2004) used an analysis of variance to evaluate the

multiple risk management instruments used by farmers, concluding that the most effective instruments for farmers are futures and payment insurance. Amador et al. (2012) used a *vector auto-regression* (VAR) model with Cholesky identification, and the effects of shocks on international coffee price over GDP, household consumption and government spending were studied through impulse-response analysis. They argued it was necessary to strengthen institutions such as the FoNC and that:

The success of the Colombian coffee sector and its ability to face price shocks associated to the globalization of markets, in addition to the welfare of the actors linked to it, possess a formidable leverage in the Federation and the FNC, with several years of experience, of which other coffee growing countries lack (Amador et al., 2012, p. 49, free translation from the original Spanish).

On the other hand, Dorsey (1999) explored the existing relationship between diversification and production scale for the coffee industry in Kenya. By making use of *two-stage least squares* (2SLS) estimators on the information obtained from surveys, Dorsey (1999) found that, unlike the expected results, there is a high correlation between diversification and trade specialization. Meanwhile, Eakin et al. (2006) studied the reaction of farmers in Mexico, Guatemala and Honduras to the coffee crisis, incorporating multiple methods such as surveys, interviews, focus groups, and secondary data collection and analysis for each country, through which they found large differences in education, health, technology access and services related to crisis exits.

The following works stood out by their analysis on farmer exposure to the risks inherent to agriculture. Tucker et al. (2010) performed the first approach to a risk map of coffee growers and their relationship towards institutions, parting from surveys and semi-structured interviews, developing a broad overview on risks at the coffee sector in Central America. Another group is formed by the studies that made use of multifactorial analysis,

such as the one developed by Cardona et al. (2006). Based on this technique, these authors defined a set of environmental and socio-economic factors in the production process of coffee and bananas in Colombia, enabling comparisons between the two agricultural sub-sectors. The developments of Kanooni (2009), Sharpe (2010), Won (2010) and Zhang (2011) showed the confirmatory factor analysis of a SEM, extending the analysis and interpretation potential of factorial models. This expansion on the possibilities of this analysis enabled the application of SEM on the study of relationships between the variables targeted by the current research, that is, risk perceptions among small coffee growers and risk management instruments offered by institutions.

Meanwhile, Toma and Mathijs (2006) identified the factors underlying farmers' propensity to enter organic agriculture programs in a Romanian rural region. For this, they employed a structural equation model SEM with latent variables, using a specific dataset gathered from a survey deployed on agro-environmental farms in 2001. The SEM model showed that environmental risk perception was the most important factor when determining farmers' propensity to participate in ecologic agriculture programs.

Van Winsen et al. (2016) estimated a model following Sitkin and Pablo (1992), and Sitkin and Weingart (1995), by assuming that the decision of implementing certain risk management strategies would be determined by risk perceptions and risk attitude. This conceptual model was empirically tested by using SEM models, in order to understand the farmers' intent to implement multiple common risk management strategies in their farms located at the region of Flanders, in Belgium, where it was found that perceptions on the main risks associated to the agricultural business have a significant impact on the intention of applying any of the risk strategies under study, and that risk attitude holds a significant impact on the management of the same (Van Winsen et al., 2016).

Sitkin and Pablo (1992), and Sitkin and Weingart (1995) proposed a SEM model in order to reconcile contradictions about the effect of risk on organizational decision-making behavior. For this, risk perception and propensity were put in a central role on what had been previously recognized. Thus, these authors proposed that risk propensity dominates the real and perceived characteristics of the situation as a determinant of risk behavior.

According to Sitkin and Pablo (1992), many of the features previously introduced as having a direct influence on risk behavior actually had an indirect influence on it, through risk propensity and risk perception. Thompson (2015) evaluated the efficiency of the model developed by Sitkin and Pablo (1992) as a predictor of decisions taken by risk managers, finding that risk perception and propensity are not predictors of risk decisions by themselves. In this sense, the current study incorporated the effect of risk management instruments offered by the institutions underlying the coffee sector into the model proposed by Sitkin and Pablo (1992), and Sitkin and Weingart (1995), in order to find whether these delivered effective risk management to coffee growers and reduced their perceptions on the risks they are vulnerable to.

Research Questions

The research questions of the current study were:

To what extent do the results of past decisions affect risk propensity of coffee growers? To what extent are risk perceptions of coffee growers affected by the assessment of a risky situation as an opportunity or a threat?

To what extent do the results of past decisions taken by coffee growers determine their perception on the institutions underlying the sector?

To what extent does risk propensity of coffee growers affect their risk perceptions?

To what extent does risk propensity of coffee growers determine their risk management strategies?

Is there a significant relationship between the risk management services offered by the institutions underlying the coffee sector and risk perceptions of coffee growers?

Is there a significant relationship between the assessment of a risky situation as an opportunity or a threat by a coffee grower and its assessment of the institutions underlying the sector?

To what extent do the institutions underlying the coffee sector affect risk perceptions of an opportunity or threat situation faced by coffee growers?

To what extent is risk management affected by risk perceptions of coffee growers?

Population

Colombian coffee growers as a whole are defined by being mostly small-scale producers, whose unit of analysis is the majority of coffee growers in condition of vulnerability against the multiple risks faced by the sector, that are associated or affiliated to existing institutions within the sector. According to Tucker et al. (2010), this group of coffee growers included small-scale owners who rely exclusively on coffee bean production for survival, with entire families involved in agriculture. In this sense, the population targeted for the current research was formed by active coffee growers affiliated to the FNC in the 22 coffee-producing Colombian departments. This population totaled 383.978 coffee growers up to 2015.

Table 3

Target Population of the Research

Department	Number of federated coffee growers			Total
	Small	Mid	Large	
Antioquia	54415	1543	1013	56971
Bolivar	289	12	1	302
Boyacá	7322	54	4	7380
Caldas	23974	1349	739	26062
Caquetá	1469	60	2	1531
Casanare	1400	28	2	1430
Cauca	47682	411	89	48182
Cesar	5772	1451	221	7444
Chocó	126	0	0	126
Cundinamarca	21388	335	80	21803
Huila	54449	2898	574	57921
La Guajira	1170	291	41	1502
Magdalena	3395	706	234	4335
Meta	1355	38	3	1396
Nariño	25135	276	45	25456
Norte De Santander	12231	382	27	12640
Putumayo	111	0	0	111
Quindío	3105	700	508	4313
Risaralda	13232	1219	728	15179
Santander	19849	819	275	20943
Tolima	48825	2028	278	51131
Valle Del Cauca	15371	1689	760	17820
TOTAL	362065	16289	5624	383978

Note. Adapted from “Sostenibilidad en Acción 2013. Informe del Gerente General de la Federación de Cafeteros 2013” by FNC de Colombia, 2013.

Informed Consent

Information collection procedures took into account that institutional directors, coffee grower representatives and experts from private institutions and companies linked to the Colombian coffee sector read, understood and signed, as a proof of compliance, the informed consent displayed in Appendix D. The informed consent clearly states the research goals, as well as the procedures used for the survey and the interview, and a compromise of confidentiality on information and on the publication of study results. A copy of the informed consent remained in power of the informants, and the other copy has been filed by the researcher, since the only incentive was making study results available to respondents and to them was having the results of the study available when these were published.

Confidentiality

The researcher guaranteed total confidentiality to the coffee grower, as well as keeping anonymity of participants as an offered privacy compromise. Throughout survey transcription and Chapter 4 writing, the participants' names were omitted and data was displayed in an aggregated manner, intending to keep privacy. A copy of the informed consent remained in custody of the participants.

Sampling Frame

The sample size was determined through simple random sampling, which led to the survey being deployed on 459 coffee growers located in 16 of the 22 coffee growing departments in Colombia, as shown in Table 2. The universe of coffee growers employed to calculate the sample was 383.978. Seeking to obtain greater coverage, the random sample was distributed among Colombian coffee growing regions in a proportional fashion, according to coffee grower concentrations.

For the current research, simple random sampling was considered since population features are similar for different groups, thus allowing greater efficiency on the elaboration of data over the stratified random sampling used to discriminate the features of different population groups (Levy & Lemeshow, 2013). The sample size selection formula is described next:

$$n = \frac{N^2 \alpha^2 p q}{4}$$

With $N = 383.978$, an error margin $\alpha = 5\%$ and probability of success p and error q of 50% each. Finally, a sample of 459 coffee growers was selected, which were proportionally distributed among 16 of the 22 coffee growing departments.

Table 4

Sample Distribution

Department	Number of federated coffee growers	
	Total	Sample
Antioquia	56971	64
Bolívar	302	0
Boyacá	7380	7
Caldas	26062	26
Caquetá	1531	3
Casanare	1430	0
Cauca	48182	84
Cesar	7444	5
Chocó	126	0
Cundinamarca	21803	20
Huila	57921	65
La Guajira	1502	1
Magdalena	4335	4
Meta	1396	0
Nariño	25456	29
Norte De Santander	12640	7
Putumayo	111	0
Quindío	4313	0
Risaralda	15179	19
Santander	20943	24
Tolima	51131	90
Valle Del Cauca	17820	11
TOTAL	383978	459

Note. Taken from Sistema de Información Cafetero SICA (2015, May 5). Bogotá. Recovered from [https://www.federaciondecafeteros.org/clientes/es/servicios_para_el_cafetero/sistema_de_informacion_sica- 1/](https://www.federaciondecafeteros.org/clientes/es/servicios_para_el_cafetero/sistema_de_informacion_sica-1/)

Since sample size is an essential aspect in SEM, Iacobucci (2010) consider that although "...there was some thinking that strong, clean measures (...) would be somewhat compensatory for sample size, but while the number of variables per factor has an effect on improving fit statistics, its effect is modest compared to that of sample size" (Iacobucci, 2010, p. 91). In this sense, Iacobucci (2010) argue that there is likely to be bias in parameter estimates, but for three or more indicators per factor, this bias almost disappears in terms of reduced bias and even of the model being executed. With three or more indicators per factor, a sample size of 100 is usually sufficient for convergence and a sample size of 150 will usually be sufficient for a convergent and adequate solution (Iacobucci, 2010).

Vargas Halabí and Mora-Esquivel (2017) worried about it, and although the literature has not provided a conclusive answer to determine the number of cases required for an analysis

of SEM, Kline (2011) identified a great diversity of criteria that constitute a disjointed mass of literature that hinders the work of the researcher. To give some order for the purposes of this paper, these criteria have been grouped into four categories: (a) absolute number of cases (Hair, Black, Babin, & Anderson, 2014); (b) cases per parameter (Hair et al., 2014; Iacobucci, 2009; Kline, 2011); (c) cases per observed variable (Hair et al., 2014), and (d) statistical power (Cumming, 2012). All these criteria agree that, for sample size definition in SEM, a minimum of 200 observations must be averaged for a SEM of six latent constructs. This is consistent with the sample of 459 observations obtained through simple random sampling, which offers an overidentified model.

Geographical Location

This study took into account grain producers, FNC high executives, coffee representatives and executives at public and private institutions, as well as companies related to the coffee sector, located in 16 of the 22 Colombian coffee producing departments, namely: Antioquia, Boyacá, Caldas, Caquetá, Cauca, Cesar, Cundinamarca, Huila, Guajira, Magdalena, Nariño, Norte de Santander, Risaralda, Santander, Tolima, and Valle Del Cauca (FNC, 2013).

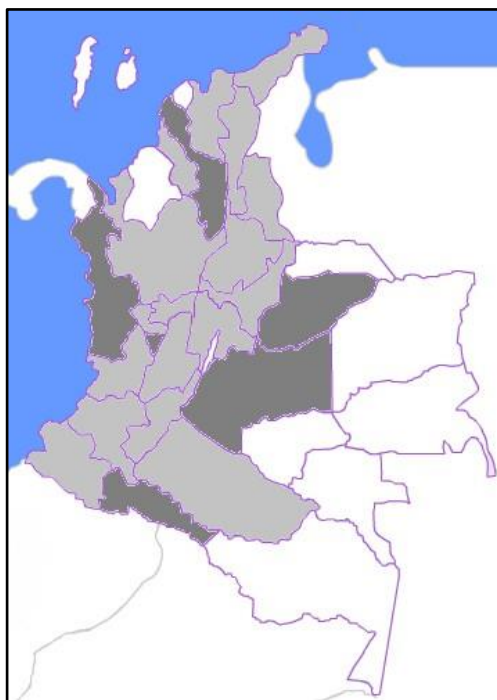


Figure 3 Geographical location. The 22 coffee growing departments are highlighted, with the 16 departments entered into the sample being highlighted in light grey.

Instrumentation

Each of the variables associated to the current research correspond to the observations performed through the survey and semi-structured interview found in appendices A and B. Both instruments were designed from previous studies (Bielza, 2004; Ramírez, et al., 2002; Tucker et al. 2010) from which the inventory of existing risks to which coffee growers are vulnerable, risk management instruments offered by institutions and risk perceptions of Colombian coffee growers, were created.

Table 5

Coffee growers' risk perception factors and variables

Factors	Risk perception variables
Climate risk	Agroclimatic, climate
Biological risk	Disease, natural inhabitants, plagues
Financial risk	Liquidity, debt, price, interest rates, commercialization, credit
Operational risk	Bad harvesting and post-harvesting practices, labor scarcity, public health, toxicology

Note. Adapted from “Perceptions of risk and adaptation: Coffee producers, market shocks, and extreme weather in Central America and Mexico,” by C. Tucker, H. Eakin and E. Castellanos, 2010. *Global Environmental Change*, 20: 23-32. “Informe final comisión de ajuste de la institucionalidad cafetera,” by L.F. Ramírez, G. Silva, L.C. Valenzuela, A. Villegas, and L.C. Villegas, 2002, Bogotá, Colombia: Comisión de ajuste de la institucionalidad cafetera.

The interview consisted of 30 questions applied on the panel of experts after signing the informed consent, from which an objective result on the risks faced by coffee growers and risk management instruments available at Colombian coffee sector institutions was obtained (Skjong & Wentworth, 2000; de Arquer, 1995). A panel of experts, usually employed to validate taxonomies (Gasca & Manrique, 2011), was summoned, which included directors, researchers and representatives of Colombian coffee sector institutions. 39 participants responded a semi structured interview of 30 questions, centered on identification of the risks coffee growers are vulnerable to, and risk management instruments available to Colombian coffee growers.

The participants went as follows: (a) the FNC was represented by the general manager, the technical manager, the commercial manager, the administrative manager, the communications and marketing manager, and ten executive directors; (b) Cenicafé was represented by its director and three researchers; (c) Expocafé was represented by its director; (d) coffee cooperatives were represented by twelve managers; (e) two representatives from public banks; (f) two representatives from commercial banks; (g) and three representatives from private exporters.

Table 6

Public and Private Institutions

Factors	Institutional variables
Private coffee institutions	Federación Nacional de Cafeteros, coffee grower cooperatives, Expocafé, Cenicafé, Fundación Manuel Mejía, Buencafé, Almacafé, Procafecol, Juan Valdez, Profesor Yarumo, Crece, EPSAGROS, ASOEXPORT, banks, insurers.
Public coffee institutions	Ministerio de Agricultura y Desarrollo Rural [Ministry of Agriculture and Rural Development], Ministerio de Hacienda y Crédito Público [Ministry of Finance and Public Credit], Ministerio de Comercio Exterior y Turismo, Departamento Nacional de Planeación [National Department of Planning], Procolombia, Superintendencia de Industria y Comercio [Superintendence of Industry and Commerce], Banco de la República [Bank of the Republic], Banco Agrario, ICA, SENA, Fondo Nacional del Café, Finagro, CAR, agricultural development secretaries.

Note. Adapted from “Sostenibilidad en Acción 2013. Informe del Gerente General de la Federación de Cafeteros 2013” by FNC de Colombia, 2013.

Of 18 institutions, 38.5% are public and 61.5% are private. Within private institutions, the FNC concentrates 85.9% of institutional agreements, followed by ASOEXPORT which has 8.1% of agreements. On public institutions, it was found that the one with the largest share of institutional agreements is the FoNC, which possesses 19.35% of risk management instruments and is managed by FNC; followed by the Ministry of Finance and Public Credit; Ministerio de Comercio, Industria y Turismo (Ministry of Trade, Industry and Tourism); and the Ministry of Agriculture and Rural Development with 16.13%, 16.13% and 11.29% of institutional agreements, respectively. Together with the National Department of Planning, these ministries are the ones representing State participation at the governance structure of the FNC.

Institutional structure at the coffee sector, and especially that of the FNC which concentrates 52.8% of risk management instruments, allowed the sector to face market flaws and positioning Colombian coffee in a high-quality segment. This institutional arrangement eases coffee grower risk management. The coffee sector counts with 161 risk management instruments, of which 99 are private, 85 of these being offered to coffee growers by the FNC. Also, among 62 public instruments, 12 are part of the FoNC, which is managed by FNC. That is, FNC manages 97 institutional agreements. Finally, these agreements were grouped into 26 risk management instruments in four categories, according to the managed risks.

In order to identify risk perceptions, these 26 instruments were included in a semistructured survey, adapted from the one applied by Tucker et al. (2005) on a group of Central American coffee growers. For the current study, the survey was conducted on 459 coffee growers of 16 Colombian departments considered as representatives of the 22 coffee growing departments, consisting of 172 questions; of these questions, 51 were Likert scales that allowed to obtain the categorical variables associated to risk perception and confidence

in institutions; 118 were dichotomous scales that gathered information for the dummy variables associated to profile and risk perceptions of Colombian coffee growers; and three open questions allowed to identify unobserved variables associated to coffee grower risk (see Appendix A). Besides the information collected through these instruments, secondary information from official documents and technical reports was obtained (Cenicafé-FNC, 2013; Fisher & Gravelet, 2013; FNC, 2011). This information validated the data obtained from the surveys.

Data Collection

Data on coffee growers was collected through a survey (see Appendix A) that was designed using the results obtained from the review of literature, which were validated by a panel of experts. Then, the next step consisted of training a group of agricultural engineers who applied the pilot survey on 20 coffee growers, thus leading to instrument validation, feedback and calibration. Finally, the survey was applied on a sample distributed to the 459 coffee producers in the mung 16 of the 22 Colombian coffee growing departments by agricultural engineers with experience in rural extension, throughout the period comprising November 2015 and February 2016, following the instructions defined in the instrument and the objective of the current study (see Appendix B).

Data Analysis

Data analysis at the current research was proposed in two stages, a qualitative stage and a quantitative one. The qualitative stage corresponded to the elaboration of the taxonomies on risk, institutions and risk management instruments. For this stage, a panel of experts was used to validate the taxonomy of risks and instruments created from literature. The taxonomy of 58 risks Colombian coffee growers were used to led to the creation of four risk groups: (a) climate risk; (b) biological risk; (c) financial risk; and (d) operational risk. Meanwhile, during the construction of the taxonomy on instruments, 161 risk

management instruments were identified, being grouped into 26 instruments that were classified into four risk management instruments according to the risks these managed.

The quantitative phase of the current research was developed in two stages. During the first stage, a Confirmatory Factor Analysis (CFA) was estimated for each of the six latent constructs: *Outcome History*, *Problem Framing*, *Risk Propensity*, *Risk Perception*, *Risk Management*, and *Institutions*. The manifest variables associated with each latent construct are described in Tables 7 to 12, and the correlation's matrix is displayed in the appendix H. Each CFA is estimated by maximum likelihood and evaluated both globally and in each of its coefficients. Standard errors of the standardized coefficients are calculated through bootstrapping with 5000 samples, using the bias-corrected percentile method, which offered the best results in hypothesis testing according to the comparison of three approaches evaluated by MacKinnon, Lockwood, and Williams (2004). The bootstrapping method does not rely on normality assumptions for the variables (Cheung & Lau, 2008), thus allowing it to offer better analysis possibilities for varied types of variables that are not necessarily normal. All CFA model estimations were performed using the software IBM SPSS AMOS v. 24.0.0.

In the second stage, the six latent constructs were integrated into a SEM that adapted the structural relations framework proposed by Sitkin and Pablo (1992) to the Colombian coffee context. Structural relations of the model are described in Figure 4, in which the observed variables describing the measure relations were omitted to facilitate reading and analysis. Like CFAs, the model is estimated through Maximum Likelihood and the hypothesis tests on the coefficients are evaluated through bootstrapping after 5000 simulations. As shown by Cheung and Lau (2008), bootstrapping provides results independent of the normality condition generally required by parametric procedures.

To determine the degree of effectiveness and the significant relationship between risk management offered by the institutions underlying the Colombian coffee sectors and risk perceptions of coffee growers, the current research estimated a SEM model formed by six latent constructs as described in the research design, following Sitkin and Pablo (1992), and Sitkin and Weingart (1995). The first construct, *Outcome History*, represents the history of successes and failures resulting from past decisions, and it is crucial to risk propensity (Sitkin & Weingart, 1995; March & Shapira, 1987; Osborn & Jackson, 1988; Thaler & Johnson, 1990). This construct answers Hypothesis 1, being built upon the variables introduced in Table 7.

Hypothesis 1: The more successful the results of past decisions taken by the coffee grower are, the greater its risk propensity will be.

Table 7

Observed Variables of the Latent Construct Outcome History

Index	Variable	Description
b32	<i>Agricultural practice</i>	This variable indicates that favorable results from agricultural practices lead to positive experiences that reinforce future positive or proactive behavior
b39	<i>Plague control</i>	This variable indicates that positive results increase optimism on the future of the productive unit
e1	<i>Price information</i>	This variable indicates frequent access to information by coffee growers
e19	<i>Climate damage</i>	This variable indicates the efficiency of decisions on climate change. Low efficiency might be related to higher climate risk and lower incomes in the future, as well as increased exposure to uncertainty due to natural events

Note. Adapted from “Determinants of risky decision-making behavior: A test of the mediating role of risk perceptions and propensity” by Sitkin and Weingart, 1995, *Academy of management Journal*, 38(6), 1573-1592.

