Universiteit Utrecht

FUTURE-PROOFING COFFEE PRODUCTION IN PERU: THE IMPACT OF NETWORK LINKAGES ON THE RESILIENCE OF SMALL-SCALE COFFEE PRODUCERS IN CAJAMARCA'S HIGHLANDS

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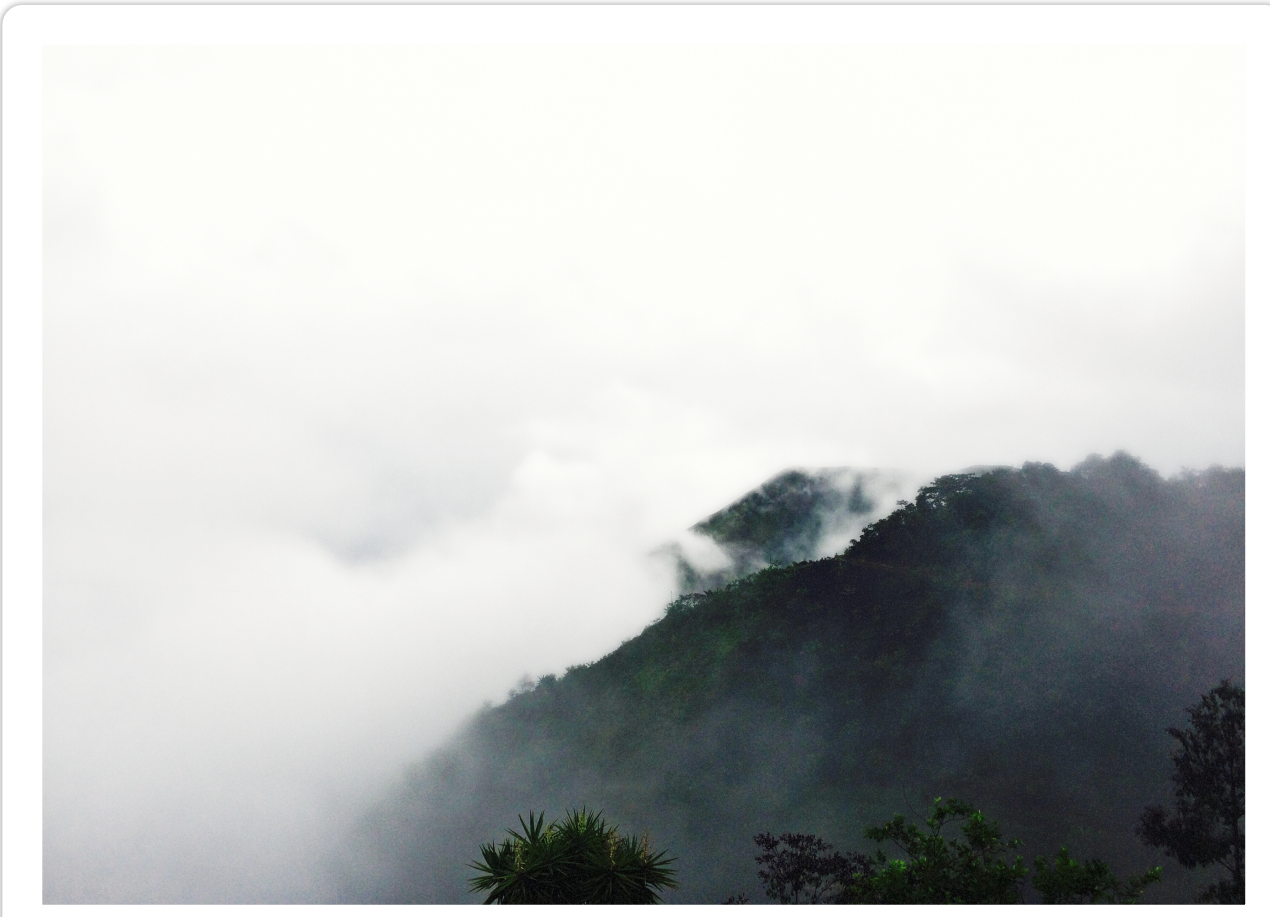

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CHAPTER 1: RESEARCH OVERVIEW

INTRODUCTION

Coffee is one of the most popular beverages on the planet (Illy, 2002), as well as one of the most valuable traded commodities produced in developing countries (FAO, 2014) on which millions of livelihoods around the globe are dependent (Baca et al, 2014; Donald, 2004).

Over the last decades, spurred by the rising popularity as a beverage in the global North, Coffee has become a highly valuable commodity and one of the most traded commodities produced in over 60 countries worldwide. As such, it is an important source of revenue for governments and producers, and is cultivated largely by small-scale producers. However, the production of coffee has become increasingly risky for those at the bottom of the value-chain due to changing environmental and market conditions (Jha et al., 2014; Rice, 2003). which subsequently casts the shadow of uncertainty over the livelihoods of many small-scale and often poor coffee farmers.

These risks stem from economic variability in the form of frequent, dramatic commodity price changes due to complex global supply anddemand dynamics. Furthermore, successful coffee cultivation is also highly dependent on environmental factors such as temperature and rainfall, which are set to shift as a result of climate change. Due to the strong position of large, often transnational companies and brands, the coffee value-chain exhibits elements of a buyer-driven chain, meaning that the producers at the bottom of the chain are in a relatively weak negotiating position and capture lower shares of the total value. Furthermore, as producers, they are also more directly exposed to the (increasing) risks of production, as they are dependent on the success of their local crop whereas the international buyers have access to the global coffee production and can thus balance their risks.

The coffee market experienced a rapid market liberalisation since the dissolution of the International Coffee Agreements around 1989, which involved the dissolution of a quota system agreed upon by producing countries in order to regulate production and stabilize prices. This fragmentation of the coffee market structure has resulted in increased market volatility, contributing to the livelihood risks to the producers at the bottom of the chain as prices as they have a higher exposure to market changes.

As a result of this, multinational companies – responsible for import/export, roasting, and distribution of the final product – hold a great deal of purchasing power and as a result, strongly define the coffee market. Effectively, the liberalisation of the coffee market and the resultingly increased 'competitionalization' have resulted in a more rapid boom-bust structures as well as a concentration of market power in the hands of multinational corporations (Rice, 2003).

As a result of the deregulation of the market, new systems of transnational private governance were established through creation of private standards that aimed at regulating the environmental, social and economic spheres of coffee production and selling by 'certifying' coffee farmers and implementing various

voluntary standards. However, while these certification systems can be seen as new access points for producers to the international markets, there are also significant investments involved that pose entry barriers to many producers and organisations; furthermore, due to a 'certification boom', some of the initial benefits of this system have been reduced and producers are forced to re-orient themselves to new market innovations once again. Furthermore, while such transnational governance systems can offer guidance on the one hand, they have also been criticized as 'usurping' local governance responsibilities by filling the vacuum left after deregulation.

According to a 2016 report by the International Coffee Organisation (ICO) short-term profitability (operating profitability) was low over the previous ten-year span with the exception of Brazil, and that furthermore there was a high variability in profits realized from year to year. The ICO suggests that as a response to this low profitability, there could be a spatial shift from less profitable growing regions to more profitable ones who are better equipped to meet the demand for quality coffee. However, it also warns that concentration increases risk and could increase the volatility of coffee prices, as such concentration is more vulnerable to the impacts of extreme weather events as well as pests and diseases compared to spatially diverse production (International Coffee Organisation, 2016). Persistent market problems such as demand/supply incongruencies due to over-or underproduction, price volatility, as well as price inelasticity on the consumer side all cast doubt on the future economic viability of coffee production for many farmers.

Around the world, the two main species of coffee being cultivated are Arabica and Robusta. Arabica (Coffea Arabica) produces high-quality coffee under the right conditions. Robusta (Coffea Canephora) on the other hand produces coffee with a lower cup quality but boasts a higher resistance to diseases such as coffee leaf rust (Hemileia vastatrix) than Arabica. Arabica requires temperatures between 18-21 degrees celsius, as outside of these the bean's cup quality suffers enormously (DaMatta et al., 2007; The Climate Institute, 2016).

As such, the production of high-value quality Arabica is by its very nature highly vulnerable to the effects of climate change. According to the Climate Institute, "a warming world is a more erratic, less predictable one, characterised by more frequent and intense weather events, such as torrential downpours and droughts, as well as long-term climatic shifts" (The Climate Institute, 2016).

Impacts felt by coffee producers include changes in rainfall patterns as well as rising minimum growing temperatures; these temperature changes have also led to an rising incidence of pests and diseases, such as coffee leaf rust and the coffee berry borer beetle (Hypothenemus hampei) that thrive in warmer regions and have enjoyed an increase in habitable zones and have severely harmed harvests in the past years such as most recently in the Americas (Woodside, 2011).