The second construct is labelled as *Problem Framing*, representing the influence of idiosyncratic features of the problem on the risk perceptions of coffee growers. That is, if situations are positively conceived, these lead to risk averse decisions, and viceversa (Kahneman & Tversky, 1979). This construct corresponds to hypotheses 2 and 3, its latent variables being shown in Table 8.

Hypothesis 2: The assessment of a risky situation as an opportunity or a threat by a coffee grower determines its risk perception.

Hypothesis 3: The results of risky past decisions taken by the coffee grower

determine its assessment of the institutions underlying the sector.

Table 8

Observed Variables of the Latent Construct Problem Framing

Index	Variable	Description
b26	<i>Price-quality ratio</i>	This variable serves as a proxy for quality management issues, which have an impact on productive unit income
b28index	<i>Commercialization complexity</i>	This index averages commercialization difficulty causes, and measures commercialization system inefficiencies. A higher index value is associated to higher commercialization risks, which leads the most risk-averse coffee growers to negative shocks
b14	<i>Harvest losses</i>	This variable indicates whether the coffee grower had losses during the latest harvest
b47	<i>Quality issues</i>	This variable indicates whether the coffee grower had quality issues originating from the productive process

Note. Adapted from “Determinants of risky decision-making behavior: A test of the mediating role of risk perceptions and propensity” by Sitkin and Weingart, 1995, *Academy of management Journal*, 38(6), 1573-1592.

The third latent construct known as *Risk Propensity*, represents the tendency of coffee growers to take or avoid risks. It is an emerging feature of the coffee grower that might change over time. The construct corresponds to Hypothesis 4, and it is built on the variables introduced in Table 9.

Hypothesis 4: The greater the risk perceptions of coffee growers are, the higher the number of risk management strategies is.

Table 9

Observed Variables of the Latent Construct Risk Propensity

Index	Variable	Description
c3	<i>Staff</i>	This variable measures the number of workers in the small-scale productive unit
b3	<i>Area scaling</i>	This variable measures the adjustments performed on the cultivated area. It is taken as the response to positive or negative shocks, depending on the coffee grower's risk propensity
e21	<i>Income changes</i>	This dummy variable displays whether income increased or decreased during the last 10 years. If an individual shows a higher risk propensity score, this means the individual has been exposed to loss situations, becoming more risk averse due to a negative assessment of the future if optimistic, or positive if optimistic
c1	<i>Management time</i>	This variable determines coffee grower behavior regarding the number of hours dedicated to coffee farming

Note. Adapted from “Determinants of risky decision-making behavior: A test of the mediating role of risk perceptions and propensity” by Sitkin and Weingart, 1995, *Academy of management Journal*, 38(6), 1573-1592.

The fourth latent construct known as *Risk Perception* represents individual risk assessment given a situation, and the confidence on that assessment. That is, risk prevention is greater when risk perceptions are higher, compared to a scenario with low risk perceptions, as the latter lead to believe there is nothing to lose (Sitkin & Weingart, 1995). This construct corresponds to Hypothesis 9, formed by Likert scale measures, where larger values are associated with greater risk perceptions. These variables are displayed in Table 10

Hypothesis 9: Risk perceptions of coffee growers determine their risk management approaches.

Table 10

Observed Variables of the Latent Construct Risk Perception

Index	Variable	Description
e23risk_cl	<i>Climate risk impact</i>	These indexes were built using a combination of risk perception variables using Likert scales, measuring the degree of perception for each risk type. A higher index value indicates a greater perception for each risk type
e23risk_bio	<i>Biological risk impact</i>	
e23risk_fin	<i>Financial risk impact</i>	
e23risk_op	<i>Operational risk impact</i>	
e12index	<i>Context complexity</i>	This index averages coffee grower expectations and measures the problematic complexity degree the farmer has on the future, with higher index values indicating more negative expectations

Note. Adapted from “Determinants of risky decision-making behavior: A test of the mediating role of risk perceptions and propensity” by Sitkin and Weingart, 1995, *Academy of management Journal*, 38(6), 1573-1592.

The construct labelled as *Risk Management* featured the alternatives faced by a decision maker. Following Sitkin and Pablo (1992), it is, to some extent, the risk component of the strategies available to coffee growers, making it a latent factor to strategies. This construct corresponds to Hypothesis 5, formed by the variables introduced in Table 11, representing strategies developed by the coffee grower.

Hypothesis 5: The risk propensity level of coffee growers determines their risk management approaches.

Table 11

Observed Variables of the Latent Construct Risk Management

Index	Variable	Description
b44	<i>Fertilization</i>	This variable represents the response to production risks due to less soil nutrients
b45	<i>Soil analysis</i>	This variable represents the strategic long-term decision associated to coffee quality through soil care
c4	<i>Technical assistance</i>	This variable represents the short-term strategy that guarantees optimization, good practices in the productive process and quality of the final product
c6	<i>Assistance requirements</i>	This variable measures the assessment on technical assistance needs by coffee growers
d1	<i>Financial support</i>	Strategic short-term decision that allows coffee growers to operate under adverse conditions
Id7	<i>Coffee ID</i>	This variable represents the association level of coffee growers and their guild strategy

Note. Adapted from “Determinants of risky decision-making behavior: A test of the mediating role of risk perceptions and propensity” by Sitkin and Weingart, 1995, *Academy of management Journal*, 38(6), 1573-1592.

In addition to the described constructs, the creation of the construct *Institutions* was proposed, which described the effects of risk management instruments available to coffee growers. According to this construct, greater institutional trust is related to greater efficiency of institutions as risk management instruments. This latent construct corresponded to hypotheses 6, 7, and 8, its construction being presented in Table 12.

Hypothesis 6: The assessment of the institutions underlying the coffee sector is directly related to risk perceptions of coffee growers.

Hypothesis 7: The assessment of risky situations as an opportunity or a threat by a coffee grower determine its assessment of the institutions underlying the sector.

Hypothesis 8: The institutions underlying the coffee sectors affect risk perceptions of opportunity or threat situations faced by coffee growers.

Table 12

Observed Variables of the Latent Construct Institutions

Index	Variable	Description
e24index_bio	<i>Trust on biological risk instruments</i>	This variable represents trust on risk management instruments, offered by public and private institutions, employed to manage biological risks
e24index_oper	<i>Trust on operational risk instruments</i>	This variable represents trust on risk management instruments, offered by public and private institutions, employed to manage operational risks
e24index_cli	<i>Trust on climate risk instruments</i>	This variable represents trust on risk management instruments, offered by public and private institutions, employed to manage climate risks
e24index_fin	<i>Trust on financial risk instruments</i>	This variable represents trust on risk management instruments, offered by public and private institutions, employed to manage financial risks

Note. The combination of variables was performed following the taxonomies obtained during the qualitative stage (panel of experts), where risk instruments refer to the different institutions related to the Colombian coffee sector

Figure 4 displays the methodological structure of the model, including the six aforementioned latent variables and their respective observed variables.

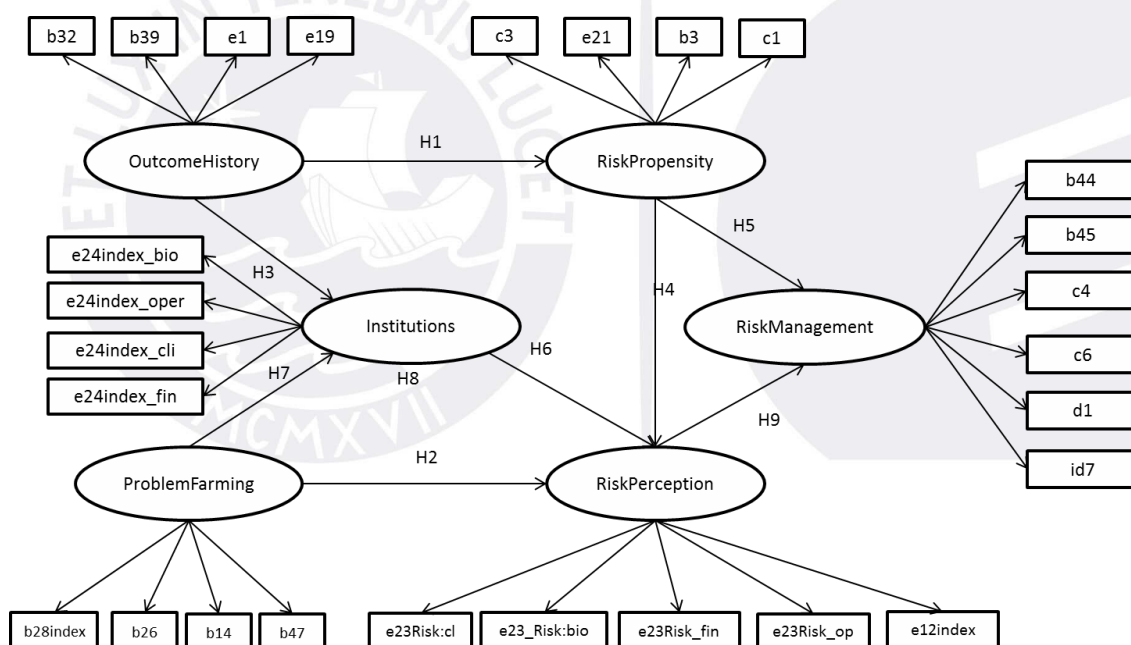


Figure 4. Theoretical structure of the SEM model

Validity and Reliability

After reviewing the methodological literature (Arbuckle, 2013; Hair et al., 2014; Véliz Capuñay, 2016), it was found that the most used indicators to evaluate model fit for SEM are: CMIN/DF ratio (*Minimum discrepancy*), GFI (*Goodness-of-Fit Index*) and AGFI

(*Adjusted Goodness-of-Fit Index*) indexes, and RMR (*Root Mean Square Residual*) and RMSEA (*Root Mean Square Error of Approximation*) indexes. The CMIN/DF ratio

corresponds to the quotient between the value χ^2 divided by its degrees of freedom. Véliz Capuñay (2016) considered that a value less than two for this quotient indicated that the covariance matrix derived from the model and the covariance matrix based on the data are close enough, thus the model adequately captures the relations between data (Véliz Capuñay, 2016, p.170). On the other hand, Van Winsen et al. (2016) considered that a value no higher than three for the CMIN/DF ratio is an acceptable result. In this research, the threshold of three proposed by Van Winsen et al. (2016, p.66) was adopted, as presented in Table 13: an indicator of 1.835 revealed that the model captured the relationships between data.

Table 13

CMIN/DF Ratio

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	61	532.031	290	.000	1.835
Saturated model	351	.000	0		
Independence model	26	3969.032	325	.000	12.212

Note. Adapted from “Determinants of risk behaviour: effects of perceived risks and risk attitude on farmer’s adoption of risk management strategies” by van Winsen F. et al. 2016, *Journal of Risk Research*, 19(1), 56-78.

*The ratio between the χ^2 value and its degrees of freedom is adjusted according to the propositions from “Análisis multivariante: métodos estadísticos multivariantes para la investigación” by Veliz Capuñay, 2016, Cengage. Buenos Aires.

The GFI (*Goodness-of-Fit Index*) and AGFI (*Adjusted Goodness-of-Fit Index*) indexes are goodness-of-fit measures designed by Jöreskog and Sörbom (1984) to evaluate a SEM estimated through maximum likelihood. The GFI index is one of the most employed measures and has a range between zero and one, where zero indicates that the model does not fit the observed covariance in the data, and one indicates that the model fits perfectly to the covariance in the data. AGFI is an adjustment to the GFI index based on the degrees of freedom. It has an upper limit of one, where it indicates perfect fit, but it does not have a

zero value as the lower limit. Véliz Capuñay (2016) considered that GFI and AGFI values above 0.90 are acceptable, whereas Van Winsen et al. (2016) used a threshold of > 0.95 as an acceptable fit value. Because the analysis of a model is not based on a single measure, but on a set of fit measures, 0.90 was defined as an acceptable value for GFI and AGFI.

Table 14 shows the goodness-of-fit of the model, with GFI = 0.914.

Table 14

Goodness-of-fit Measures

Model	RMR	GFI	AGFI	PGFI
Default model	.023	.914	.896	.755
Saturated model	.000	1.000		
Independence model	.091	.585	.552	.542

Note. Adapted from “Determinants of risk behaviour: effects of perceived risks and risk attitude on farmer’s adoption of risk management strategies” by van Winsen, F. et al. 2016, Journal of Risk Research, 19(1), 56-78.

The goodness-of-fit measures were adjusted according to the propositions “Análisis multivariante: métodos estadísticos multivariantes para la investigación” by Veliz Campuñay, C., 2016, Cengage. Buenos Aires.

RMR and RMSEA are measures based on residuals. RMR (*Root Mean Square Residual*) is the square root of the mean quadratic difference between the observed variances and the estimated variances under the assumption that the model is correct (Arbuckle, 2013, p.636). RMSEA (*Root Mean Square Error of Approximation*) is an adjustment measure that uses the population discrepancy function adjusted by the model’s complexity level. Both measures are better the closer these are to zero. Arbuckle (2013, p.624) and Véliz Capuñay (2016) considered that an RMSEA value of 0.05 or less would indicate a proper model fit in relation to degrees of freedom. However, Arbuckle (2013) also considered that values lower than 0.08 would indicate a reasonable approximation error, but models with RMSEA greater than 0.10 should not be used for analysis. Van Winsen et al. (2016) used a limit of 0.05 for RMR and 0.08 for RMSEA. In this study, the recommendations of Arbuckle (2013) were adopted, as presented in Table 15 with RMSEA = 0.043.

Table 15

Model RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.043	.037	.048	.984
Independence model	.156	.152	.161	.000

Note. The residual-based measures are adjusted according to the proposition from “IBM SPSS AMOS 22 Users’ Guide” by Arbuckle, J. L. 2013, IBM Corp.

It is important to note that a single goodness-of-fit measure is not enough to accept or reject a model. For model assessment in the current research, there is a simultaneous evaluation of statistical goodness-of-fit measures, but mainly theoretical considerations for model acceptance are considered. From the theoretical point of view, the models must have the signs and values appropriate to the theoretical precepts on which it was built. Summing up, theoretical considerations are also relevant, and sometimes they will prevail over statistical considerations.

Summary

In order to answer the proposed research questions, an explanatory research with a mixed (qualitative and quantitative) approach was developed, linking risk perceptions of coffee growers with risk management instruments offered by Colombian coffee institutions. Due of this, risk perceptions of coffee growers were identified, as well as the respective risk management instruments available from Colombian coffee sector institutions.

The newly created taxonomy on risks allowed to know the inventory of risks Colombian coffee growers are vulnerable to, thus enabling future studies to conduct evaluations on the sources behind these risks, aiming to improve risk management instruments. Also, the taxonomy on risk management instruments shall prove useful for other agricultural sectors with similar features to those of the Colombian coffee sector to implement a similar institutional structure. Collected information brings the chance to expand upon studies on the Colombian coffee sector by conducting traceability on

interviewed coffee growers, thus identifying the changes in risk perceptions over time. Meanwhile the proposed SEM model, which followed Sitkin and Weingart (1995), and Sitkin and Pablo (1992), synthesized these results into six latent constructs: *Outcome History*, *Problem Framing*, *Risk Propensity*, *Risk Perception*, *Risk Management* and *Institutions*. This allowed identifying the existing relationship between perceived risks, risk perceptions, and the effectiveness of risk management instruments offered by Colombian coffee sector institutions to coffee growers.



Chapter 4: Results

Based upon a sequential mixed research approach, with a qualitative phase of descriptive, non-experimental, cross-sectional nature, and a quantitative phase of descriptive, non-experimental, cross-sectional nature; the results of the current study are presented in three sections throughout this chapter: the first section introduces the characteristics of the population sample; the second section shows the descriptive results of the research, which emphasizes the taxonomies of risks and instruments that were used in the third part of the research; and finally, the results obtained with the SEM and the hypotheses tests are presented in the third section.

Sample characterization

The survey was applied on a selected sample of 459 coffee growers throughout the country, classified by region and size where the largest representation came from Tolima, Cauca and Huila with 19%, 18%, and 14% respectively, with 74% of respondents being male and 26% of them being females. The population universe from which the sample was extracted contains 383,978 individuals where 94.3% corresponds to small coffee growers, 4.2% are medium coffee growers, and 1.5% can be considered as large coffee growers. The sample n was selected using simple random sampling, with $N = 383.978$, an error margin $\alpha = 5\%$ and probability of success p and error q of 50% each.

The sample included participants from 16 of the 22 Colombian coffee growing departments, the highest shares going to those from Tolima, Cauca and Huila with 19%, 18%, and 14% respectively; 74% of respondents are male, and 26% are. In accordance with the proportions in the population universe, 95% of respondents are small-scale growers, 4% are mid-scale growers and only 1% are large-scale coffee growers.

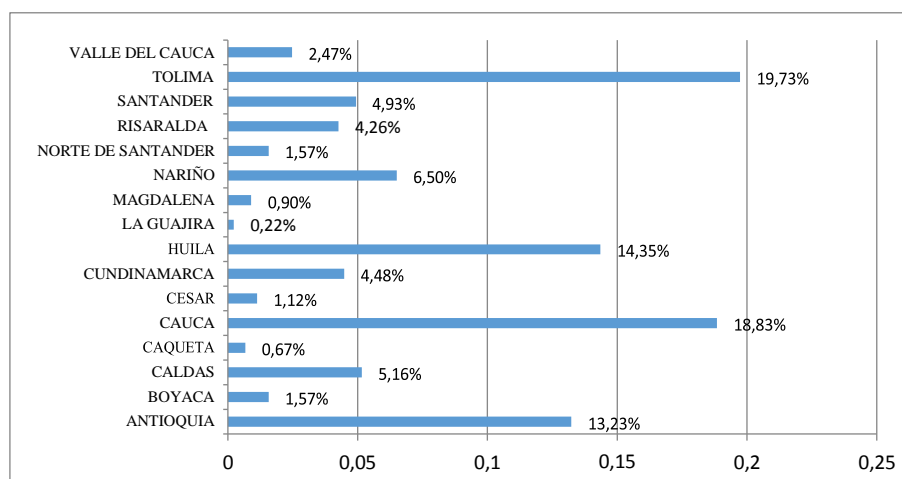


Figure 5 Sample distribution by department

For 86.9% of respondents, coffee growth is their main income source, while it represents a secondary income source for 13.1% of respondents, who make use of other sources for their main income.

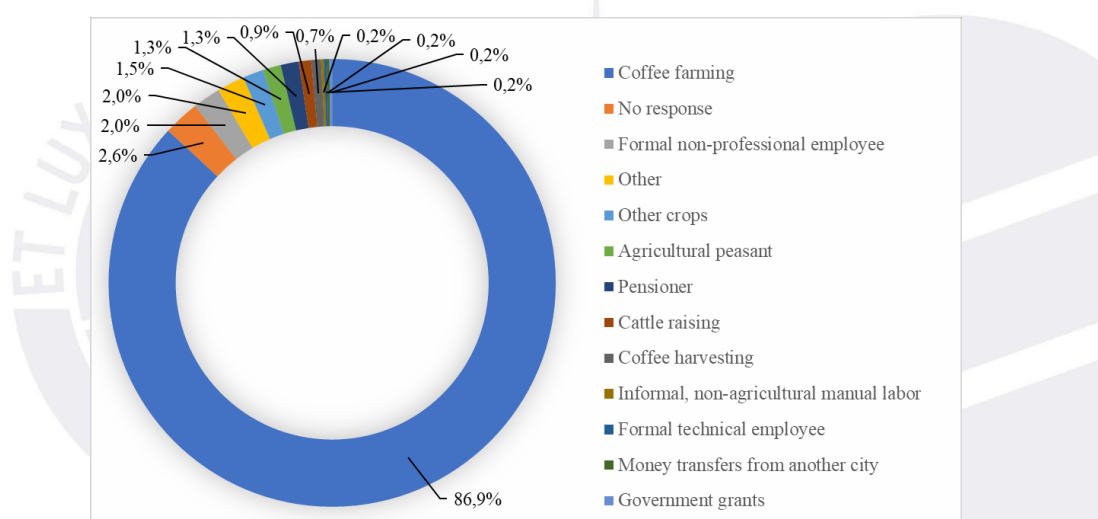


Figure 6 Main income source for coffee growers

Regarding the capital goods available to small coffee growers for carrying out their production processes, 72.9% of respondents own at least a motor depulper, 48.2% own a hopper, with a similar percentage owning a milling booth, 46% own a tub tank and 41.3% own a pit for coffee pulp treatment. It must be clarified that in section B, corresponding to coffee handling, respondents could select multiple processing equipment. Combining these categories, it could also be stated that 41% of respondents own a motor depulper and a tub tank at the same time, while 27% own a milling booth in addition to the former; 22%

of respondents own motor depulpers, tub tanks, milling booths and hoppers, and 15% of them own all of the above plus a pit for coffee pulp treatment.

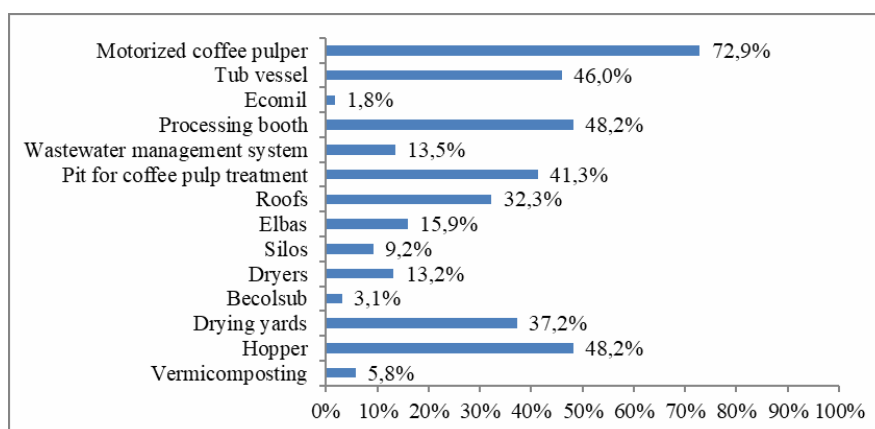


Figure 7 Processing equipment owned by Colombian coffee producers, measured as percentages.

On the other hand, the experience of responding coffee growers is evidence in the fact that 38% of respondents have at least 20 years of experience in coffee growth; 30% have between 10 and 20 years; 18% have between 5 and 10 years and 14% have less than 5 years of experience. Therefore, when asking them on the changes in cultivated soil during the last 10 years, it was found that 47% of respondents increased their coffee-cultivated area in the last 10 years; 38% did not change said area and 14% decreased the area dedicated to that crop.

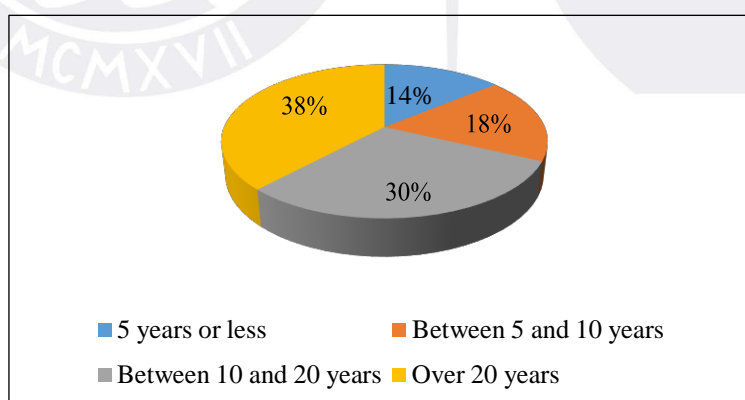


Figure 8 Experience years in coffee production of the responding coffee growers

Within the multiple reasons for the increases in the coffee-cultivated area, 70% of respondents stated that obtaining additional income led them to increase this area; followed by a 62% who mentioned good market prices and 50% who quoted good weather

conditions. In contrast, among the respondents that decreased the coffee-cultivated area during the last 10 years, 31% used the soil to grow other crops; 19% gave other activities to the soil, 17% converted to cattle raising or distributed the land between children; 13% sold the land and 5% built housing.

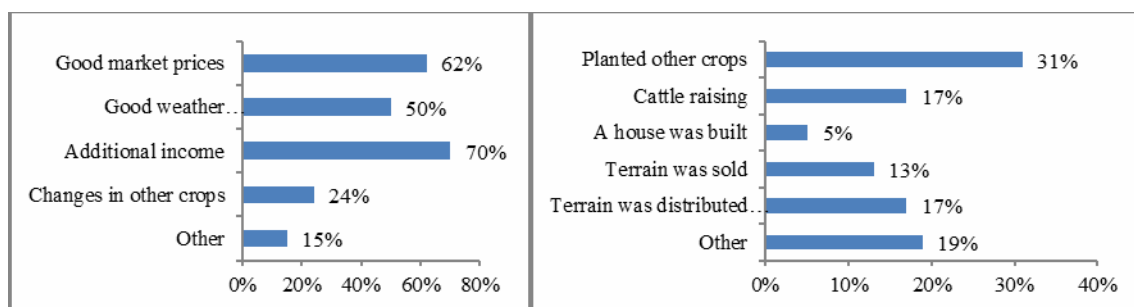


Figure 9 Reasons behind changes in coffee-cultivated hectares. The left figure shows the reasons behind increases in cultivated area, while the right figure shows the reasons behind decreases in coffee-cultivated areas.

Decisions linked to risk

Regarding the most representative risk factors, it was found that coffee growers decreased the area dedicated to coffee due to climate changes (47%); not having money for input (45%); lower coffee prices (44%), and plant diseases (39%).

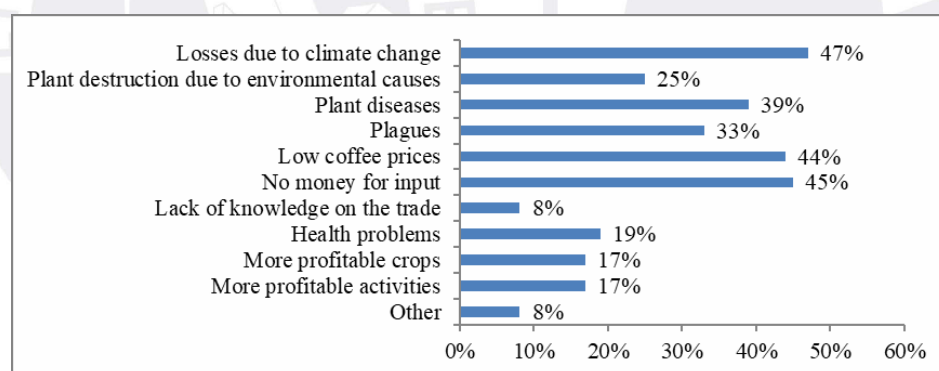


Figure 10 Causes related to risk, because of which coffee-cultivated area decreased.

Related to the former, Figure 11 shows the drivers behind Colombian coffee growers' losses during the last 10 years, where 61% of respondents had losses during harvest; while 33% experienced no loss and 6% declined from answering the question. The main drivers behind these losses were climate phenomena such as El Niño or La Niña in 53% of cases; followed by droughts in 40% of cases.

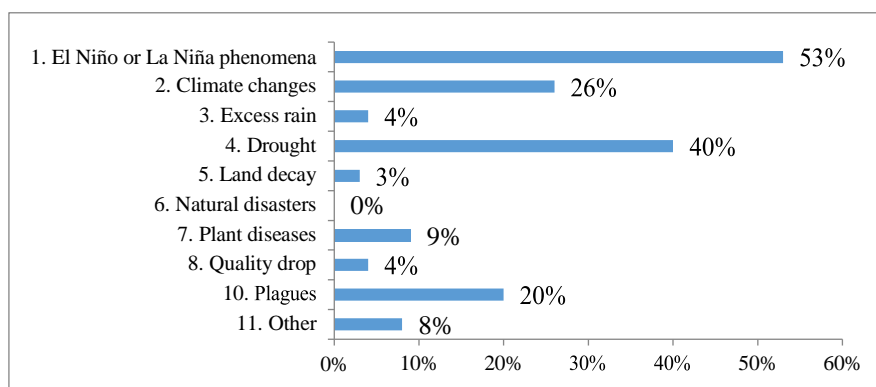


Figure 11 Main drivers behind Colombian coffee growers' losses

Coffee growers' issues

Average price for 125 Kg of coffee reached COP 675,591 during the latest harvests for 74% of respondents, where 61% was acquired by local distributors, 37% by coffee cooperatives, and 2% by associative distributing groups and others. 22% had an average price for 125 Kg of coffee of COP 740,000 as toasted coffee; 39% of respondents stated they received low prices due to quality issues, and 27% stated they have faced difficulties to sell their coffee. Among these difficulties, the most relevant ones correspond to quality issues on 75% of cases, prices in 61% of cases, bad road infrastructure in 40% of respondents, and other causes with 30%.

On crop management, 86% of respondents assured having changed their practices during the last 10 years; from these, 75% implemented soil conservation, while 42% began using agrochemicals. Among other implemented practices, adequate shade management and fertilization stand out. Meanwhile, 52% of coffee growers performed these changes due to technical recommendations from the extension service and, as a result, 57% of these stated that recommendations have been beneficial for productivity at their crops.

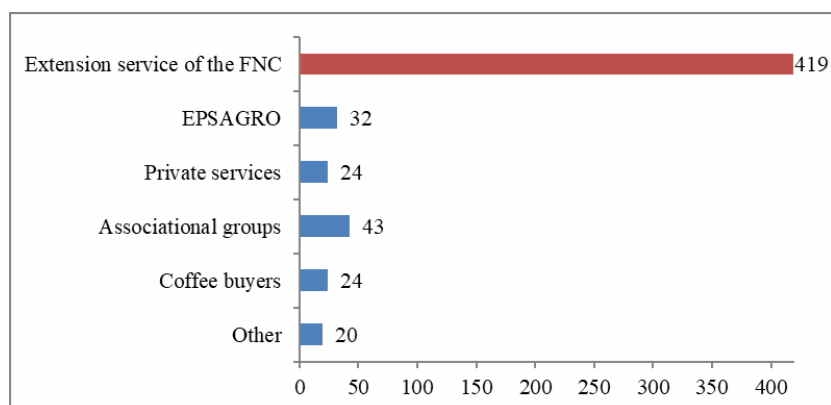


Figure 12 Institutions from which Colombian coffee growers receive technical assistance

Within the most representative risks in coffee plantations, most coffee growers (98%) have been affected by plague and disease at least once. Among these, 86% has been affected by the coffee borer beetle, 33% by the coffee leaf miner. Also, regarding natural plantation inhabitants, 43% of respondents have been damaged by leafcutter ants and 12% by mealybugs on coffee branches.

Just like technical assistance played an important role to coffee growers, financing Access does as well, since 68% of responding coffee growers have received some kind of financial support for their agricultural operation, and from these, 86% have received it through Banco Agrario, while 53% has obtained it from FNC. From this financing, 85% of respondents have had or have to pay interests on the loan they obtained, while 14% have not had to pay these. It is important to highlight the success of this financing, as 91% of respondents are currently up-to-date on their loans; due to the fact 77% received some sort of discount ranging between 15% and 40% on the total credit used.

Descriptive Results

Taxonomy of risks

The taxonomy of risks Colombian coffee growers are vulnerable to delivered 58 types of risk, grouped into four categories: (a) biological risk; (b) climate risk; (c)

operational risk and (d) financial risk. The taxonomy of risks is introduced in Tables 16 to 19:

Table 16

Biological Risks

Biological risks	
Plant diseases	Coffee leaf scorch (<i>Xylella fastidiosa</i>)
	Black rot (<i>Ceratocystis fimbriata</i>)
	Root rot (<i>Rosellinia bunodes</i> and <i>Rosellinia pepo</i>)
	Thread blight (<i>Corticium koleroga</i>)
	Pink disease (<i>Corticium salmonicolor</i>)
	Iron spot disease (<i>Cercospora coffeicola</i>)
	Anthraxnose (<i>Colletotrichum</i>)
	Phoma leaf spot (<i>Phoma</i> spp.)
	Nematodes
	South American leaf spot (<i>Mycena citricolor</i>)
Coffee rust (<i>Hemileia vastatrix</i>)	
Black root rot (<i>Rhizoctonia solani</i>)	
Natural inhabitants	Slug (<i>Colosius pulcher</i>)
	Brown twig beetle (<i>Xilosandrus morigerus</i>)
	Stem and root boorer (<i>Plagiohammus colombiensis</i>)
	Mealybug (<i>Planococcus citri</i>) on coffee branches
	Termite (<i>Comatermes perfectus</i>)
	Monkey slug (<i>Phobethron hipparachia</i>)
	Tobacco budworm (<i>Helicoverpa virescens</i>)
	Gregarious foliage beetle (<i>Ancistrosoma rufipes</i>)
	Jelly worm (<i>Paracruga argentea</i>)
	Fall armyworm (<i>Spodoptera frugiperda</i>)
	Leafcutter ant (<i>Atta cephalotes</i>)
	Bean slug (<i>Sarasinula plebeia</i>)
	Snouth moth (<i>Pococera hermasalis</i>)
White fly (<i>Aleurothrixus floccosus</i>)	
Plagues	Coffee red mite (<i>Oligonychus yothersi</i>)
	Coffee borer beetle (<i>Hypothenemus hampei</i>)
	Coffee chamusquina bug (<i>Monalonion velezangeli</i>)
	Mealybug on coffee roots
	Coffee bean weevil (<i>Araecerus Fasciculatu</i>)
Coffee leaf miner (<i>Leucoptera coffeellum</i>)	

Note. Adapted from “Informe Anual Cenicafé 2013” by Cenicafé, 2013, Blanecolor S.A.S Colombia, “Assessing the adaptation strategies of farmers facing multiple stressors: Lessons from the Coffee and Global Changes project in Mesoamerica” by Castellanos et al., 2013, Environmental Science & Policy. 20:23-32. And “Adaptation in a multi-stressor environment: perceptions and responses to climatic and economic risks by coffee growers in Mesoamerica” by Eakin et al., 2014, Environment, development and sustainability, 16(1), 123-139.

*The taxonomy on the 58 risk types in four risk categories obtained from literature and validated through a panel of experts.

Table 17 shows the classification of climate risks in two groups; the first one encompasses climate risks associated to climate change, greenhouse effect and weather

volatility. The second group includes those risks associated to agroclimatic risks such as hydric deficit, natural disasters, water erosion and hydric excess, among others.

Table 17

Climate Risks

Climate risks	
Climate	Global warming
	Climate change
	Greenhouse effect
	Weather volatility
Agroclimatic	Hydric deficit
	Natural disaster/phenomena
	Wind erosion
	Water erosion
	Hydric excess
	Solar brightness reduction
	Temperature

Financial risks were divided in two groups, the first one relating to economic factors such as commercialization, market prices, exchange rates, interest rates and demographics. On the other hand, those financial risk associated to credit and liquidity risks were grouped in the second group. The results are showed in Table 18.

Table 18

Financial Risks

Financial risks	
Economic	Commercialization
	Market prices
	Exchange rates
	Interest rates
	Demographics
Financial	Credit
	Liquidity

Finally, Table 19 shows operational risks as clasifised into three groups. The first group includes public health risks, such as infectious diseases, ergonomics and physical risks; the second group is formed by toxicological risks, related to agrochemical poisoning

factors. Finally, the third group was labelled as operational, involving human errors, labor scarcity, bad harvesting practices and bad post-harvesting practices.

Table 19

Operational Risks

Operational risks	
Public health	Infectious diseases
	Ergonomics
	Physical
Toxicological	Agrochemical poisoning
Operational	Human error
	Labor scarcity
	Bad harvesting practices
	Bad post-harvesting practices

Note. Adapted from “Informe Anual Cenicafé 2013” by Cenicafé, 2013, Blanecolor S.A.S Colombia, “Assessing the adaptation strategies of farmers facing multiple stressors: Lessons from the Coffee and Global Changes project in Mesoamerica” by Castellanos et al., 2013, Environmental Science & Policy. 20:23-32. And “Adaptation in a multi-stressor environment: perceptions and responses to climatic and economic risks by coffee growers in Mesoamerica” by Eakin et al., 2014, Environment, development and sustainability, 16(1), 123-139.

*The taxonomy on the 58 risk types in four risk categories obtained from literature and validated through a panel of experts.

Taxonomy of risk management instruments

Risk management instruments refer to the inventory of institutional agreements fulfilling different roles on risk management for coffee producers. Thus, the coffee sector counts with 161 risk management instruments, from which 99 are of private nature and 82 are offered by FNC to coffee growers (see Appendix G). Also, on 62 public instruments, 12 are part of the FoNC managed by FNC. That is, the FNC manages 97 institutional agreements. Finally, these were grouped into 26 risk management instruments, identified and distributed according to the type of risk managed by these.

Table 20

Biological risk Management Instruments

Instrument	Institution	Nature
Rural extension	FNC extension service	Private
Research and transfer	CENICAFÉ	Private
	CRECE	Private
Information systems	FNC extension service	Private
	CENICAFÉ	Private
	CRECE	Private
	Coffee Information System SICA	Private
	ICA	Public
	Ministry of Agriculture and Rural Development	Public
Technical assistance	EPSAGROS	Private
Technical assistance and financing	Rural development secretaries	Public
Research and diffusion	Ministry of Finance and Public Credit	Public

Note. The classification was created according to the risk managed by each of these instruments.

The first group refers to biological risk management instruments, such as rural extension, research and transfer, information systems, technical assistance and financing. These instruments seek to prevent biological risk for small coffee producing units.

Table 21

Climate Risk Management Instruments

Instrument	Institutional agreement	Nature
Rural extension	FNC extension service	Private
Research and transfer	CENICAFÉ	Private
	CRECE	Private
Information systems	FNC extension service	Private
	CENICAFÉ	Private
	CRECE	Private
	Coffee Information System SICA	Private
	ICA	Public
	Ministry of Agriculture and Rural Development	Public
	Bank of the Republic	Public

Note. The classification was created according to the risk managed by each of these instruments.

The second set comprises climate risk management through instruments such as rural extension, research and transfer, and information systems. These instruments manage the risks of coffee growers, aimed towards minimizing the effects of climate risk.

Table 22

Operational Risk Management Instruments

Instrument	Institutional agreement	Nature
Commercialization	FNC	Private
	Procafecol (Juan Valdez stores)	Private
Commercialization and export	FNC	Private
	Private exporters	Private
Media	FNC	Private
	“Las Aventuras Del Profesor Yarumo” TV show	Private
	Extension service	Private
Operation and logistics	ALMACAFÉ	Private
Industrial services	ALMACAFE and coffee grower cooperatives	Private
Educational processes	CRECE	Private
	Manuel Mejía Foundation	Private
	"Profesor Yarumo" character	Private
	SENA	Public
Regulation and control	Coffee inspections	Private
	FoNC	Public
	ICA	Public
	INCODER	Public
	Ministry of Agriculture and Rural Development	Public
	Superintendence of Industry and Commerce	Public
	Ministry of Finance and Public Credit	Public
	Bank of the Republic	Public
State representation	Ministry of Finance and Public Credit	Public
	Ministry of Agriculture and Rural Development	Public
	Ministry of Trade, Industry and Tourism	Public
Guild representation	Café de Colombia	Private
	Coffee ID	Private
	FNC	Private
	"Juan Valdez" character	Private
	Procafecol (Juan Valdez stores)	Private
	Extension service	Private
Social security	Extension service	Private
	BUENCAFÉ	Private
Productive processes with value added	EXPOCAFÉ	Private
	FNC	Private
	Procafecol (Juan Valdez stores)	Private
	Ministry of Trade, Industry and Tourism	Public
Value added	BUENCAFÉ	Private
	EXPOCAFÉ	Private
	Extension service	Private
	FoNC	Public

Note. The classification was created according to the risk managed by each of these instruments.

A third set comprises operational risk management instruments such as labor scarcity, bad practices, public health issues and lack of training, among others. These

include instruments such as commercialization, export, media, operations and logistics, educational processes, regulation and control, State representation, guild representation, social security and value added; these are needed to guarantee the development of the productive activity in the sector.

Table 23

Financial Risk Management Instruments

Instrument	Institutional agreement	Nature
Financing	Private banks	Private
	Coffee grower cooperatives	Private
	Extension service	Private
	Banco Agrario	Public
	FINAGRO	Public
	PRAN CAFETERO	Public
	INCODER	Public
	Ministry of Finance and Public Credit	Public
Export promotion	PROCOLOMBIA	Public
Purchase guarantee	FoNC	Public
Insurance	Insurers	Private
Commercialization	Coffee grower cooperatives	Private
Commercialization and export	ASOEXPORT	Private
	EXPOCAFÉ	Private
	FNC	Private
Consulting	Banco Agrario	Public
Payment methods	Coffee ID	Private
Public policies	CAR	Public
	ICA	Public
	INCODER	Public
	Ministry of Agriculture and Rural Development	Public
	Ministry of Trade, Industry and Tourism	Public
	Ministry of Finance and Public Credit	Public
	Ministerio de Salud y Protección Social [Ministry of Health and Social Protection]	Public
Financial backing	FOGACAFÉ	Public
	FAG	Public

Note. The classification was created according to the risk managed by each of these instruments.

The final set of instruments corresponds to those managing financial risk, with financial and economic risks standing out among the latter. The management of these risks guarantees the functioning of the commercial activities of coffee producers while minimizing the impact of risks such as price volatility and commercialization difficulties. In this group, there are instruments such as: insurance, commercialization,

commercialization and export, consulting, financing, export promotion, purchase guarantee, payment methods, public policies, and financial backing.

Perceived risks and risk management

The risks coffee growers are exposed to affect economic sustainability of the coffee sector. Factors such as the combination of price and yield, volatility, low household savings, climate change, disease, plague and operational risks, among others, put coffee growers in a vulnerable state (Giovannucci & Potts, 2008). However, the ability these factors have to damage coffee growers' profitability and sustainability is not equal. As the study had a cross-sectional nature, it was determined to measure risk perceptions of coffee growers as a proxy for the actual effect of each risk factor. Throughout this section, results describing the findings from the estimation of the SEM model laid out in Chapter 3 are shown.

Measurement models

The estimations were performed based on the surveys that were previously filled. This decreased the sample size from 459 to 434 observations, meaning a reduction of 5,45 % in the observations, thus having no major impact on the estimates. Throughout the following section, the measurement model results for each latent construct and the implications of these results shall be examined. Next, the structural model results and their implications on the hypotheses created in Chapter 1 shall be displayed.

Outcome history. The four observed variables associated to the construct *Outcome History*, and the respective loadings or standardized regression coefficients, are shown in Table 24. Even though the absolute values for the loadings are low for two of the observed variables, all of these are statistically significant, while also defining the latent construct in a satisfactory way as a whole. The individual significance of these coefficients is a proper

criterion for supporting the convergent validity of the construct in a statistical manner (Anderson & Gerbing, 1988).

Table 24

Measurement Model for the Latent Construct Outcome History

Item	Indicator	Standardized regression coefficient
Outcome of the change in agricultural practices compared to practices implementd ten years ago. (B32, Likert scale: 1: Very bad, 5: Excellent)	<i>Agricultural Practice</i>	0.519*** (0.165)
Efficacy of plague and disease control (B39, dichotomous: 0: No, 1: Yes)	<i>Plague Control</i>	0.202** (0.093)
Frequent access to coffee price information (E1, dichotomous: 0: No, 1: Yes)	<i>Price Information</i>	0.283*** (0.093)
Efficacy of actions to prevent climate damages (E19, dichotomous: 0: No, 1: Yes)	<i>Climate Damage</i>	0.400*** (0.112)

No. of indicators = 4, $\lambda = 0.060$, $\lambda = 0.060$, $\lambda = 0.453$, $\lambda = 0.453$, $\lambda = 0.003$, $\lambda = 0.003$
The value in parentheses corresponds to the standard error of the coefficient, obtained from bootstrapping with 5000 subsamples.

* indicates significance at 10% level.
** indicates significance at 5% level.
*** indicates significance at 1% level.