Research suggests that an increased frequency of extreme weather events, such as floods and droughts, can cause irreversible damage to coffee zones by causing "landslides, soil erosion, floods, and damage to

transport and processing infrastructure" (Läderach et al, 2013, p.2). The impacts of climate shocks and variability – loss of quality and yield and associated increase in economic uncertainty – can furthermore have long-term affects that inhibit farmers from recovering in the following season, such as being forced into debt, unable to invest in their production, and trapping them in poverty (Läderach et al, 2013.)

These impacts signify hardships at the farm-level for coffee farmers, with the vulnerable poor suffering especially due to their "generally low adaptive capacity to shocks, low access to new technologies, inadequate knowledge of pest and disease management, and shallow market linkages" (Läderach et al, 2013, p.2) as well as further increasing competition with low-quality and low-cost producers such as Brazil and Vietnam (Läderach et al, 2013).

Echoing the conclusion drawn by other researchers such as Jha et al (2014) and Bunn et al. (2015), the Climate Institute posits that "the coming decades are likely to see dramatic shifts in where and how much coffee is produced worldwide" (2016, p.2), with potential outcomes including outmigration and land-use conflicts as people seek to adapt their livelihood to the changing environmental circumstances and increasing risks to the crop they once relied on for their livelihoods.

RESEARCH OVERVIEW

The goal of this research is to find out more about the factors that influence the capacity of small-scale producers to adapt to and overcome external challenges to their livelihood security. Specifically, this research focuses on the role played by the networks formed by the various actors that act on and within the coffee sector – cooperative enterprises, companies, and (non-)governmental organisations – on this livelihood resilience, which is critically important to the sustainability of coffee-growing in an unpredictable and shifting context for the coffee farmers and the many other livelihoods involved in the coffee-chain.

The field research that serves as the foundation of this thesis was conducted in the Department of Cajamarca, North-Eastern Peru, in the provinces of Jaén and San Ignacio. These two provinces and their eponymous provincial capitals represent the primary local and regional hubs for production, processing and sale of coffee in Cajamarca.

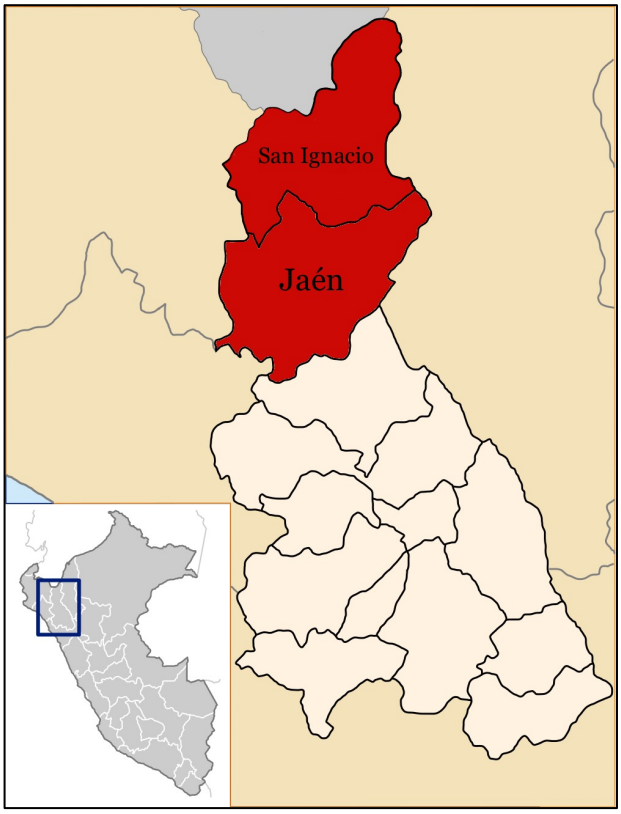


Figure 1: Provincial Map of the Department of Cajamarca [1]

The data in this research was collected between August and October 2017, and utilized both quantitative and qualitative data collection methods through surveys as well as semi-structured interviews with various stakeholders in the coffee chain from coffee farmers and cooperative staff to company managers and government staff. Furthermore, policy documents and reports were collected from several organisations, including the local government level. These were used to gain a better understanding of the past, current and future developmental trajectories of the smallholder producers and their organisations as well as the wider institutional context of coffee production in Peru.

Coffee production in Peru and Cajamarca

Coffee is the main agricultural export product of Peru, consisting chiefly of Arabica variants and making up a 30% share of the Peruvian export market. Between 2001 and 2011, the coffee sector experienced dynamic growth, with conventional coffee (which makes up the bulk of exports) growing 24.3% annually on average and organically certified coffee growing 44.6% in this time period, respectively (MINAGRI, 2014). However, a rapid decline in the coffee price in 2011/2012, which has only been recovering gradually, has caused difficulties for the sector.