The coefficients of the observed variables *Agricultural Practice*, *Plague Control*, *Price Information* and *Climate Damage* introduced in Table 24 indicate that successful experiences in agricultural practice changes, plague control, price information access and climate damage prevention are positively and significantly associated to high values for the construct *Outcome History*. This allows stating that the construct can be defined as an indicator of the success of decisions and actions taken by the coffee grower in the past. Increasing values for the factor indicate better decisions and experiences from the coffee grower in relation to the context or environment, and lower values for the construct are associated to lower gratification or more frustrating experiences for the coffee grower.

Problem Framing. Just like the previous construct, the four observed variables associated to the latent construct *Problem Framing*, and their respective loadings or standardized regression coefficients, are shown in Table 25. The coefficients for the observed variables

Commercialization Complexity, *Price-Quality Ratio*, *Harvest Losses* and *Quality Issues* are all statistically significant, while also defining the latent construct in a satisfactory way as a whole. The coefficients represent a proper criterion for supporting the convergent validity of the construct in a statistical manner (Anderson & Gerbing, 1988).

Table 25

Measurement Model for the Latent Construct Problem Framing

Item	Indicator	Standardized regression coefficient
Causes originating difficulties in coffee commercialization. (B28index, continuous scale on interval [0,1] where 1 indicates all causes identified by the experts create difficulties simultaneously.)	<i>Commercialization Complexity</i>	0.510*** (0.045)
Quality issues at the time of sale that affected the price (B26, dichotomous: 0: No, 1: Yes)	<i>Price-Quality Ratio</i>	0.603*** (0.051)
Losses during the latest harvest (B14, dichotomous: 0: No, 1: Yes)	<i>Harvest Losses</i>	0.459** (0.050)
Quality issues originating from the productive process (B47, dichotomous: 0: No, 1: Yes)	<i>Quality Issues</i>	0.629** (0.045)

$\chi^2 = 10.092$, $df = 5$, $p = 0.000$, $RMSEA = 0.300$, $\chi^2/df = 2.018$, $CFI = 0.998$, $GFI = 0.998$, $NFI = 0.998$, $TLI = 0.998$, $IFI = 0.998$, $HLI = 0.998$. The value in parentheses corresponds to the standard error of the coefficient, obtained from bootstrapping with 5000 subsamples.

* indicates significance at 10% level.

** indicates significance at 5% level.

*** indicates significance at 1% level.

These values indicate that the influence of idiosyncratic features on the problem of risk perceptions by coffee growers lead coffee growers to take risk averse decisions if these are positively conceived situations, as proposed by Kahneman and Tversky (1979). This leads to state that the construct *Problem Framing* may be defined as a risk aversion indicator. Thus, higher values for the factor indicate greater risk aversion.

Risk Propensity.

The four observed variables associated to the latent construct *Risk Propensity*, and their respective loadings or standardized regression coefficients, are shown in Table 26. All coefficients are significant and define the latent construct as a whole in a satisfactory fashion. The coefficients for the observed variables *Staff*, *Area scaling*, *Income changes*

and *Management time*, represent a proper criterion for supporting the convergent validity of the construct in a statistical manner (Anderson & Gerbing, 1988), representing the tendencies coffee growers have when taking or avoiding risks.

Table 26

Measurement Model for the Latent Construct Risk Propensity

Item	Indicator	Standardized regression coefficient
Staff size. (C3, Ordinal scale: -1: decreased, 0: unchanged, 1: increased)	<i>Staff</i>	0.776*** (0.049)
Area dedicated to coffee growth (B3, Ordinal scale: -1: decreased, 0: unchanged, 1: increased)	<i>Area scaling</i>	0.546*** (0.052)
Changes in economic income (E21, Ordinal scale: -1: decreased, 0: unchanged, 1: increased)	<i>Income changes</i>	0.437*** (0.050)
Time dedicated to coffee plantation management (C1, Ordinal scale: -1: decreased, 0: unchanged, 1: increased)	<i>Management time</i>	0.589*** (0.051)

The value in parentheses corresponds to the standard error of the coefficient, obtained from bootstrapping with 5000 subsamples.

* indicates significance at 10% level.

** indicates significance at 5% level.

*** indicates significance at 1% level.

Risk Perception. The five observed variables associated to the latent construct *Risk Perception* and their respective regression coefficients are shown in Table 27. All coefficients are statistically significant and define the latent construct as a whole in a satisfactory way. The coefficients for the observed variables *Biological Risk Impact*, *Financial Risk Impact*, *Operational Risk Impact*, *Climate Risk Impact* and *Context Complexity*, support the convergent validity of the construct in a statistical manner. These represent the individual assessment of risk in a situation and the trust on that assessment (Sitkin & Weingart, 1995).

Table 27

Measurement Model for the Latent Construct Risk Perception

Item	Indicator	Standardized regression coefficient
Average impact of biological risks on coffee production. (E23risk_bio, Likert scale: 1: minimum, 5: maximum)	<i>Biological risk impact</i>	0.557*** (0.065)
Average impact of financial risks on coffee production. (E23risk_fin, Likert scale: 1: minimum, 5: maximum)	<i>Financial risk impact</i>	0.459*** (0.067)
Average impact of operational risks on coffee production. (E23risk_op, Likert scale: 1: minimum, 5: maximum)	<i>Operational risk impact</i>	0.616*** (0.073)
Average impact of climate risks on coffee production. (E23risk_cl, Likert scale: 1: minimum, 5: maximum)	<i>Climate risk impact</i>	0.315*** (0.074)
Environment complexity perception (E12Index, continuous scale on an interval [0, 1] where 1 is the highest complexity perception due to the perceptions on all economic and environmental pressures.)	<i>Context complexity</i>	0.256*** (0.064)

No. of FA indicators = 30, $R^2 = 0.098$, $U^2 = 5.37$, $RMSEA = 0.000$, $CFI = 0.038$, $GFI = 0.977$, $NFI = 0.930$, $TLI = 0.964$, $IFI = 0.985$, $TLI = 0.998$. The value in parentheses corresponds to the standard error of the coefficient, obtained from bootstrapping with 5000 subsamples.

* indicates significance at 10% level.

** indicates significance at 5% level.

*** indicates significance at 1% level.

Risk Management. Regarding the latent construct *Risk Management*, five observed variables and their respective regression coefficients define the latent construct as a whole. The loadings for the observed variables *Fertilization*, *Soil Analysis*, *Technical assistance*, *Financial Support* and *Coffee ID* are displayed in Table 28. These variables are defined as a set of strategies characterizing the alternatives available to a decision maker when faced with risk situations. Following Sitkin and Pablo (1992), it is the risk component of the strategies available to coffee growers and, as such, strategies are positively and significantly associated to the latent construct *Risk Management*. This leads to state that the latent construct might be defined as an indicator of the decisions of coffee growers when faced with risk situations.

Table 28

Measurement Model for the Latent Construct Risk Management

Item	Indicador	Coefficiente estandarizado de regresión
Production improvement activities through fertilizers. (B44, dichotomous: 0: No, 1: Yes)	<i>Fertilization</i>	0.575*** (0.083)
Soil analysis before fertilization activities (B45, dichotomous: 0: No, 1: Yes)	<i>Soil Analysis</i>	0.295*** (0.045)
Receives technical assistance (C4, dichotomous: 0: No, 1: Yes)	<i>Technical assistance</i>	0.650*** (0.084)
Receives financial support for coffee production (D1, dichotomous: 0: No, 1: Yes)	<i>Financial Support</i>	0.408*** (0.054)
Owens a Coffee ID (ID7, dichotomous: 0: No, 1: Yes)	<i>Coffee ID</i>	0.211*** (0.087)

The value in parentheses corresponds to the standard error of the coefficient, obtained from bootstrapping with 5000 subsamples.

* indicates significance at 10% level.

** indicates significance at 5% level.

*** indicates significance at 1% level.

Institutions. Table 29 displays the loadings or regression coefficients of the five latent variables associated to the latent construct *Institutions*. The coefficients for these latent variables, *Trust on biological risk instruments*, *Trust on operational risk instruments*, *Trust on climate risk instruments* and *Trust on financial risk instruments*, support the validity of the construct in a statistical manner and represent the multiple types of risk as displayed on Tables 20 to 23. The loadings for the observed variables of the latent construct *Institutions* are positively related to the construct, thus showing that the higher the values for the latent variables, the greater the value of the construct is, translating into greater trust on the institutions underlying the Colombian coffee sector when managing the risks faced by coffee growers.

The mediation analysis strategy follows the four steps suggested in Baron and Kenny (1986); James and Brett (1984); and Judd and Kenny (1981). The first step, related to the assessment of the correlation between the causal variable and the outcome variable, refers to the analysis of the effect *Problem Framing* has on the construct *Risk Perception* in the model proposed by Sitkin and Pablo (1992). The relationship was verified on a restricted model where the mediating variable *Institutions* was absent (Base model: without a moderating variable). Figure 13 shows the dependency relationships or paths of the model with continuous arrows, and the paths related to the mediation are represented as discontinuous arrows. In the base model, the construct *Institutions* and the discontinuous arrows are either absent or with their parameters set to zero. In the extended model, both the construct *Institutions* and its relationships with the other constructs *Outcome History*, *Problem Framing* and *Risk Perception* are unconstrained model components that must be estimated through the selected optimization method.

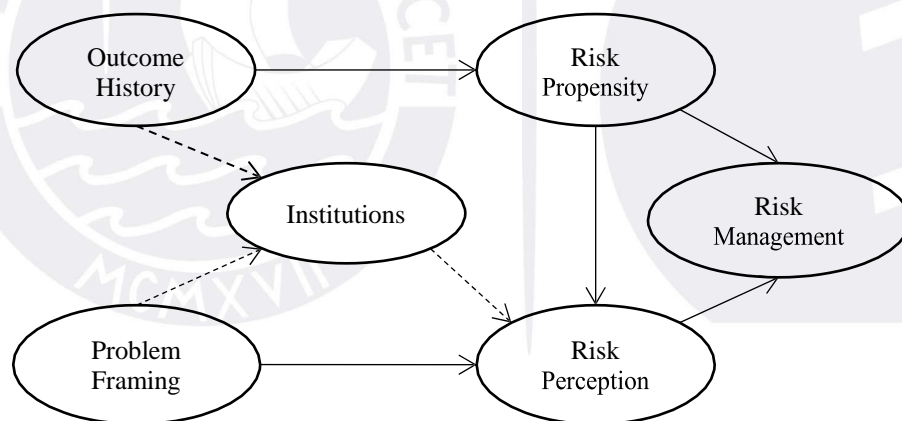


Figure 13 Structural model with the incorporation of the mediating variable *Institutions*

Base model results, summarized in the first row of Table 30, indicate a proper fit to data, while the structural relationship coefficient measuring the impact of *Problem Framing* over the construct *Risk Perception* (third row of Table 30) indicates that the relationship is both statistically significant and theoretically consistent. That is, higher risk values in *Problem Framing* are related with a higher risk perception level, *Risk Perception*, by the

coffee grower. This agent sensitivity to different intensity levels of the phenomenon and its risk features might lead them towards strategies with a greater immunizing effect, or towards decisions related with the postponement of investment projects (Pindyck, 1988).

In the three steps afterwards, the mediating variable was introduced, also declaring its relationship with both the causal variable and the outcome variable. For the case of the current research, the latent variable *Institutions* was entered as a mediating variable on the relationship between *Problem Framing* and *Risk Perception* levels. For the second step, the mediating and causal variables were related, by measuring the relationship between *Institutions* and the construct *Problem Framing* to identify the importance of the mediating construct on the explanatory variable. The relationship between the response variable, *Risk Perception*, and the mediating variable, *Institutions*, was analyzed during the third step. In the fourth and final step, the mediation was theoretically and statistically analyzed based on the results of the previous steps. The steps two to four were performed on the extended SEM model including the variable *Institutions*, as shown in Figure 14.

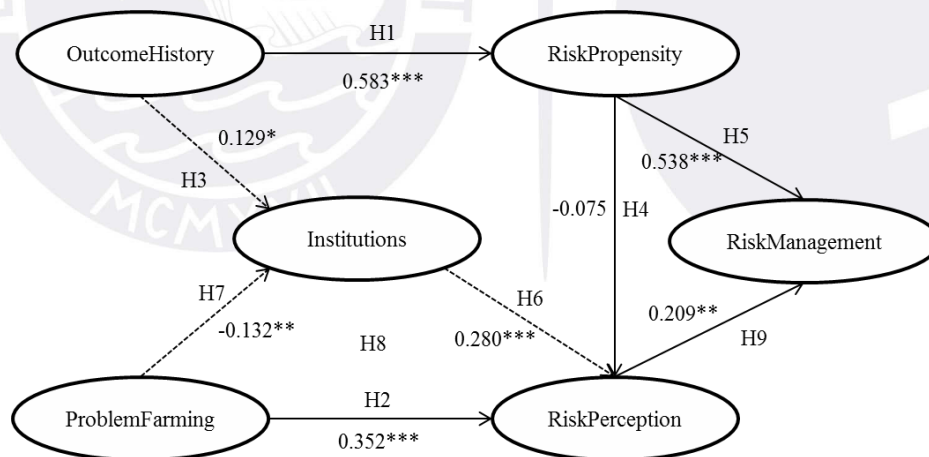


Figure 14 Results of the extended model with the mediating variable *Institutions* and the related hypotheses

Model comparison through model global fit indicators delivered results that favored the addition of the latent construct *Institutions*. As shown in Table 30, fit for the extended model introduced in Figure 15 created changes on fit indicators while remaining

satisfactory. Two of these, CMIN/DF and CFI, showed the extended model as the best one: CMIN/DF went down from 1.89 to 1.84 and the CFI index increased from 0.836 to 0.934. Except for AGFI, the other indicators did not show substantial changes on fit levels. Even though GFI and AGFI decreased, fit levels remained satisfactory after introducing the construct *Institutions*.

Table 30

SEM Models Related with Institutional Moderation

Model	CMIN	DF	P-val	CMIN/DF	RMR	GFI	AGF I	CFI	RMSEA
Base model: without a moderating variable	384.82	204	0.00 0	1.89	0.02 2	0.92 7	0.91 0	0.83 6	0.044
Extended model: with a moderating variable	532.03	290	0.00 0	1.84	0.02 3	0.91 4	0.89 6	0.93 4	0.043

Note. CMIN is the χ^2 statistic once the SEM model has been optimized, DF is the number of degrees of freedom, P-val is the significance level of the CMIN statistic with DF degrees of freedom. RMR, GFI, AGFI, CFI, RMSEA are goodness-of-fit statistics of the model on the data explained at the beginning of the section.

Hypotheses Testing

Estimates of the structural coefficients for both the base and the extended models are shown in Table 31. Correlations found in the base model validated the capacity of the model proposed by Sitkin and Pablo (1992) to capture the relationships found in the context of the Colombian coffee grower. Except for the coefficient of the path from *Risk Propensity* to *Risk Perception*, the other coefficients of the base and extended models were statistically significant and theoretically consistent.

For the first research question: To what extent do the results of past decisions relate with risk propensity of coffee growers? Hypothesis 1 was tested: *The more successful the results of past decisions taken by the coffee grower are, the greater its risk propensity will be.* As a result, the model shows that the relation between the latent construct *OutcomeHistory* and *RiskPropensity* is positive. The estimated coefficient of (0.583) for structural regression relationship, with a significance level ($p < 0.095$), indicates that risk

propension of the agents was reinforced by successful decisions on their own domain. During a review of the prospect theory of Kahneman and Tversky (1979), Sitkin and Pablo (1992) had already identified this type of result as plausible. Besides, the empirical studies of Taylor, Hall, Cosier, and Goodwin (1996); Cho and Lee (2006) and van Winsen et al. (2016) on the impact of experience on agent risk propensity validate the result obtained for this coefficient, thus confirming Hypothesis 1 is supported on the variable nature of risk propension and its dependence on past experiences of the agent.

For the second research question: To what extent are risk perceptions of coffee growers related with by the assessment of a risky situation as an opportunity or a threat? Hypothesis 2 was tested: *The assessment of a risky situation as an opportunity or a threat by a coffee grower determines its risk perception.* The significant coefficient obtained from (0.352) suggests a positive with a significance level ($p < 0.085$) and statistically discernible relationship between both constructs. In other terms, data support Hypothesis 2 and lead to conclude that agents have conceptual frameworks for problem analysis that allow them to identify different risk levels associated to a given decision situation. Summing up, the agent or producer is sensitive to environmental features, such sensitivity determining its behavior.

For the third research question: To what extent do the results of past decisions taken by coffee growers determine their perception on the institutions underlying the sector? Hypothesis 3 was tested: *The results of risky past decisions taken by the coffee grower determine its assessment of the institutions underlying the sector.* The statistically significant and positive coefficient obtained for the path from *Outcome History* to *Institutions*, amounting (0.129) with a significance level ($p < 0.066$), supported this relationship proposed in Hypothesis 3. This indicates that perceptions on institutional arrangement effectiveness is assessed as the capacity of institutions and the current rules to

mitigate or cover the multiple risk dimensions a farmer is subject to. Successful experiences in the past must be correlated with positive evaluations of the institutional apparatus.

For the fourth research question: To what extent does risk propensity of coffee growers affect their risk perceptions? Hypothesis 4 was tested: *The greater the risk perceptions of coffee growers are, the higher the number of risk management strategies is.* The not significance in the estimated coefficient of (-0.075) for the path from *Risk Propensity to Risk perception*, seemed to question the validity of the relationship proposed in Hypothesis 4, the negative sign is consistent with the arguments of Sitkin and Pablo (1992), Sitkin and Weingart (1995) and the empirical results obtained by Cho and Lee (2006) and Van Winsen et al. (2016). That is, the greater the risk perception of the coffee grower, the higher the number of risk management strategies

Table 31
Estimated Coefficients for Structural Relationships

Path (Independent → Dependent)	Hypothesis	Base model	Extended model
Outcome history → Risk propensity	H1	0.611*** (0.093)	0.583*** (0.095)
Outcome history → Institutions	H3		0.129* (0.066)
Problem framing → Risk perception	H2	0.318*** (0.088)	0.352*** (0.085)
Problem framing → Institutions	H7		-0.132** (0.057)
Institutions → Risk perception	H6, H8		0.280*** (0.065)
Risk propensity → Risk perception	H4	-0.063 (0.080)	-0.075 (0.076)
Risk propensity → Risk Management	H5	0.540*** (0.069)	0.538*** (0.069)
Risk perception → Risk Management	H9	0.229** (0.097)	0.209** (0.093)

Note. The values in the upper section of each cell correspond to maximum-likelihood estimates. The values in parentheses are the standard errors calculated through bootstrapping with 5000 subsamples. * indicates significance at 10% level, ** indicates significance at 5% level, and *** indicates significance at 1% level.

coefficient estimated for the path from *Institutions* to *Risk Perception* (0.280) with ($p < 0.065$) (see Table 31) indicated that better valued institutions are positively correlated with risk perception levels. This result validates Hypothesis 6.

For the seventh research question: Is there a significant relationship between the assessment of a risky situation as an opportunity or a threat by a coffee grower and its assessment of the institutions underlying the sector? Hypothesis 7 was tested: *The assessment of risky situations as an opportunity or a threat by a coffee grower determine its assessment of the institutions underlying the sector.* The coefficient estimated for the path from *Problem Framing* to *Institutions* (-0.132) with ($p < 0.057$) indicated that cognitive schemes with higher risk levels are related to lower scores for the institutional arrangement. This result validates the Hypothesis 7.

For the eighth research question: To what extent do the institutions underlying the coffee sector affect risk perceptions of an opportunity or threat situation faced by coffee growers? Hypothesis 8 was tested: *The institutions underlying the coffee sectors affect risk perceptions of opportunity or threat situations faced by coffee growers.* The significant coefficients for the path from *Outcome History* to *Institutions* (0.129) with ($p < 0.066$), and the path from *Institutions* to *Risk Perception*, (0.280) with ($p < 0.065$), as well as an increase on risk perceptions after incorporating the mediating variable, from 0.318 to 0.352 against *Problem Framing*, and from (-0.063) to (-0.075) against *Risk Propensity*, demonstrated that institutions affect risk perceptions of coffee growers through the instruments they offer to the latter. The above validates Hypothesis 8.

Finally, for the ninth research question: To what extent is risk management affected by risk perceptions of coffee growers? Hypothesis 9 was tested: *Risk perceptions of coffee growers determine their risk management approaches.* The significant coefficient (0.209) with ($p < 0.093$) for the path from *Risk Perception* to *Risk Management* also indicate a

statistically significant impact, albeit of lower magnitude than the one estimated for Hypothesis 5, of *Risk Perception over Risk Management*. Both coefficients and their respective hypotheses lead to conclude that risk management of coffee growers is a function of both their risk propensity and their risk perceptions during decision situations. Both constructs are variables and functions of both coffee grower experience and their mental framework to analyze and take decisions under risk contexts. Under these terms, coffee grower behavior can be described from the basic constructs outlined by Sitkin and Pablo (1992) and empirically evaluated by van Winsen et al. (2016) in European farms. This validates Hypothesis 9.

Discussion

It was found there is a significant relationship between risk management offered by institutions underlying the coffee sector and the risk perception of Colombian coffee producers. The results laid out in the previous section indicate that the model of Sitkin and Pablo (1992) underlies the covariance structure of the data obtained from a sample of Colombian coffee growers. When the base model is extended with the construct *Institutions*, the model improves its CFI fit index and its CMIN/DF ratio. Such improvement in these global indexes, coupled with the individual significance of the variance of the construct *Institutions* and its relationships or paths with the other constructs in the base model, suggest that the model of Sitkin and Pablo (1992) must be extended to include the effect institutions might have on the behavior and risk perceptions of an agent. Throughout the current research, the agent is defined as a small-scale producer that could be considered as a representative of the Colombian coffee sector. Said producer or agent has managed to set a State-backed institutional arrangement that gives the required action for certain operation rules to have the credibility and enforcement required to be seen as legitimate by all agents participating in this market.

Colombian coffee sector institutions are designed to act over multiple variables of interest for the Colombian coffee grower. For example, the National Federation of Coffee Growers (FNC) and the cooperatives provide the purchase guarantee, as well as public instruments and goods that lower the effect of external price shocks that could threaten the stability and survival of the coffee grower. Said mitigation effect on prices is not included in the model of Sitkin and Pablo (1992), but it does lower risk perceptions held by coffee growers. Under market conditions, all agents are exposed to these market shocks. In the Colombian case, the institutional arrangement supported by coffee growers and the government modifies the way market rules are seen. This arrangement, centered on the coffee production unit, provides macroeconomic and sectorial instruments that have mitigated external and internal shocks that might have, under the conditions of small-scale coffee growers, affected them directly. Mechanisms such as complete supply absorption at published prices (purchase guarantee), research and innovation, varieties improvement, plague control, future purchase contracts, commercialization networks operating in a coordinated manner with other mechanisms, constitute risk management instruments for agents in the sector.

The institutional arrangement underlying the coffee sector configures cognitive and knowledge schemes (Cornelissen & Werner, 2014) that are essentially dynamic and outcomes from social constructs (Kaplan, 2008). The rules governing the institutional arrangement give some stability to the agreement, but said institutional arrangement might change depending on the interactions of some agents with different levels of power and communication skills (Fligstein & McAdam, 2011; Gray, Purdy, & Ansari, 2006; Kaplan, 2008). The extended model proposed in the present research suggested the construct *Institutions* could perform as a proxy for the variable nature of the institutional arrangement

that is instrumented through agent perceptions of the usefulness of institutions meant to cover their multiple risk dimensions.

The unidirectional relationship linking this construct as an output variable to the constructs *Outcome History* and *Problem Framing* does not satisfy the dynamic and bidirectional interaction argued by Kaplan (2008) in his analysis of political interactions to set up an operation scheme favorable to agents, or the dynamics of power supporting the strategic fields of action mentioned by Fligstein and McAdam (2011). The main reason for considering the relationship as unidirectional is the horizon of analysis for the information available to the current research. The analyzed sample gathered current opinions and perceptions of the agents in comparison to their status ten years ago. A decade of analysis is not enough to deliver conclusions on the coffee sector in Colombia, and the author preferred to be conservative regarding research scope.

The construct *Institutions* responds in a statistically significant way to the constructs *Outcome History* and *Problem Framing*. Specifically, perceptions on institutional arrangement effectiveness is assessed as the capacity of institutions and the current rules to mitigate or cover the multiple risk dimensions a farmer is subject to. Successful experiences in the past must be correlated with positive evaluations of the institutional apparatus. The statistically significant and positive coefficient obtained for the path from *Outcome History* to *Institutions* that was presented in Table 31, amounting (0.129), supported this relationship proposed in Hypothesis 3.

Regarding the construct *Problem Framing*, the coefficient estimated for the path (-0.132) (see Table 31) indicated that cognitive schemes with higher risk levels are related to lower scores for the institutional arrangement. Meanwhile, the coefficient for the path from *Institutions* to *Risk Perception* indicated that better valued institutions are positively correlated with risk perception levels. This result validates Hypothesis 6. Both coefficients,

which describe Hypotheses 6 and 7, indicated that mediation is statistically significant, and the negative sign of both coefficients showed that the mediation can be classified as suppression-type mediation (Conger, 1974).

A suppressor is a mediating variable that, once introduced into the model, increases the value of the coefficient between the independent and the dependent variables. As shown in Table 31, the coefficient for the path from *Problem Framing* to *Risk Perception* increased from (0.318) to (0.352) when the latent construct *Institutions* was added to the model (extended model). Cheung and Lau (2008) considered that this phenomenon indicates that the relationship between the latent constructs, in this case *Problem Framing* and *Risk Perception*, is hidden or suppressed by the effect of *Institutions*. When the model is not controlled by *Institutions*, the relationship coefficient might be lower or even negative (Cheung & Lau, 2008). The mediation effect can also be operationalized through the product of the estimated coefficients for the paths linking the mediating variable with the independent and dependent constructs.

The mediation value, calculated as the difference between the coefficients of the path from *Problem Framing* to *Risk Perception* in the base and extended models, indicates that the mediation had a mean value of (-0.037)¹. This difference in the coefficient suggested that institutions underlying the coffee sector lower the risk magnitude farmers perceived by approximately 10%. The suppressive effect, although small, is statistically discernible when considered within the context of the extended model.

Summary

Throughout the current chapter, a comprehensive profile of the Colombian coffee grower was proposed according to the results of a survey including 172 questions divided

¹ The suppressing mediation value is -0.034 [= 0.318 - 0.352] when calculated from the coefficients in Table 31. However, bootstrapping estimation in IBM SPSS AMOS v.24 showed an average value of -0.037 with a bias-adjusted standard error of 0.019, and a bilateral significance level of 0.013.

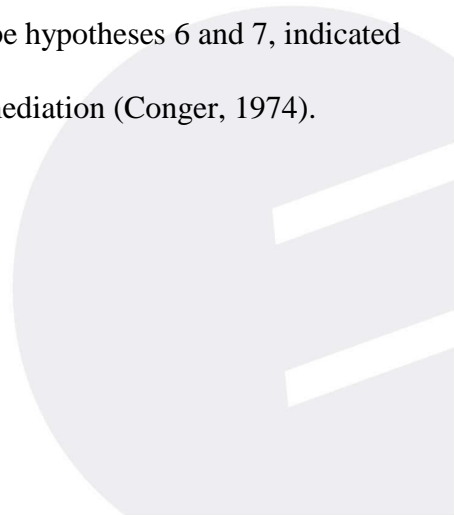
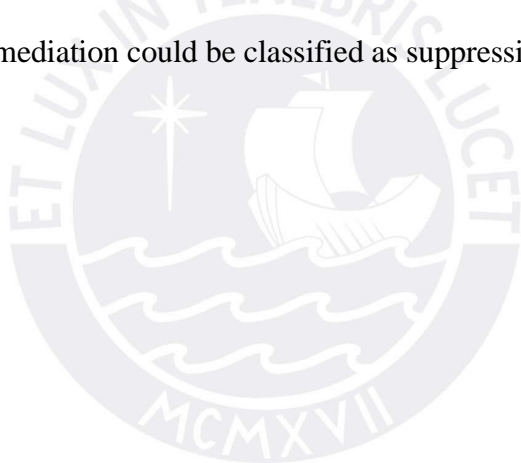
in six sections, that was deployed on 459 coffee growers of 16 coffee growing departments, in order to identify the most important features defining their risk perceptions and propensity, risk management strategies, and relevant past decisions and problems. This way, coffee growers' particularities were known, parting from the study of a coffee grower population, their environments, production methods, income sources, and the coffee institutionality surrounding them.

Following the model of Sitkin and Pablo (1992), hypotheses were evaluated through six constructs: *Outcome History*, *Problem Framing*, *Risk Propensity*, *Risk Perception*, *Risk Management* and the mediating variable *Institutions*. Hypotheses were validated by comparing structural models. For Hypothesis 4, although the calculated coefficient of -0.075 for the path from *Risk Propensity* to *Risk Perception* was not significant, the negative sign is consistent with the arguments of (Sitkin & Pablo, 1992; Sitkin & Weingart, 1995). Hypothesis 1, which referred to the variable nature of agents' risk propensity depending on their historical record of successes or failures in risk situations, is supported by data. The estimated coefficient of 0.583 for this structural regression relationship indicated that risk propensity of the agent was reinforced by successful decisions in its own domain, which is confirmed by the works of Taylor, Hall, Cosier, and Goodwin (1996), Cho and Lee (2006), and Van Winsen et al. (2016).

Regarding Hypothesis 2, a significant coefficient of 0.352 suggested a positive and statistically significant relationship between both constructs. This led to conclude that agents have conceptual schemes of problem analysis that allow them to identify different risk levels associated to a given decision situation. The significant coefficient of 0.538, corresponding to Hypothesis 5, indicated a dependence of agent behavior on its risk propensity levels. Also, the significant coefficient of 0.209 associated with Hypothesis 9

indicated a statistically significant impact, albeit of a smaller magnitude than the estimate for Hypothesis 5. Both coefficients, and their respective hypotheses, led to the conclusion that the risk management of coffee growers is a function of both their risk propensity and their risk perception of a decision situation.

The statistically significant and positive coefficient obtained for the path from *Outcome History* to *Institutions*, which amounts to 0.129, supported the relationship proposed in Hypothesis 3, where the results of risky past decisions by the coffee grower determined their assessment of the institutions underlying the sector. The estimated coefficient for the relationship, -0.132, indicated that cognitive schemes with higher risk levels are related to lower assessments on the institutional arrangement. This result validated Hypothesis 6. Both coefficients, which describe hypotheses 6 and 7, indicated that mediation could be classified as suppression-type mediation (Conger, 1974).



Chapter 5: Conclusions and Recommendations

The current research identified there is a significant relationship between risk perceptions of Colombian coffee growers and risk management instruments offered by coffee institutions. In this sense, a research with sequential mixed approach was proposed, which was conducted in two phases, one with a qualitative approach during which taxonomies on risks faced by coffee growers, and on risk management instruments offered by institutions to farmers, were built; the taxonomy on the risks Colombian coffee growers are vulnerable to identified 58 risks, which were divided into four categories: (a) biological risk; (b) climate risk; (c) operational risk and (d) financial risk. Meanwhile, the taxonomy on risk management instruments is the inventory of institutional arrangements fulfilling different functions in the risk management of coffee growers, from which it was found that the coffee sector has 161 institutional agreements for risk management, from which 99 are private and 62 are public; these were grouped into 26 risk management instruments, identified and distributed between four groups according to the managed risk type. The qualitative stage assessed, through the use of Structural Equation Models, the hypothesis that the actions of Colombian coffee sector institutions affect risk perceptions of coffee growers, thus indirectly determining their risk management behaviors. In accordance to the former, conclusions and recommendations are exposed.

Conclusions

1. The results of the current study showed that through the comparison of the models after the incorporation of global fit indicators that adding the latent construct *Institutions* offered favorable results to the expansion of the model proposed by Sitkin and Pablo (1992). Regarding Hypothesis 1 which refers to the variable nature of the agents' risk propensity depending on the historical record of successes or failures in risk situations, and answer to the question: To what extent do the results of past decisions relate with

risk propensity of coffee growers? it is supported by data. That is: the more successful the results of past decisions taken by the coffee grower are, the greater its risk propensity will be. The estimated coefficient of 0.583 for this structural regression relationship indicated that the risk propensity of the agent is reinforced by successful decisions in its own domain. In their review of *Prospect Theory*, introduced by Kahneman and Tversky (1979), Sitkin and Pablo (1992) identified this type of outcome as important. Plus, the results of Taylor et al. (1996), Cho and Lee, (2006) and Van Winsen et al. (2016) on the impact of the experience over the agents' risk appetite validate the result obtained for this coefficient, confirming this hypothesis on the variable nature of risk propensity and its dependence on past agent experience.

2. Regarding the second research question: To what extent are risk perceptions of coffee growers related with the assessment of a risky situation as an opportunity or a threat? Hypothesis 2 was tested: the assessment of a risky situation as opportunity or threat by the coffee producer determines its risk perception. Opportunities and threats were represented by the construct *Problem Framing*, being evaluated against risk perception (*Risk Perception* construct). The obtained significant coefficient of 0.352 suggested a positive, statistically significant relationship between both constructs. That is, data supported Hypothesis 2 and led to the conclusion that agents have conceptual problem analysis schemes that allow them to identify different risk levels associated to a given decision situation.
3. For the third research question: To what extent do the results of past decisions taken by coffee growers determine their perception on the institutions underlying the sector? The construct *Institutions* that represented the risk management instruments offered by the institutions, respond in a statistically significant way to the constructs that represented past decisions and the coffee grower's problematic framework (*Outcome History* and

Problem Framing respectively). Specifically, regarding Hypothesis 3: the results of risky past decisions taken by the coffee grower determine its assessment of the institutions underlying the sector, specifically the perception on the effectiveness of institutional agreements, is evaluated as the capacity of institutions and current rules to cover the different risk dimensions coffee growers are subject to. That is, successful past experiences must be correlated with positive evaluations of the institutional apparatus. The statistically significant, positive coefficient obtained for the path from *Outcome History* to *Institutions*, amounting to 0.129, supported the relation laid out in Hypothesis 3.

4. Regarding the fourth research question: To what extent does risk propensity of coffee growers relate with their risk perceptions? The adjustment of the extended model showed its capacity to capture the relationships observed in the context of the Colombian coffee grower. Except for the coefficient of the path from *Risk Propensity* to *Risk Perception* which, although its coefficient was not significant and seemed to question the validity of the relationship put forward in Hypothesis 4, the negative sign is consistent with the arguments of Sitkin and Pablo (1992), Sitkin and Weingart (1995), and the empirical results obtained by Cho and Lee (2006) and Van Winsen et al. (2016). That is, the greater the risk perception of the coffee grower, the higher the number of risk management strategies.
5. On the fifth research question: To what extent does risk propensity of coffee growers determine their risk management strategies? Hypothesis 5 was tested: the risk propensity level of coffee growers determines their risk management approaches, it is also backed by the evidence. The obtained significant coefficient of 0.538 validates Hypothesis 5, and indicated a dependence on coffee grower behavior regarding its level of risk propensity. That is, the behavior and decisions of risk-averse farmers differ from

the behaviors of risk-loving farmers. The former agents take more conservative decisions that contain less risk or have been previously tested by other agents in the market. Membership in associations and the adoption of techniques previously tested in other productive units are a manifestation of risk aversion.

6. Meanwhile, for the eighth research question: Is there a significant relationship between the risk management services offered by the institutions underlying the coffee sector and risk perceptions of coffee growers? Hypothesis 6 was tested: the assessment of the institutions underlying the coffee sector is directly related to risk perceptions of coffee growers; the coefficient of 0.280, which indicated that the top-valued institutions are positively correlated with risk perception levels, validates Hypothesis 6.
7. On seventh research question: Is there a significant relationship between the assessment of a risky situation as an opportunity or a threat by a coffee grower and its assessment of the institutions underlying the sector? Hypothesis 7 was tested: The assessment of risky situations as an opportunity or a threat by a coffee grower determine its assessment of the institutions underlying the sector; the estimated coefficient for the relationship, (-0.132), indicated that cognitive schemes with higher risk levels are related with lower scores for the institutional agreement. This supported Hypothesis 7. For both coefficients, which described hypotheses 6 and 7, mediation could be classified as a suppression-type mediation which, according to Conger (1974), is a mediating variable that, once introduced in the model, increases the value of the coefficient between the independent and the dependent variables. This phenomenon indicates that the relationship between latent constructs is hidden or suppressed by the effect of *Institutions* (Cheung & Lau, 2008).
8. On the other hand, for the eighth research question: To what extent do the institutions underlying the coffee sector affect risk perceptions of an opportunity or threat situation

faced by coffee growers? Hypothesis 8 was tested: The institutions underlying the coffee sectors affect risk perceptions of opportunity or threat situations faced by coffee growers, it is also validated through the existing relationship between the constructs *Institutions*, *Risk Perception* and, indirectly, with *Outcome History*. The significant coefficients for these paths (*Outcome History* and *Institutions*, 0.129; *Institutions* and *Risk Perception*, 0.280), and an increase on risk perceptions after incorporating the mediating variable, from 0.318 a 0.352 against *Problem Framing* and (-0.063) to (-0.075) against *Risk Propensity*, demonstrated that institutions affect risk perceptions of coffee growers through the instruments they offer to the latter, what validates Hypothesis 8.

9. Finally, for the ninth research question: To what extent is risk management affected by risk perceptions of coffee growers? Hypothesis 9 was tested: risk perceptions of coffee growers determine their risk management approaches. A significant coefficient of 0.209 also indicated a statistically significant impact, albeit of a smaller magnitude than the one estimated for Hypothesis 5. Both coefficients and their respective hypotheses led to the conclusion that coffee grower risk management is a function of both its risk propensity and its risk perception during a decision situation. Both constructs are variables and functions of both the coffee grower's experience and its mental scheme to analyze and make decisions under risk contexts. In these terms, coffee grower behavior can be described through the basic constructs delineated by Sitkin and Pablo (1992), empirically evaluated in European farms by Van Winsen et al. (2016). This validates Hypothesis 9.
10. Regarding the descriptive results, it was found that 94% of coffee growers are small farmers who rely on coffee farming for sustenance, thus confirming the studies conducted by Castellanos et al. (2012), Eakin et al. (2005), and Tucker et al. (2010),

who performed a characterization on risk perceptions in Central America. So, it was evidenced that the risks small coffee growers are exposed to are of a scale that is beyond their capabilities to manage, which created the need for institutions that enable them to resist changes and fluctuations in international markets, besides requiring guild representation to negotiate and reach commercial agreements.

11. On the other hand, it was identified that 86% of respondents changed their crop management practices during the last 10 years; 75% implemented soil conservation, while 42% started using agrochemicals. Meanwhile, 52% of coffee producers made these changes due to the technical recommendations of the extension service and, as a result, 57% of them stated that the recommendations had been beneficial to the productivity of their crops; which demonstrated the confidence generated by the institutions underlying the Colombian coffee sector.

Theoretical Contributions

As evidenced throughout the discussion in Chapter 4, the current research makes three important contributions to knowledge: one within the framework of the neo-institutional theory, providing empirical evidence of the collective construction of institutional arrangements that aim to minimize the risks of coffee growers through risk management decisions and affecting risk perceptions; a second contribution goes to risk theory, through the incorporation of institutions as a mediating variable determinant of risk-taking agents; and finally to the studies on risk perception in agriculture, by providing new elements of analysis such as the assessment of risk management instruments.

The confirmation of hypotheses 1 and 2 showed that the relationship between the risk perception of the coffee grower as a function of a problematic framework with risk propensity as a function of decisions in the past is evidence that the influence of the idiosyncratic characteristics of the (Kahneman & Tversky, 1979), which in agreement with

the hypothesis 5, indicates a dependence on the behavior of the producer of coffee regarding its level of risk propensity, where the behavior and decisions of risk-averse producers differ from the behavior of producers who are "lovers" of risk. This leads to the conclusion that the risk management of the coffee grower is a function of both its risk propensity and its perception of the risk of the decision situation, and it constitutes an important contribution to the research line of risk perception proposed by Castellanos et al. (2012), Eakin et al. (2005), and Tucker et al. (2010), which aims to improve both the coffee industry and the conditions of small-scale coffee producers in different sectors of emerging and developing economies with conditions similar to those in Colombia.

As for the contribution to neo-institutional theory, empirical studies such as Taylor & Van Grieken (2014); Buainain & García (2013); And Garrett et al. (2013) confirm the importance of institutions in agriculture in different regions. In this sense, hypothesis 3 confirmed that the perception of the effectiveness of the institutional agreement is evaluated as the capacity of the institutions and the rules in force to cover the different dimensions of risk to which a producer is subject. That is, successful experiences in the past must be correlated with positive evaluations of the institutional apparatus. Then, the influence of local institutions associated with agricultural subcultures such as cooperative crop groups or standards of practice and local institutions are introduced to facilitate delivery under decentralized government schemes such as regional extension networks. Assessment by the coffee producer of risk situations as an opportunity or threat determine their assessment of the institutions that underlie the sector, it was confirmed through hypothesis 7, the influence of the institutions, not only in the formation of cooperative groups, but Also in the decisions of the coffee producers with respect to the management of their risks and in the changes in the perception of risk.

With regard to risk theory, based on the work of Sitkin and Pablo (1992) and Sitkin and Weingart (1995), they examined the usefulness of placing risk propensity and risk perception in a central role; It was proposed to incorporate the effect of the institutions as a mediating variable that affects the perception of the risk of the coffee producers. These results are consistent with those obtained by van Winsen et al. (2016) in which they identified that farmers who are more willing to take risks manage the same with a proactive attitude, trying to reduce the impact and the occurrence of the risk through external risk management tools, such as the instruments offered by The institutions of the Colombian coffee sector.

As a final contribution, the role of institutions in the risk perception of coffee farmers is presented and results that are consistent with those obtained by Tucker et al. (2010) who explored the perception of risk in the coffee sector and identified that the perception of risk is a determining factor in the lives of coffee growers; Eakin et al. (2014) who defined perception as one of the determinants of the adaptation of Central American coffee growers to risk situations; And Frank et al. (2011) argued that risk perception is a cognitive variable and that it greatly influences the risk aversion of Central American coffee growers.

Recommendations and Future Research

Parting from the results of the current study, the following recommendations are introduced for future research:

Recommendations

First: it is recommended to apply the same methodology to other agricultural sectors in countries with similar features and associations, in order to identify the different strategies promoted to manage the potential risks associated to farmers, as well as affecting risk perceptions.

Second: despite Colombian coffee growers are represented by the FNC, and count with a strong institutional infrastructure, it is suggested to strengthen the divulgation of

management instruments, on both their existence and their uses. This, in order to increase voluntary utilization of more sophisticated instruments such as insurance and futures market.

Future research

The interpretation of the suppressing effect exerted by coffee sector institutions, introduced in Chapter 4, corresponds to an average assessment for the institutional agreement. In this sense, it is not the individual assessment of a given legal institution or entity. Some institutions have a greater suppressing effect on determined risk dimensions. The discrimination of such suppressing effect for each institution within their domain of risk has not been estimated in the current research, but it could be a research objective in the future through a case study complemented with quantitative analysis techniques.

On the risk perception survey applied on 459 coffee growers in 16 Colombian departments, it is recommended to perform a longitudinal study and deploy the survey every three years to evidence changes in the relationship between risk perception and risk management instruments offered by Colombian coffee institutions, as well as the evolution of said instruments and updating the inventory of risks coffee growers are vulnerable to.

Finally, for further studies, there remains an ample research agenda on the relationship between risk perception in agriculture and risk management instruments offered by institutions; it must allow to describe and strengthen sustainable development of small productive units in emerging and developing countries.