In Peru, coffee is grown throughout 10 out of 24 departments (regions), 95 provinces and 450 districts. (Minagri, 2003, 2017). However, 95% of this production is concentrated in 7 regions: Junín, San Martín, Cajamarca, Cusco, Amazonas, Huánaco, and Pasco; less productive regions are Ayacucho, Piura and Puno. Especially the North-Eastern Region, which consists of Cajamarca, San Martín and Amazonas, is an important hub for coffee production in Peru, and contains almost half (49%) of the national area under coffee production as Amazonas makes up 10%, Cajamarca 17%, and San Martín 22% (Minagri, 2017).

[1] Image licensed from commons.wikimedia.org under the under the Creative Commons Attribution-Share Alike 3.0 Unported license, 12.02.2018; modifications: removal of district lines and highlighting of Jaén province in red by author.

Figure 2: Map adapted from Minagri (2003, 2017) showing the 10 coffee-growing regions of Peru. The darker shaded regions represent the most productive coffee-growing zones.

These provinces combined produce around 62% of the national coffee production (Robiglio et al., 2017), and the region has been increasing its share of the national production in recent years. In the North-East, a total of 52 producer organizations and 20 companies are responsible for the coffee export.

However, the NE organizations were responsible for only around 13% of the national export by producer organizations (associations and cooperatives), while the share of exports by NE companies amounted to roughly 40% of the national company exports (GRDC, 2015).

In 2016, Peru exported more than 237,575,016 kg of green coffee (Robiglio et al, 2017), of which 75% were exported by private companies and 25% by cooperatives and associations. The bulk of this production is exported, chiefly to the United States, the European Union (Germany and Belgium in particular), Colombia, and Japan. Only 5% of production was destined for domestic consumption in 2015.

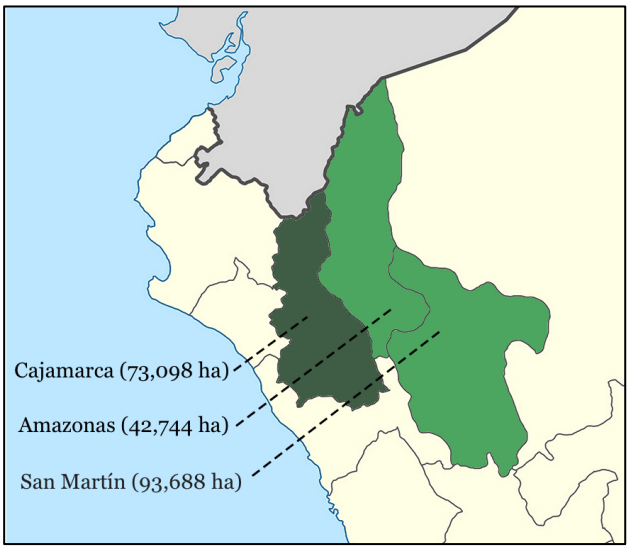


Figure 3 Map adapted from Minagri (2017) showing area under coffee cultivation in the North-East of Peru

Of the total of 162 companies responsible for the 2016 export figures, 30 were private companies and 132 were cooperative organizations or producer's associations (Robiglio et al, 2017). However, The bulk of coffee exports is concentrated in the hands of a small group of high-capacity companies, with 65% of coffee exports being carried out by 8 companies, whereas the largest cooperative (situated in Cajamarca) contributes 5% of national exports (ibid). Furthermore, roughly 9% of exported coffee was produced under one or more Voluntary Standard representation, followed by Fairtrade, Rainforest Alliance, UTZ and 4C.

Around 2 million Peruvians, roughly 6.25% of the total population, participate either partially or fully in the coffee industry. Coffee therefore forms important source of employment and revenues according to the Ministry of Agriculture and Irrigation's 2014 report laying out the 'National Coffee Farm Renovation Plan". (Minagri, 2014). Coffee producers are chiefly smallholder farmers, with 85% of coffee producers working plots of less than 5 hectares, which are often managed with intensive labor and within the producer family (UNDP 2017), with a focus on specialty and high quality coffee. Furthermore, 65% of coffee producers are above the age of 50 (Minagri, 2017).