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Appendices

A. Survey on risk perceptions of coffee growers

Presentación			
ASEGURESE QUE LA PERSONA QUE VA A ENCUESTAR CUMPLE CON LAS CARACTERISTICAS ESPERADAS.			
HAGA LAS SIGUIENTES DOS PREGUNTAS, SI LA PERSONA RESPONDE "SI" A AMBAS CONTINUE CON LA ENCUESTA, DE LO CONTRARIO AGRADEZCA Y TERMINE.			
¿Produce usted café? / ¿Actualmente vende usted café?			
Explique esto al encuestado en sus propias palabras: Quiero invitarle responder una encuesta sobre su producción y vida en la región. La encuesta puede tardar de 40 minutos aproximadamente. Debo aclarar que el presente estudio no tiene que ningún vínculo con programas de apoyo del gobierno y por tanto responder esta encuesta no vincula a programas de subsidios			
SECCIÓN IDENTIFICACION			
ID1	Encuesta No.		
ID2	Nombre de encuestado		
ID3	Fecha (día, mes, año)		
ID4	Vereda		
ID5	Municipio		
ID6	Departamento		
ID7	Tiene cédula cafetera	Si. 1 No. 0	Número
ID8	Nombre del encuestador		

SECCION A: INGRESO				
A1		A2		A3
¿Cuáles son sus fuentes de ingreso?		¿De estas, cuál es su mayor fuente de ingreso?		¿Cuál es la segunda más importante?
ANOTE TODAS LAS QUE EL ENTREVISTADO RESPONDA		(MARCAR SOLO UNA)		(MARCAR SOLO UNA)
	CATEGORIA	0. No 1. Si	PRIMERA	SEGUNDA
1	Cultivo de café			
2	Recolección de café			
3	Otros cultivos			
4	Ganadería			
5	Jornalero en agricultura			
6	Fabricación y venta de artesanías			
7	Trabajos manuales no agrícolas e informales			
8	Asalariado formal no profesional			
9	Asalariado formal técnico			
10	Pensionado			
11	Giros o remesas de otra ciudad			
12	Subsidios del gobierno			
13	Otros: (especificar) _____			
14	NO SABE / NO RESPONDE			

SECCION B: AGRICULTURA		
B1	Cuenta con equipos para beneficio y secado del café en su finca?	
	INDICAR TODAS LAS OPCIONES QUE MENCIONE	
	OPCION	0. No / 1. Si
	1 Despulpadora con motor	
	2 Tanque tina	
	3 Ecomil	
	4 Caseta de beneficio	
	5 Sistema de tratamiento de aguas residuales	
	6 Fosa para el tratamiento de la pulpa del café	
	7 Marquesinas	
	8 Ebas	
	9 Silos	
	10 Paseras	
	11 Becosub	
	12 Patios para secado	
	13 Tolva	
	14 Lombricompostaje	
	15 Otro: _____	
	16 Otro: _____	
B2	¿Hace cuantos años se dedica a la producción de café?	_____
B3	En los últimos 10 años, ¿ha cambiado la cantidad de terreno que usted dedica a café?	No ha cambiado: 0
		Incrementó: 1
		Disminuyó: 2
B4	¿Por qué incrementó?	
	INDICAR TODAS LAS OPCIONES QUE MENCIONE	
	OPCION	0. No / 1. Si
	1 Buenos precios en el mercado	
	2 Buenas condiciones climáticas	
	3 Ingresos extra	
	4 Cambios en otros cultivos	
	5 Otro: _____	
B5	¿Qué pasó con el terreno donde antes tenía café y ahora no? (MARQUE TODAS LAS OPCIONES QUE MENCIONE)	
	OPCION	0. No / 1. Si
	1 Siembra otros cultivos	
	2 Tiene ganado	
	3 Construyó una vivienda	
	4 Vendió el terreno	
	5 Repartió el terreno a los hijos	
	6 Otro: _____	
B6	¿Por qué disminuyó?	
	INDICAR TODAS LAS OPCIONES QUE MENCIONE	
	OPCION	0. No / 1. Si
	1 Perdidas por cambios climáticos	
	2 Destrucción del cultivo por causas ambientales	
	3 Enfermedades de la planta	
	4 Plagas en el cultivo	
	5 Bajo precio del café	
	6 No tenía dinero para insumos	
	7 Desconocimiento del oficio	
	8 Problemas de salud que le impedían la labor	
	9 Otros cultivos más rentables	
	10 Otras actividades más rentables	
	11 Otro: _____	

B7			B8		B9	
¿Qué variedades de café tiene usted en su(s) finca(s)?			¿Qué variedades nuevas ha sembrado en los últimos 10 años?		¿Por qué realizó el cambio? O ¿por qué comenzó a sembrar estas nuevas variedades?	
			NINGUNA: SI NO TIENE NUEVAS PASE A B28.		1. Más resistente a sequías	
					2. Más resistente a alta humedad	
					3. Más rentable	
					4. Más resistente a plagas	
					5. Condiciones climáticas	
					6. Mejor calidad	
					7. Otro: _____	
					88. NO APLICA	
	VARIEDAD	0. No / 1. Si	0. No / 1. Si	RAZON		
1	Tipica (Pajarito o nacional)					
2	Borbón					
3	Tabí					
4	Caturra					
5	Colombia					
6	Castillo					
7	Costa Rica					
8	Robusta					
9	NS/NR					
10	Otros					
11	¿Cuál? _____					
12	¿Cuál? _____					
Ahora vamos a hablar de la última cosecha de café que usted tuvo:						
B10	¿Cuánto obtuvo de café? (En pergamino seco)				B11 Cantidad: _____	
					B12 Unidad:	
					1. Cargas	
					2. Arrobas	
					3. Kilos	
					4. Otro: _____	
					B13 Equivalencia en kg: _____	
B14	De acuerdo a lo que esperaba cosechar, ¿hubo pérdidas de la cosecha?				Si 1	
					No 0	
					NS/NR 9	
					Causa: _____	
					1. Fenómeno del niño o niña	
					2. Cambios de clima	
					3. Exceso de lluvias	
					4. Sequía	
					5. Deterioro de la tierra	
					6. Desastres naturales	
					7. Enfermedades de la planta	
					8. Deterioro de la calidad	
					10. Plagas	
					11. Otro: _____	
					9. NS/NR	
B16	¿Cuánto café cree que perdió o dejó de producir en la última cosecha?				B17 Cantidad: _____	
					B18 Unidad:	
					Bultos 1	
					Arrobas 2	
					Kilos 3	
					Cargas 4	
					Otro: _____	
					B19 Equivalencia en kg: _____	

COMERCIALIZACION									
E20	En Pesos colombianos ¿A qué precio vendió la carga de café de su última cosecha?								
B21			B22		B23		B24	B25	B26
¿A quien le vendió su café?			¿En qué forma vendió el café a ese comprador?		¿Cuál fue el precio por unidad vendido?		¿Recibió un adelanto del comprador?	¿El café lo vendió como certificado?	¿Cuándo usted vendió su café, el comprador bajó sus precios por problemas de calidad?
			(MARQUE TODAS LAS QUE APLIQUEN) 1. Cereza/uva/Maduro 2. Pergamino seco tipo FNC 3. Excelso 4. Tostado 5. Pergamino mojado				0. NO 1. SI	0. No SI: 1. Orgánico 2. Comercio justo FLO 3. RAS 4. En transición 5. Código de conducta 4C 6. Practices 7. Otro _____	0. NO 1. SI
	DESTINO	0. No /1. SI	FORMA	PRECIO	UNIDAD	ADELANTO	CERTIFICADO	BAJO PRECIO	
1	Distribuidor local particular								
2	Cooperativa								
3	Beneficio Comunitario								
4	Distribuidor Grupo asociativo								
5	Otro: _____								
B27	¿Ha tenido dificultades para la comercialización del café?					Si 1 No 0			
B28	¿Cuál fue la causa?					Causa: _____ 1. Pocos clientes 2. Problemas de calidad 3. Precio 4. Sobreproducción 5. Caída del consumo 7. Problemas con los distribuidores 8. Infraestructura de vías 10. Otro: _____ 9. NS/NR			

	ENFERMEDAD	0. No / 1. Si	DAÑO	EVITA	ACCION	CAMBIO
21	Mancha mantecosa					
22	Crespera					
23	Raya del cafeto					
24	Mancha de Hierro					
25	Mal de Hielchas o Arañera (Corbicium koleroga)					
26	Ojo de gallo o gotera					
27	Mal Rosado					
28	Muerte deso entente					
29	Llega macana					
30	Llegas Radicales					
31	Nematodos					
32	Volcan lerto o Mal del Tallito					
MANEJO DE PLAGAS						
B39	¿Considera que sus medidas para controlar las plagas y/o enfermedades le han servido?					Si 1 No 0 No aplica 8 NS/NR 9
B40	¿Ha tenido dificultades para el control de plagas y enfermedades?					Si 1 No 0 NS/NR 9
B41	¿Por qué tuvo dificultades para el manejo del plagas y enfermedades?					Causa: _____ 1. Desconocimiento del proceso 2. Falta de asistencia técnica 3. Dificultades económicas 4. Otro: _____ 9. NS/NR
B42	¿Hace usted algo para manejar/controlar las malezas/arvenses?					Si 1 No 0 NS/NR 9
B43	¿Qué practicas o manejo realiza?					1. Control químico 2. Control mecánico 3. Control manual 4. Selector de arvenses 5. Otro: _____ 9. NS/NR
B44	¿Usted fertiliza su cafetal?					Si 1 No 0 NS/NR 9
B45	¿Usted fertiliza de acuerdo a las recomendaciones técnicas de un análisis de suelos?					Si 1 No 0 SECCION C NS/NR SECCION C
B46	¿Qué tipo de fertilizante utiliza?					
FERTILIZANTE		0. No / 1. Si	B69. Cantidad usada al año	Unidad	B69. Número de veces que lo aplica al año	B70. Forma de aplicación
1	Orgánico (abono, pulpa, estiércol, composta)					
2	Fertilizante químico					
3	Foliar					
4	Otro: _____					
				1. Kilos 2. Litros 3. Bultos		1. Manual 2. Aspersión 3. Otro _____
B47	¿Ha tenido problemas de calidad en el café?					Si 1 No 0 NS/NR 9
B48	¿Cuáles?					Causa: _____ 1. Beneficio 2. Transporte 3. Clima 4. Plagas 5. Enfermedades 6. Recolección 7. Almacenamiento 8. Otro: _____ 9. NS/NR

SECCION C: IMPACTOS Y RESPUESTAS		
C1	Comparado con hace 10 años ¿ha cambiado la cantidad de tiempo que usted dedica al manejo de sus cafetales?	Es igual 0
		Disminuyó 1
		Aumentó 2
		NS/NR 9
C2	Comparado con hace 10 años ¿ha cambiado la cantidad de productos (estiércol, químicos) que compra para sus cafetales?	Es igual 0
		Disminuyó 1
		Aumentó 2
		NS/NR 9
C3	Comparado con hace 10 años, ¿ha cambiado el número de personas que emplea para trabajar en sus cafetales?	Es igual 0
		Disminuyó 1
		Aumentó 2
		NS/NR 9
C4	¿Ha recibido asistencia técnica?	Si 1
		No 0
		NS/NR 9
C5	¿De quién ha recibido la asistencia técnica?	
	MARQUE TODAS LAS QUE MENCIONE	
ORGANIZACIÓN		0. No / 1. Si
1	Servicio de extensión de la Federación Nacional de Cafeteros	
2	EPSAGRO	
3	Servicios privados	
4	Grupos asociativos	
5	Compradores de café	
6	Otros: _____	
C6	¿Considera que la asistencia técnica recibida es suficiente para cubrir sus necesidades?	Si 1
		No 0
		NS/NR 9
SECCION D: FINANZAS		
D1	En los últimos 10 años ¿Ha recibido algún apoyo financiero (préstamo/crédito) para su producción agrícola?	Si 1
		No 0
		NS/NR 9
D2	¿Qué tipo de organización(es) le ha(n) dado el préstamo/crédito?	
	MARQUE TODAS LAS QUE MENCIONE	
ORGANIZACIÓN		0. No / 1. Si
1	Banco agrario	
2	Banco privado	
3	Federación Nacional de Cafeteros	
4	FINAGRO	
5	INCODER	
6	Cooperativas de caficultores	
7	Cooperativas de microcrédito	
8	ASOEXPORT	
9	Proveedor	
10	Comprador particular de café	
11	Asociaciones de productores	
12	Organización no gubernamental (ONG) o	
13	Otro: _____	
D3	¿Tiene que pagar intereses sobre el préstamo/crédito?	Si 1
		No 0
		NS/NR 9
D4	¿Va al día con los pagos?	Si 1
		No 0
		NS/NR 9
D5	¿Ha recibido descuento sobre el crédito que ha tiene o ha tenido? ICR (Incentivos de Capitalización Rural) por parte de Finagro?	Si 1 D6
		No 0 D7
		NS/NR 9
D6	¿Cuál es el porcentaje del incentivo ICR que recibe?	

SECCION E: INFORMACION		
Nos interesa la información que ustedes como productores usan en sus actividades del campo.		
E1	¿Está usted informado sobre el precio diario del café?	SI N0 E3 NS/NR 9 E3
E2	¿Cómo lo hace?	
MARQUE TODAS LAS QUE MENCIONE		
MEDIO		0. No / 1. Si
1	Mira los medios de comunicación (radio, televisión, periódico, internet, mensajes de texto, etc.)	
2	Pregunta a la Federación Nacional de Cafeteros	
3	Pregunta a la cooperativa de caficultores de la zona	
4	Pregunta al Servicio de Extensión	
5	Pregunta a un vecino	
6	No sabe donde buscar esa información	
7	Comprador particular	
8	Otro: _____	
E3	¿Usted recibe noticias del clima o tiene una manera de saber como van a estar las lluvias para sus actividades agrícolas?	SI N0 E5 NS/NR 9 E5
E4	¿Cómo las recibe?	
MARQUE TODAS LAS QUE MENCIONE		
ORGANIZACIÓN		0. No / 1. Si
1	Mira los medios de comunicación (radio, televisión, periódico, internet, mensajes de texto, etc.)	
2	Pregunta a la Federación Nacional de Cafeteros	
3	Pregunta a CENCAFE	
4	Averigua en AGRONET	
5	Pregunta a la cooperativa de caficultores de la zona	
6	Pregunta al Servicio de Extensión	
7	Pregunta a un vecino	
8	No se donde buscar esa información	
9	Otro: _____	
10	Otro: _____	
ORGANIZACIÓN SOCIAL		
E5	Marque los beneficios que obtiene al pertenecer a la Federación Nacional de Cafeteros Marque todas las que responda	
RAZON		0. No / 1. Si
1	Asistencia técnica	
2	Mejores precios	
3	Adaptación al impacto del cambio climático	
4	Apoyo para combatir plagas y enfermedades	
5	Programas de diferenciación o valor agregado	
6	Información	
7	Capacitaciones	
8	Subsidios	
9	Acceso a financiación	
10	Participación en proyectos	
11	Transferencia de tecnología	
12	Acceso a insumos	
13	Infraestructura comunitaria (Vías, polideportivos, salones comunitarios, etc.)	
14	Acceso a maquinaria y tecnología	
15	Otro: _____	
E6	¿Conoce los mecanismos de venta de café a futuro?	N0 E14 SI E13.1 NS/NR 9 E14
E7	¿Ha utilizado los mecanismos de venta de café a futuro?	N0 E13.2 SI E14 NS/NR 9 E14
E8	¿Por qué razón no ha utilizado el mecanismo de venta de café a futuro? (Pregunta Abierta)	
E9	¿Conoce los seguros de cosecha?	N0 E15 SI E14.1 NS/NR 9 E15
E10	¿Ha utilizado los seguros de cosecha?	N0 E15.2 SI E15 NS/NR 9 E15
E11	¿Por qué razón no ha utilizado los seguros de cosecha? (Pregunta Abierta)	

PRESIONES DE PRECIOS Y CLIMA		
E12	Hay muchas cosas de las que se preocupan las familias en el campo, pero también no todos los hogares se preocupan por las mismas cosas. Por ejemplo, alguna gente se preocupa mucho por la posibilidad de no conseguir empleo, y otros se preocupan por los precios de los cultivos o los malos tiempos que pueden destruir la cosecha, y otros hogares se preocupan más por la salud de su familia, o los gastos de las útiles escolares, u otra cosa.	
	Cuando está pensando en el año que viene ¿qué tipo de cosa le preocupa más?	
	DEJELO ABIERTO PERO APUNTE SU RESPUESTA EN EL RENGLON QUE MAS CORRESPONDE A SU RESPUESTA. MARQUE TODAS LAS QUE MENCIONE	
	PREOCUPACIONES	0. No / 1. Sí
1	Mano de obra escasa, costosa y no calificada	
2	Altos costos de los insumos	
3	Altos costos de producción	
4	Falta de política pública hacia el agro	
5	Baja tecnificación	
6	Baja productividad	
7	Cambios climáticos	
8	Eventos naturales	
9	Problemas de enfermedades en sus cultivos	
10	Problemas de plagas en sus cultivos	
11	Caída de los precios del café	
12	Falta de acceso al crédito	
13	Problemas en el cultivo por falta de capacitación	
14	Desempleo	
15	Problemas de salud por exposición a los plaguicidas	
16	Mala salud en la familia	
17	Otro: _____	
E13	Hace unos años, los precios de café bajaron muchísimo en el país ¿Cómo manejó usted sus cafetales en ese periodo de bajos precios?	
	DEJELO ABIERTO PERO APUNTE SU RESPUESTA EN EL RENGLON QUE MAS CORRESPONDE. MARQUE TODAS LAS QUE MENCIONE	
	ALTERNATIVAS	0. No / 1. Sí
1	No me afectó, no hice nada diferente	
2	No apliqué tantos agroquímicos en el cafetal	
3	No invertí tanto tiempo en las labores de mi cafetal	
4	No empleaba tanta mano de obra en el cafetal	
5	Dejé de sembrar café	
6	No recolecté	
7	Sembré otros cultivos	
8	Pedí préstamos	
9	Otro: _____	

CLIMA						
A veces hay factores climáticos que afectan a la agricultura, por ejemplo sequías, inundaciones, heladas o granizadas.						
E14		E15	E16	E17	E18	
¿Qué factores han afectado su producción de café en los últimos 10 años?		Cuando ocurre mal clima, ¿Qué tanto daño causa?	En comparación con la década anterior, ¿ha cambiado la frecuencia de mal clima en los últimos 10 años?	¿Cuál de esos malos climas le preocupa más?	¿Qué hace usted para que no afecte tanto ESE mal clima a sus cultivos?	
DEJELO ABIERTO PERO APUNTE SU RESPUESTA EN EL RENGLON QUE MAS CORRESPONDE A SU RESPUESTA. MARQUE TODAS LAS QUE MENCIONE		1. Poco 2. Regular 3. Mucho 9. NS/NR	0. Esigual 1. Disminuyó 2. Aumentó 9. NS/NR	MARCAR SOLAMENTE UNA OPCION	1. No hace nada 2. Seguro 3. Variedades 4. Fecha de siembra 5. Manejo de insumos 6. Mete riego 7. Maneja sombra 8. Maneja el suelo 10. No hay nada que uno puede hacer 11 Otro: _____ 9 NS/NR	
	FACTOR	0. No /1. Si	DAÑO	CAMBIO	PREOCUPA	ACCION
1	Sequías					
2	Temperatura alta					
3	Granizadas					
4	Fríos/heladas					
5	Cambios en las épocas/tiempo que llueve (estacionalidad)					
6	Lluvias torrenciales					
7	Otro: _____					
E19	Si usted ha tomado acciones para evitar daños climáticos, ¿considera que le han servido?				No 0	
					Si 1	
					NS/NR 9	
Ahora vamos a hablar de cómo está su vida y producción ahora en comparación de cómo fue hace 10 años, para entender como está cambiando la vida aquí en la zona. Le agradecemos su respuesta. Recuérdense que las repuestas son anónimas y no compartimos estas repuestas con nadie.						
E20	Por favor, nos puede decir si en los últimos 10 años, ¿ha cambiado su ingreso económico?				Si 1	
					No 0	
					NS/NR 9	
E21	¿Cómo cambió?				Incrementó 1	
					Bajó 2	
					NS/NR 9	
E22	¿Por qué ha cambiado?					
RIESGO						
E23	Califique de 1 a 5 los siguientes factores que afectan la producción de café donde 1 es el que menor riesgo le representa y 5 es el que mayor riesgo representa para la producción					
	Factor	1	2	3	4	5
1	Cambio climático					
2	Variedad climática					
3	Plagas (biológicos)					
4	Habitantes Naturales (biológicos)					
5	Enfermedades (biológicos)					
6	Factores económicos (volatilidad del precio, tasa de cambio, tasa de interés, comercialización, de mercado, demográficos)					
7	Factores financieros (acceso al crédito, liquidez)					
8	Factores operacionales (errores humanos, escasez de mano de obra, malas prácticas cosecha, malas prácticas postcosecha)					
9	Factores (higienicos) por intoxicación con agroquímicos					
10	Factores asociados a la salubridad (Enfermedades transmisibles, físicos, ergonómicos, intoxicación por agroquímicos)					
11	Factor de orden público					

GESTIÓN DEL RIESGO						
E23	Califique de 1 a 5 los siguientes acuerdos institucionales, donde 1 es el que menos confianza le da para la administración del riesgo y 5 es el que mayor cobertura representa.	1	2	3	4	5
	Factor					
1	ALMACAFÉ					
2	ASOEXPORT					
3	BANCO AGRARIO					
4	BANCO DE LA REPÚBLICA					
5	BANCOS PRIVADOS					
6	BUENCAFÉ					
7	CAFÉ DE COLOMBIA					
8	CAR					
9	CÉDULA CAFETERA					
10	CENICAFÉ					
11	COMPAÑÍAS DE SEGUROS					
12	COOPERATIVAS DE CAFICULTORES					
13	CRECE					
14	EPSAGROS					
15	EXPOCAFÉ					
16	Exportadores privados					
17	FAG					
18	FINAGRO					
19	FEDERACION NACIONAL DE CAFETEROS FNC					
20	FOGACAFÉ					
21	FONDO NACIONAL DEL CAFÉ					
22	FUNDACIÓN MANUEL MEJÍA					
23	ICA					
24	INCODER					
25	INSPECCIONES CAFETERAS					
26	MINISTERIO DE AGRICULTURA Y DESARROLLO RURAL					
27	MINISTERIO DE COMERCIO, INDUSTRIA Y TURISMO					
28	MINISTERIO DE HACIENDA Y CRÉDITO PÚBLICO					
29	MINISTERIO DE PROTECCIÓN SOCIAL					
30	PERSONAJE JUAN VALDEZ					
31	PERSONAJE PROFESOR YARUMO					
32	PRAN CAFETERO					
33	PROCAFECOL (TIENDAS JUAN VALDEZ)					
34	PROCOLOMBIA					
35	PROGRAMA LAS AVENTURAS DEL PROFESOR YARUMO					
36	SECRETARÍAS DE DESARROLLO RURAL					
37	SENA					
38	SERVICIO DE EXTENSIÓN					
39	SISTEMA DE INFORMACIÓN CAFETERA SICA					
40	SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO					

B. Instructions to the Survey

INSTRUCTIVO GENERAL PARA EL ESTUDIO

Fecha: 25 de octubre de 2015

Nombre: Riesgo Café

Número de Estudio: 001

Responsable: Gildardo Monroy

TECNICA	
Entrevista Personal Intercepción	
Entrevista Personal en Localización	X
Entrevista personal en Hogares	
Entrevista Telefónica	

OBJETIVO DEL ESTUDIO

Hombres y mujeres mayores de edad, pertenecientes al sector cafetero colombiano, que se dediquen al cultivo, producción o recolección de café.

GRUPO OBJETIVO

Edad	18 años en adelante
Genero	Hombres y mujeres
Cargo	Cultivadores, recolectores o productores de café
Tipo	Cafeteros federados

COBERTURA GEOGRAFICA

Departamento	Total	Cantidad de Registros
Antioquia	56971	64
Bolívar	302	0
Boyacá	7380	7
Caldas	26062	26
Caquetá	1531	3
Casanare	1430	0
Cauca	48182	84
Cesar	7444	5
Chocó	126	0
Cundinamarca	21803	20
Huila	57921	65
La Guajira	1502	1
Magdalena	4335	4
Meta	1396	0
Nariño	25456	29
Norte De Santander	12640	7
Putumayo	111	0
Quindío	4313	0
Risaralda	15179	19
Santander	20943	24
Tolima	51131	90
Valle Del Cauca	17820	11
TOTAL	383978	459

C. Semistructured interview

Instituciones y la Gestión del Riesgo del Productor de Café en Colombia	
Guion de la entrevista	
Presentación	
<p>El propósito de esta entrevista, es recopilar información de carácter cualitativo sobre los caficultores Colombianos y las Instituciones e instrumentos de gestión de riesgo del sector cafetero Colombiano, con el fin de elaborar las taxonomías de Riesgos a los que es vulnerable el caficultor, las Instituciones que subyacen el sector cafetero y los Instrumentos de gestión de riesgos con que cuentan, al servicio del caficultor Colombiano. A efectos de la elaboración de la tesis "Instituciones y la Gestión del Riesgo del Productor de Café en Colombia".</p> <p>Elaborada por Gildardo Monroy Guerrero.</p>	
Riesgos a los que es Vulnerable el Caficultor Colombiano	
1	Antes de abordar los tipos de riesgos, ¿qué características tiene el caficultor colombiano? (información relevante para contextualizar el perfil del caficultor).
2	¿Qué características destacaría del caficultor Colombiano? (tales como tamaño, edad promedio y caracterización social).
3	¿Qué tipos de riesgos debe enfrentar el caficultor colombiano? (listado de los riesgos a los que es vulnerable el caficultor y su posible clasificación).
4	¿Cuáles son los riesgos que más afectan al caficultor colombiano? (listado de los riesgos que más lo afectan).
Instituciones y Arreglos del Sector Cafetero Colombiano	
5	¿Qué características destacaría de las Instituciones que subyacen el sector cafetero Colombiano? (Públicas, Privadas, función, años de servicio, presencia nacional o regional y misión específica).
6	¿Qué organizaciones, públicas o privadas, han servido como referente para el desarrollo institucional del sector cafetero? (listado y descripción).
7	¿Qué tipos de Instituciones hacen parte del sector cafetero colombiano? (listado de las instituciones, clasificadas en públicas y privadas).
8	¿Qué tipo de Arreglos Instituciones hacen parte del sector cafetero colombiano? (listado de los arreglos y su función específica).
9	¿Cuáles han sido las realizaciones de esas instituciones, para cubrir las necesidades de los caficultores colombianos? (en cuanto a logros y resultados)
Instrumentos de Gestión de Riesgos	
10	¿Existe una política propia y diferenciada de gestión de riesgos en la institucionalidad cafetera?
11	¿Cuáles son los instrumentos de gestión de riesgos que ofrecen las instituciones al caficultor colombiano? (Listado de los instrumentos, clasificados por tipo e identificación de la institución que lo provee)
12	¿Qué ámbitos de la gestión de riesgos del caficultor colombiano, tiene mayor importancia en la institucionalidad cafetera? ¿Cuáles deberían tener mayor importancia? (se busca identificar prioridades dentro de la gestión de riesgos)
13	¿Qué importancia se ha otorgado a la gestión de los riesgos a los que es vulnerable el caficultor colombiano, en los programas desarrollados por la Institucionalidad cafetera? ¿Qué proyectos alternativos se han considerado para mejorar la gestión de los riesgos del caficultor? ¿En qué referentes se han inspirado estas alternativas?
14	¿Considera que son efectivos los instrumentos de gestión de riesgos que ofrecen las instituciones a los caficultores colombianos? ¿Cuáles deberían mejorarse o implementarse?
15	Para finalizar la entrevista se propone, clasificar cuales de los instrumentos de gestión de riesgos que ofrecen las instituciones son los de mayor eficiencia y cuáles deberían mejorarse o implementarse.

D. Informed consent

CONSENTIMIENTO INFORMADO

Estimado participante.

Asunto: Cuestionario para medir la percepción del riesgo del productor de café colombiano.

Sirva la presente para expresarle mi saludo y agradecimiento por su participación contestando el cuestionario adjunto, el mismo que es parte de la investigación que realizo para optar el título de Doctor en Dirección Estratégica de Empresas por la Pontificia Universidad Católica del Perú y Doctor in Business Administration por la Maastricht School of Management de Holanda, con la tesis titulada "Gestión y Percepción de Riesgo del Productor de Café".

Responder el presente cuestionario le tomará alrededor de 40 minutos y una hora. Los resultados de este estudio serán puestos a su disposición, en junio de 2016. Los datos a ser publicados no serán individualizados, por lo que el nombre de su persona y el de su familia no son considerados como información para el estudio.

De ser usted tan amable de contestar el cuestionario, manifestará su consentimiento de participar en el estudio de investigación.

En espera de su apoyo y acogida me pongo a su disposición y para cualquier pregunta de detalle sírvase comunicar conmigo al siguiente correo: gilmogue1970@gmail.com

Cordialmente
Gildardo Monroy Guerrero



E. SEM model estimation

			Estimate	S.E.	C.R.	P	Label
Risk_Propensity	<---	Outcome_history	.632	.146	4.320	***	
Institutions	<---	Outcome_history	.204	.104	1.950	.051	
Institutions	<---	Problem_framing	-1.861	.839	-2.218	.027	
Risk_perception	<---	Problem_framing	2.921	.760	3.844	***	
Risk_perception	<---	Risk_Propensity	-.064	.060	-1.079	.280	
Risk_perception	<---	Institutions	.165	.041	4.068	***	
Risk_management	<---	Risk_perception	.093	.034	2.694	.007	
Risk_management	<---	Risk_Propensity	.205	.033	6.279	***	
b28index	<---	Problem_framing	1.000				
c1	<---	Risk_Propensity	1.000				
b39	<---	Outcome_history	.110	.036	3.077	.002	
e19	<---	Outcome_history	.379	.092	4.137	***	
e23risk_bio	<---	Risk_perception	1.212	.205	5.919	***	
e23risk_fin	<---	Risk_perception	1.000				
e23risk_op	<---	Risk_perception	1.404	.233	6.031	***	
c4	<---	Risk_management	.880	.120	7.356	***	
d1	<---	Risk_management	1.020	.171	5.974	***	
b3	<---	Risk_Propensity	.827	.098	8.454	***	
e1	<---	Outcome_history	.259	.072	3.612	***	
e24Index_Bio	<---	Institutions	1.195	.021	56.268	***	
e24Index_Fin	<---	Institutions	1.000				
b45	<---	Risk_management	.764	.166	4.602	***	
e23risk_cl	<---	Risk_perception	.821	.179	4.587	***	
b32inv	<---	Outcome_history	1.000				
b47	<---	Problem_framing	5.973	.822	7.268	***	
e21	<---	Risk_Propensity	.956	.130	7.377	***	
c3	<---	Risk_Propensity	1.292	.138	9.392	***	
e24Index_Ope	<---	Institutions	1.136	.028	40.976	***	
e24Index_Cli	<---	Institutions	.925	.024	38.416	***	
id7	<---	Risk_management	.259	.069	3.744	***	
b44	<---	Risk_management	1.000				
b14	<---	Problem_framing	4.687	.719	6.521	***	
b26	<---	Problem_framing	5.784	.800	7.227	***	
e12index	<---	Risk_perception	.207	.049	4.246	***	

F. Standardized Regression Weights: (Total - Default model)

			Estimate
Risk_Propensity	<---	Outcome_history	.583
Institutions	<---	Outcome_history	.129
Institutions	<---	Problem_framing	-.132
Risk_perception	<---	Problem_framing	.352
Risk_perception	<---	Risk_Propensity	-.075
Risk_perception	<---	Institutions	.280
Risk_management	<---	Risk_perception	.209
Risk_management	<---	Risk_Propensity	.538
b28index	<---	Problem_framing	.540
c1	<---	Risk_Propensity	.581
b39	<---	Outcome_history	.219
e19	<---	Outcome_history	.337
e23risk_bio	<---	Risk_perception	.542
e23risk_fin	<---	Risk_perception	.441
e23risk_op	<---	Risk_perception	.607
c4	<---	Risk_management	.591
d1	<---	Risk_management	.396
b3	<---	Risk_Propensity	.561
e1	<---	Outcome_history	.271
e24Index_Bio	<---	Institutions	.973
e24Index_Fin	<---	Institutions	.967
b45	<---	Risk_management	.286
e23risk_cl	<---	Risk_perception	.330
b32inv	<---	Outcome_history	.605
b47	<---	Problem_framing	.604
e21	<---	Risk_Propensity	.461
c3	<---	Risk_Propensity	.731
e24Index_Ope	<---	Institutions	.913
e24Index_Cli	<---	Institutions	.907
id7	<---	Risk_management	.227
b44	<---	Risk_management	.647
b14	<---	Problem_framing	.472
b26	<---	Problem_framing	.590
e12index	<---	Risk_perception	.295

Descriptives

Covariances: (Total - Default model)

		Estimate	S.E.	C.R.	P	Label
ee24rmpvt	<--> ee24indexcli	-.036	.005	-7.347	***	

Correlations: (Total - Default model)

		Estimate
ee24rmpvt	<--> ee24indexcli	-.607

Variances: (Total - Default model)

	Estimate	S.E.	C.R.	P	Label
Problem_framing	.002	.001	4.834	***	
Outcome_history	.196	.050	3.902	***	
epropensity	.152	.033	4.653	***	
einstitutions	.471	.034	13.826	***	
eperception	.139	.038	3.689	***	
emanagement	.023	.005	4.832	***	
eb28	.006	.001	11.731	***	
ee21	.453	.037	12.212	***	
ee23risk_fin	.702	.055	12.837	***	
ee23risk_bio	.597	.054	11.074	***	
ee23risk_cl	.933	.067	13.987	***	
eb3	.344	.027	12.512	***	
eb32	.340	.048	7.105	***	
eb39	.047	.003	14.474	***	
ee23risk_op	.571	.060	9.505	***	
ee19	.220	.016	13.393	***	
eb26	.154	.014	10.687	***	
eb44	.046	.005	8.954	***	
eb45	.219	.015	14.406	***	
ec4	.048	.005	10.457	***	
ed1	.188	.014	13.599	***	
ee1	.166	.012	14.078	***	
ee24rmpvt	.040	.006	6.766	***	
ee24mpub	.033	.004	8.766	***	
eb14	.188	.015	12.785	***	
eb47	.152	.015	10.345	***	
eb4index	.781	.057	13.627	***	
eb6index	.336	.039	8.669	***	
ee24IndexOpe	.125	.009	13.621	***	
ee24indexcli	.090	.008	11.853	***	
eid7	.041	.003	14.693	***	
ee12index	.076	.005	14.240	***	

Squared Multiple Correlations: (Total - Default model)

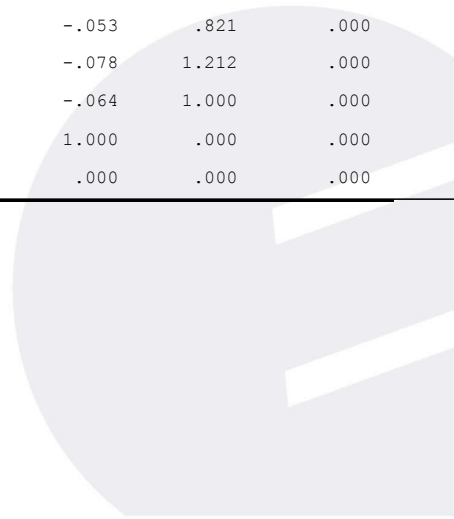
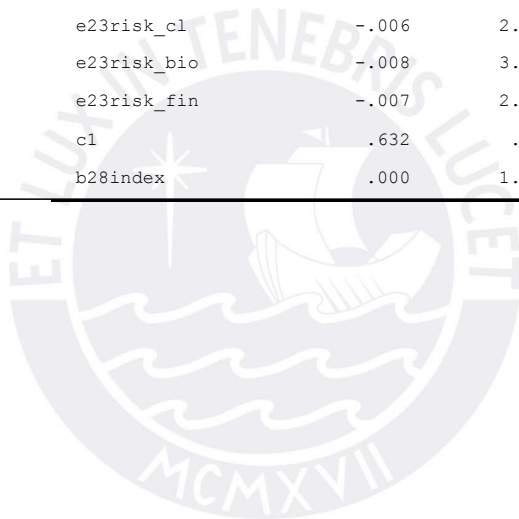
	Estimate
Institutions	.034
Risk_Propensity	.340
Risk_perception	.179
Risk_management	.321
e12index	.087
id7	.051
e24Index_Cli	.823
e24Index_Ope	.834
c3	.535
e21	.213
b14	.223
b47	.365
e24Index_Fin	.936
e24Index_Bio	.946
e1	.074
d1	.157
c4	.349
b45	.082
b44	.419
b26	.348
e19	.114
e23risk_op	.369
b39	.048
b32inv	.366
b3	.315
e23risk_cl	.109
e23risk_bio	.294
e23risk_fin	.194
c1	.337
b28index	.291

Matrices (Total - Default model)

Total Effects (Total - Default model)

	Outcome_h istory	Problem_f raming	Insti tutio ns	Risk_Pr opensit y	Risk_pe rceptio n	Risk_man agement
Institutions	.204	-1.861	.000	.000	.000	.000
Risk_Propensity	.632	.000	.000	.000	.000	.000
Risk_perception	-.007	2.613	.165	-.064	.000	.000
Risk_management	.129	.242	.015	.199	.093	.000
e12index	-.001	.541	.034	-.013	.207	.000

id7	.033	.063	.004	.051	.024	.259
e24Index_Cli	.188	-1.721	.925	.000	.000	.000
e24Index_Ope	.232	-2.115	1.136	.000	.000	.000
c3	.817	.000	.000	1.292	.000	.000
e21	.604	.000	.000	.956	.000	.000
b14	.000	4.687	.000	.000	.000	.000
b47	.000	5.973	.000	.000	.000	.000
e24Index_Fin	.204	-1.861	1.000	.000	.000	.000
e24Index_Bio	.243	-2.223	1.195	.000	.000	.000
e1	.259	.000	.000	.000	.000	.000
d1	.131	.247	.016	.203	.095	1.020
c4	.113	.213	.013	.175	.082	.880
b45	.098	.185	.012	.152	.071	.764
b44	.129	.242	.015	.199	.093	1.000
b26	.000	5.784	.000	.000	.000	.000
e19	.379	.000	.000	.000	.000	.000
e23risk_op	-.010	3.669	.232	-.090	1.404	.000
b39	.110	.000	.000	.000	.000	.000
b32inv	1.000	.000	.000	.000	.000	.000
b3	.523	.000	.000	.827	.000	.000
e23risk_cl	-.006	2.146	.136	-.053	.821	.000
e23risk_bio	-.008	3.166	.200	-.078	1.212	.000
e23risk_fin	-.007	2.613	.165	-.064	1.000	.000
c1	.632	.000	.000	1.000	.000	.000
b28index	.000	1.000	.000	.000	.000	.000



G. Taxonomy of Risk Management Instruments

<i>Public Risk Management Instruments</i>		
Instrument	Function	Institutional agreement
Technical assistance and financing	Promotion, development and financing of agricultural projects	Rural Development Secretaries
Consulting	Financial planning	Banco Agrario
Financing	Rural and agrarian credit	Banco agrario
	Credit lines	Banco agrario
	Debit and credit cards	Banco agrario
	Research financing	Fondo Nacional del Café
	Extension service financing	Fondo Nacional del Café
	Educational process promotion	Fondo Nacional del Café
	Strengthening cooperativism	Fondo Nacional del Café
	Coffee grower welfare promotion	Fondo Nacional del Café
	FOGACAFE – Financial guarantee	Fondo Nacional del Café
	Rural and agrarian credit	Finagro
	Specialized credit lines	Finagro
	Incentives on rural capitalization (ICR)	Finagro
	Agrarian sector reactivation	Pran cafetero
	Financing and subsidy delivery to the agrarian sector	Incoder
Financial support	Ministerio de hacienda y crédito público	
Export promotion	Specialized advice	Procolombia
	Training on export	Procolombia
	Market studies	Procolombia
	Strategic alliances	Procolombia
	Contact with international customers	Procolombia
Purchase guarantee	Reducing asymmetries on negotiation power	Fondo Nacional del Café
Research and diffusion	Performing market analyses	Ministerio de hacienda y crédito público
Public policies	Regulation and environmental norms	Car
	Executing public policies defined for the agricultural sector	ICA
	Biological and chemical hazard prevention	ICA
	Land allocation policy execution	Incoder
	Welfare programs: rural housing	Ministerio de agricultura y desarrollo rural
	Rural development programs	Ministerio de agricultura y desarrollo rural
	Productive alliances	Ministerio de agricultura y desarrollo rural
	Executing foreign trade policies, general plans, programs and projects.	Ministerio de comercio, industria y turismo
	Adopting, driving and coordinating general policies on national economic and social development	Ministerio de comercio, industria y turismo
	Public policy design	Ministerio de hacienda y crédito público
Public policy execution	Ministerio de hacienda y crédito público	

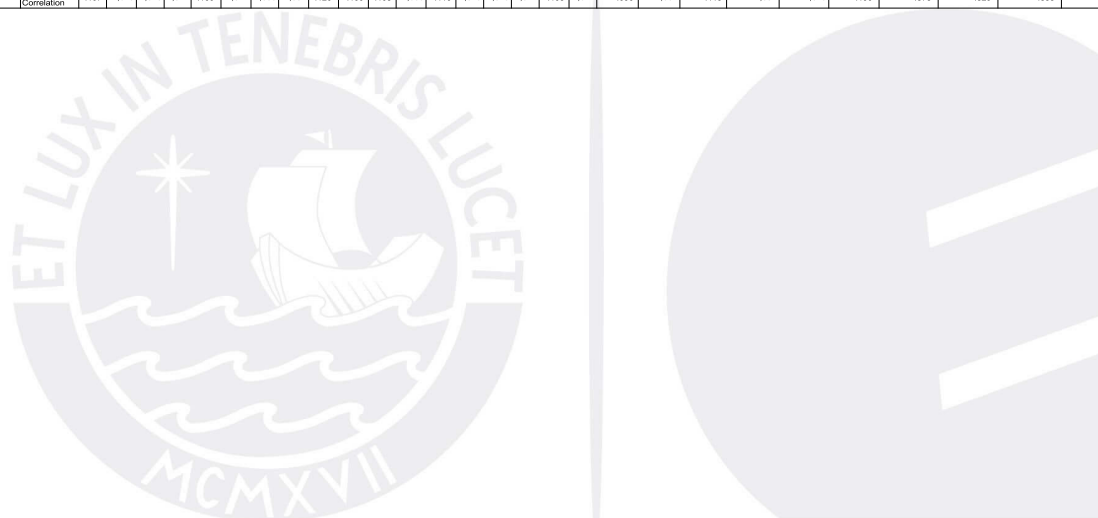
	Long-term strategic planning	Ministerio de hacienda y crédito público
	Health and social security programs	Ministerio de protección
Educational processes	Training and formation for work	SENA
Value added productive processes	Commercial support to promote competitiveness, integration and development of productive sectors at industry, micro, small and medium Enterprise	Ministerio de comercio, industria y turismo
	Industry support	Ministerio de hacienda y crédito público
Regulation and control	Coffee supply and demand regulation	Fondo Nacional del Café
	Price fixation	Fondo Nacional del Café
	Enforcing international agreements	Fondo Nacional del Café
	Health regulation and control in the agrarian sector	ICA
	Land access management	Incoder
	Rural property formalization	Ministerio de agricultura y desarrollo rural
	Acts, Decrees, Resolutions, CONPES	Ministerio de agricultura y desarrollo rural
	Normalization and control	Superintendencia de industria y comercio
	Fiscal and tax regulation	Ministerio de hacienda y crédito público
State representation	Economic and rural promotion and consolidation of rural areas	Incoder
	Project promotion and execution	Incoder
	Intersectoral coordination	Incoder
	International cooperation process coordination	Ministerio de agricultura y desarrollo rural
	Support on international trade negotiations	Ministerio de comercio, industria y turismo
Financial backing	Coffee Guarantee Fund	Fogacafé
	Agrarian Guarantee Fund	FAG
Information systems	Registry and approbation of agrarian input	ICA
	Aaronet	Ministerio de agricultura y desarrollo rural
	Financial information	Banco de la república
	Economic-sectorial analyses	Banco de la república
Value added	Value added programs	Fondo Nacional del Café
<i>Private Risk Management Instruments</i>		
Instrumento	Función	Acuerdo Institucional
Insurance	Insurance	Insurance companies
Technical assistance	Agribusiness Technical Assistance Services Companies	Epsagros
Commercialization	Coffee commercialization	Cooperativas de caficultores
	Input commercialization	Cooperativas de caficultores
	Future sales	Cooperativas de caficultores
	Price protection contract	FNC
	Value added commercialization	Procafecol (tiendas Juan Valde)
Commercialization and export	Commercialization and export	Asoexport

	Industry-specific consulting Statistical information Grouping private exporters Export promotion Coffee industry defense Interinstitutional collaboration and integration Speaking and defense of associates Commercialization and export Future sales Coffee commercialization and export Future sales Coffee commercialization and export	Asoexport Asoexport Asoexport Asoexport Asoexport Asoexport Asoexport Expocafé Expocafé FNC FNC Exporters
Rural extension	Education program and rural training Colombian coffee quality assurance programs Competitiveness programs: commercialization and financing Technical assistance Coffee plantation renewal program New plantations program Plant health program Business management program	Rural extension service Rural extension service Rural extension service Rural extension service Rural extension service Rural extension service Rural extension service Rural extension service
Financing	Financing Specialized credit lines Debit and credit cards Financing to associated coffee growers Credit programs	Private banks Private banks Private banks Coffee cooperatives Extension service
Research and transfer	Coordinating research processes and technology transfers Production and commercialization of certified coffee seeds Promoting scientific and academic interaction spaces Managing the coffee agroclimate information system Elaboration of briefings and technical reports Conducting weather alert processes Participative research programs Institutional studies and diagnoses Project impact evaluations Construction of geographic and socioeconomic indicators Technology transfers	Cenicafé Cenicafé Cenicafé Cenicafé Cenicafé Cenicafé Cenicafé CRECE CRECE CRECE Extension service
Payment method	Enables financial system access Access to non-banking commercial networks	Coffee ID Coffee ID
Media	Coffee portal management Difussion and promotion of technical-educational shows Radio and press shows	FNC “Las Aventuras Del Profesor Yarumo” TV show Extension service
Operations and logistics	Fund management Duty procedures Shipment preparations Storage Certification and classification Definition of profiles Distribution Coffee quality assessment Aspersion and plague control in stored coffee Metrology Traceability Coffee threshing	Almacafé Almacafé Almacafé Almacafé Almacafé Almacafé Almacafé Almacafé Almacafé Almacafé Almacafé
Educational processes	Design of training and education programs Training Coffee education programs Formal education support programs Training programs on rural development Virtual training and education programs	CRECE Fundación Manuel Mejía Fundación Manuel Mejía Fundación Manuel Mejía Fundación Manuel Mejía Fundación Manuel Mejía

	Representation of the extension service	“Profesor Yarumo” character
Value added productive processes	Coffee industrialization	Buencafé
	Supply chain traceability	Expocafé
	Product portfolio creation	Expocafé
	Commercialization of value added products	FNC
	Product portfolio	Procafecol
Regulation and control	Research and studies, programs and projects	CRECE
	Institutional activities focused on enforcing current regulation applying on all Colombian coffee exports	Coffee Inspections
Guild representation	Brand positioning	Café De Colombia
	International visibility	Café De Colombia
	Guild identification and representation of coffee growers	Coffee ID
	Guild representation	FNC
	Intellectual property defense	FNC
	Positioning the “100% café de Colombia” brand	FNC
	FoNC management	FNC
	Designation of origin	FNC
	Representation and brand positioning	“Juan Valdez” character
	International visibility	PROCAFECOL
Social security	Brand positioning	PROCAFECOL
	Coordination and guild support	Extension service
Social security	Social security programs	Extension service
Industrial services	Coffee threshing process	Coffee grower Cooperatives
Information systems	Managing the institutional documentation center	CENICAFÉ
	Managing coffee alert processes	CENICAFÉ
	Information digitization and analysis	CRECE
	Coffee farm geotagging	Coffee Information System
	Consolidation of the alphanumeric database of coffee growers, coffee farms and plots	Coffee Information System
	Environmental information delivery (Coffee Ecotopos)	Coffee Information System
Value added	Delivering information for performing forecasts	Coffee Information System
	Certification and seal processes	Coffee grower Cooperatives
	Certification processes	EXPOCAFÉ
	Differentiation and value added programs	Extension service

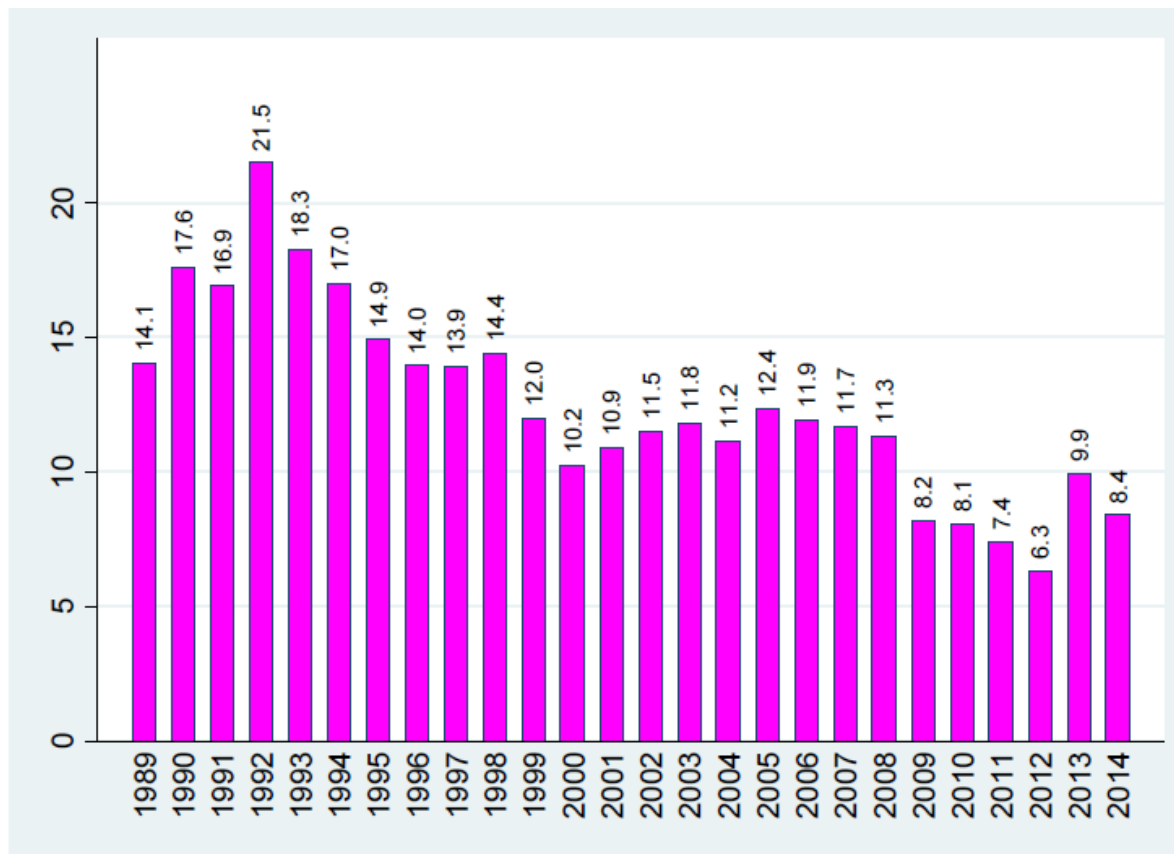
H. Matrix of Correlations

		Correlations																											
		b7	b3	b14	b26	b32	b39	b44	b45	b47	c4	c6	d4	e1	e3	e7	e19	e21	b28index	e12index	e23risk_cl	e23risk_bio	e23risk_fm	e23risk_op	e24index_fm	e24index_bio	e24index_ope	e24index_cli	
b7	Pearson Correlation	1	.135	-.006	-.066	-.101	.039	.209	.097	-.011	.129	.117	.124	.126	.012	.003	.051	.014	.038	.003	.046	.064	.041	.069	.038	.117	.105	.104	.107
b3	Pearson Correlation	.135	1	.025	-.027	-.237	.127	.133	.035	-.044	.115	.046	.149	.195	.001	.034	-.015	.078	.270	.027	.009	.105	-.041	.018	-.038	.013	.020	.038	.029
b14	Pearson Correlation	-.006	.025	1	.256	-.039	.032	.105	.005	.304	.064	-.034	.142	.086	.011	.017	.028	.009	-.107	.257	.185	.112	.105	.032	.077	-.025	-.033	-.022	-.016
b26	Pearson Correlation	-.066	-.027	.256	1	.058	-.017	.105	.014	.409	-.009	-.086	.106	.065	-.012	-.075	.043	-.011	-.066	.312	.067	.056	.061	.067	.082	-.044	-.045	-.006	-.011
b32	Pearson Correlation	-.101	-.237	.039	.058	1	-.145	-.104	-.133	.090	-.181	-.106	-.139	-.139	-.096	-.113	-.018	-.165	-.122	.002	.025	-.031	.035	-.034	.054	-.124	-.120	-.146	-.160
b39	Pearson Correlation	.039	.127	.032	-.017	-.145	1	.188	.013	.026	.243	.091	.031	.011	.044	.000	-.039	.067	.110	-.027	-.009	.052	-.020	.052	-.047	.040	.034	.070	.071
b44	Pearson Correlation	.209	.133	.105	.105	-.104	.188	1	.152	-.057	.182	.089	.112	.089	.050	.056	.058	-.019	.098	-.040	.072	-.001	.046	.096	.058	.025	.003	.031	.038
b45	Pearson Correlation	.097	.035	.005	.014	-.133	.152	.152	1	-.023	.101	.115	.100	.141	.053	.081	.035	.070	.053	-.041	.071	.113	-.081	.050	-.014	.051	.038	.056	.064
b47	Pearson Correlation	-.011	-.044	.304	.409	.090	.026	-.057	-.023	1	-.003	-.049	.075	.029	.021	-.030	.011	.007	-.088	.319	.028	.045	.116	-.028	.049	+.127	-.120	-.127	-.128
c4	Pearson Correlation	.129	.115	.054	-.009	-.181	.243	.182	.101	-.003	1	.192	.173	.149	.086	.094	.056	.097	.040	-.052	-.020	.102	-.003	.025	-.090	.095	.065	.112	.100
c6	Pearson Correlation	.117	.046	-.034	-.086	-.106	.091	.089	.115	-.049	.192	1	.148	.148	.123	.158	.049	.076	.123	-.032	-.023	.033	-.082	-.060	-.118	.126	.117	.115	.108
d4	Pearson Correlation	.124	.149	.142	.106	-.139	.031	.112	.100	.075	.173	.148	1	.796	.016	.169	.061	.081	.057	.076	.182	.038	.001	.041	.055	.129	.049	.091	.080
e1	Pearson Correlation	.126	.195	.096	.065	-.139	.011	.089	.141	.029	.149	.148	.796	1	.034	.155	.054	.135	.094	.028	.112	.048	-.022	.014	.038	.145	.070	.128	.110
e3	Pearson Correlation	.012	.001	.011	-.012	-.098	.044	.050	.053	.021	.086	.123	.016	.034	1	.389	-.038	.104	.063	-.023	.091	-.015	-.027	-.027	.014	.064	.037	.072	.073
e7	Pearson Correlation	.003	.034	.017	-.075	-.113	.000	.056	.081	-.030	.094	.158	.169	.155	.389	1	.086	.091	.079	-.022	.137	.023	-.042	-.033	-.019	.074	.055	.094	.045
e19	Pearson Correlation	.051	-.015	.028	.043	-.018	-.039	.058	.035	.011	.058	.049	.061	.054	-.038	.088	1	.007	-.103	.048	-.001	.015	.032	.035	-.011	-.020	-.030	-.004	-.017
e21	Pearson Correlation	.014	.078	.009	-.011	-.165	.067	-.019	.070	.007	.097	.076	.081	.135	.104	.091	.007	1	.122	.037	.040	.127	-.083	-.093	-.023	.085	.074	.073	.108
e28index	Pearson Correlation	.038	.270	-.107	-.086	-.122	.110	.098	.053	-.089	.040	.123	.057	.084	.083	.079	-.103	.122	1	-.060	-.037	-.035	-.117	-.084	-.042	.082	.074	.109	.071
e12index	Pearson Correlation	.003	.027	.257	.312	.002	-.027	-.040	-.041	.319	-.052	-.032	.076	.026	-.023	-.022	.046	.037	-.060	1	.212	.152	.085	.035	.143	-.114	-.114	-.107	-.096
e23risk_cl	Pearson Correlation	.046	.009	.188	.067	.025	-.009	.072	.071	.026	-.020	-.023	.182	.112	.091	.137	-.001	.040	-.037	.212	1	.154	.096	.147	.163	.084	.016	.015	.064
e23risk_bio	Pearson Correlation	.064	.105	.112	.056	-.031	.062	-.001	.113	.045	-.102	.033	.038	.048	-.015	.023	.015	.127	-.035	.152	.154	1	.196	.257	.130	.037	.010	.041	.115
e23risk_fm	Pearson Correlation	.041	-.041	.108	.061	.035	-.020	.046	-.081	.116	-.003	-.082	.001	-.022	-.027	-.042	.032	-.083	-.117	.085	.096	.196	1	.190	.390	.103	.106	.068	.092
e23risk_op	Pearson Correlation	.069	.018	.032	.067	-.034	.052	.098	.050	-.026	.025	-.060	.041	.014	-.027	-.033	.035	-.093	-.084	.035	.147	.257	.190	1	.292	.048	.008	.059	.079
e24index_fm	Pearson Correlation	.038	-.038	.077	.082	.054	-.047	.058	-.014	.049	-.090	-.118	.055	.038	.014	-.019	-.011	-.023	-.042	.143	.163	.130	.390	.292	1	.214	.211	.182	.190
e24index_bio	Pearson Correlation	.117	.013	-.025	-.044	-.124	.040	.025	.051	-.127	.095	.126	.129	.145	.064	.074	-.020	.085	.082	-.114	.084	.037	.103	.048	.214	1	.942	.886	.876
e24index_ope	Pearson Correlation	.105	.020	-.033	-.045	-.120	.034	.003	.036	-.120	.065	.117	.049	.070	.037	.055	-.030	.074	.074	-.114	.016	.110	.108	.008	.211	.942	1	.888	.829
e24index_cli	Pearson Correlation	.104	.038	-.022	-.006	-.146	.070	.031	.056	-.127	.112	.115	.091	.128	.072	.094	-.004	.073	.109	-.107	.015	.041	.068	.059	.182	.886	.888	1	.838
	Pearson Correlation	.107	.029	-.016	-.011	-.160	.071	.038	.064	-.126	.100	.108	.080	.110	.073	.045	-.017	.108	.071	-.096	.084	.115	.092	.079	.190	.878	.829	.838	1



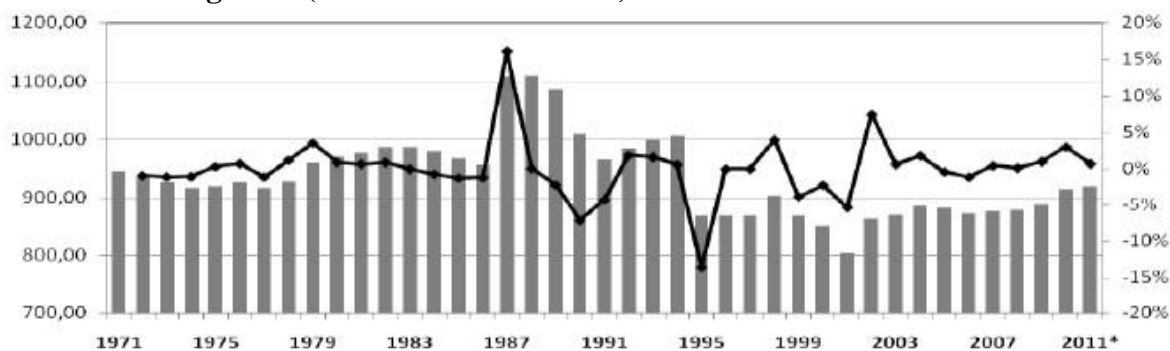
I. Statistics of the Coffee Sector

Colombia's share in the World Coffee Market (% Kg).



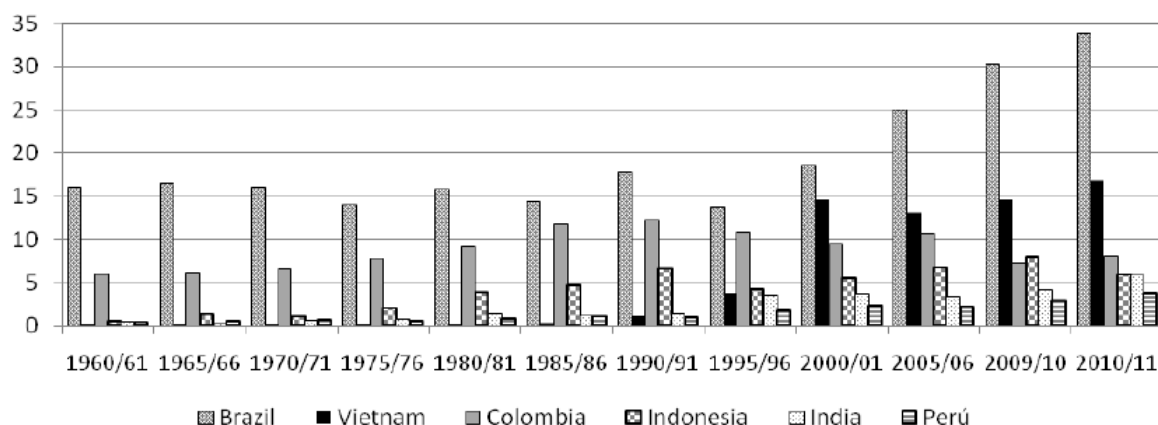
It shows the share of Colombia in the world exports of coffee in bags of 60 thousands of kilograms. This declined gradually during the 1990s, from a peak of 21.5% in 1992 to just 10.2% in 2000, remained at an average level of 11.6% between 2001 and 2008, and declined again year after year, between 2008 and 2012. The recovery in 2013 is important, but it has a level that is still below any pre-2008 level. By 2014, it expects a participation close to 8.4% (Echavarría et al., 2014)

Coffee Growing Area (Thousands of hectares)



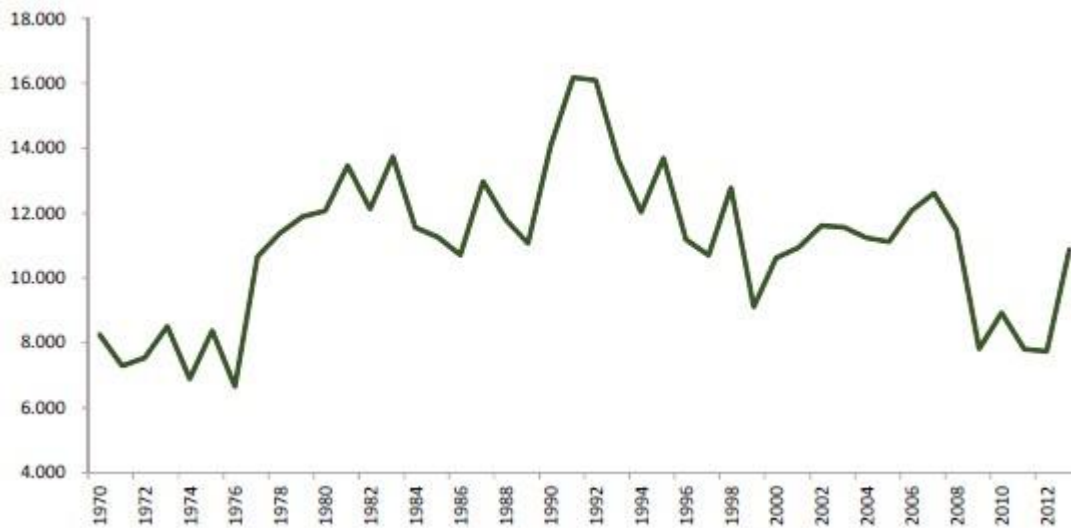
The area planted to coffee at the national level has increased in the last five years, from 873,500 hectares in 2006 to 914,400 hectares in 2010 and 921,100 hectares in 2011, although this last level is still a little far from the historic ceiling reached during 1987 and 1988, years in which the number of one million one hundred thousand hectares sown was exceeded (Sanz et al., 2012).

Largest exporters of coffee (60 thousands of millions of kilograms of coffee)



Colombian share was 6.8% in the coffee year 2008/94 and with 6.3% in 2010/11, when exports were 103.2 million at present Colombia is the third world exporter behind Brazil and Vietnam, although it is still the first in soft coffees (Sanz et al., 2012).

Annual Coffee Production in Colombia (60 thousands of millions of kilograms of coffee)



Colombia's long-term historical production has been around 12 million bags.

Between 1990 and 1993, production levels ranged from 13 to 16 million bags, which can be explained by the climatic conditions recorded during these years. It is worth mentioning that at that time the situation of the world coffee market and the productive structure with which Colombia was counted were very different from the current ones. Therefore, the production of 2014 is located in what can be classified as a normal level without this meaning denying that with the area planted currently there is still a potential for growth through increases in productivity (Echavarría et al., 2014).