While 30% of producers are organised in some form of association or cooperative, unassociated farmers, meaning those not belonging to any specific producer's organisation or cooperative, make up the bulk of the producer base with around 70% of farmers not belonging to a larger organisation (Minagri, 2014). These producers chiefly sell to local intermediaries, as well as the various private companies, and form the foundation of the supply-chain for the large (inter-)national coffee exporting companies and their consortiums.

The other 30% of farmers are organised in cooperatives or associations, with the former requiring specific legal and organisational aspects to be met in order for an organisation to be registered as a cooperative through the *Ley Cooperativa* (cooperative law). These producers sell their product primarily to the cooperative, who is responsible for marketing and selling the product through their various market outlets. It usually takes a while for the final payment for the coffee to be made to the producer to be made; in the case of larger cooperatives, farmers will often have received a prior advance from the cooperative to cover harvesting and living costs. The cooperatives then sell the coffee to national exporting companies, or join together to reduce the cost of exporting, which is higher for cooperatives that do not have the same volumes

of coffee as the large companies. Cooperatives that do not operate at sufficiently large economies of scale are thus disadvantaged from participation in global markets unless they can 'piggyback' with other, larger organisations that offer them and their members this access.

CAJAMARCA

The Department of Cajamarca is the second-largest producer of coffee at the national level. The coffee chain generates employment and income for 58.000 producers in the region (GRDC, 2015), and the coffee farms also generate a high demand for local and seasonal labourers. Coffee also forms the chief income for the region in terms of agricultural production.

Around 15% of producers in Cajamarca are members of cooperatives or other coffee-producer organizations that offer services of capacitations, technical assistance, credit, support in becoming certified and secure market access for their harvests (GRDC, 2015). Compared to the national percentage of 30% of coffee-farmers that are enrolled in the coffee organizations, this figure is quite low. However, it has been pointed out that the cooperative sector in Cajamarca is organised in a particularly efficient and business-minded model compared to other regions of the country (GRDC, 2015). This may mean that the entry barriers here are higher due to the necessity for more stringent selection criteria, resulting in overall less farmers being cooperative members.

The cooperatives are important providers of agricultural services but restrict themselves to their members, while the services offered by the public sector through the governmental agrarian agencies are limited in number and scope (GRDC, 2015). These organisations therefore form primary access points to technological know-how and economic support to rural coffee farmers; on the other hand, this means that the bulk of farmers do not have access to this specialised knowledge and other support frameworks, or at least not as directly as farmers enrolled in government programs or the networks of the cooperatives and certain companies.

CHAPTER 2: THEORETICAL FRAMEWORK

SOCIAL CAPITAL

This research focuses on the role of social capital in determining the efficacy of organiational networks in increasing their members resilience and adaptive capacity. Moser et al (2010) define social capital to be an "intangible asset, defined as the rules, norms, obligations, reciprocity and trust embedded in social relations, social structures, and societies' institutional arrangements [...] embedded at the micro-institutional level (communities and households) as well as in the rules and regulations governing formalized institutions in the marketplace, political system and civil society" (2010, p.7). Social capital informs the strength of social networks and the benefits this holds for members, through incentivizing members to cooperate, reciprocate and share resources and information, while also disincentivizing negative behaviors such as opportunism.

Furthermore, one can separate social capital into 'bonding' and 'bridging' social capital (Ruben & Heras, 2012), where bonding applies to the relationships within the (homogeneous) group, and bridging refers to linkages to external (hetereogenous) groups and the access to resources these may provide, thus providing a basis for analysing the internal and external functions of social capital in the form of networks of trust and reciprocity. According to Ruben & Heras (2012), both "internal networks for knowledge sharing, as well as external networks that provide access to competitive markets" (2012, p.470) are crucial requirements to increase productive performance of the cooperative and its members.

Grootaert (2001) posits that social capital can be divided further into three dimensions: 1) a structural dimension in the form of membership in associations and networks 2) a cognitive dimension in the form of trust and adherence to norms and 3) the outcome of these two dimensions in the form of collective action.

Evidence suggests that social capital operates not only at the horizontal level – between community members – but also at the vertical level, engaging in and building networks of trust, reciprocity and cooperation with external stakeholders and actors such as governmental (state) and non-governmental (NGOS, Media, Labels) actors (Folke, et al., 2005; Leonard and Pelling, 2010), in other words the 'internal' and 'external' forms of social capital. As a result of this formation of 'vertical' networks into which the 'horizontal' social capital is embedded, the literature speaks of 'networking social capital or synergy' (Berenyan, n.d.; Leonard and Pelling, 2010; Adger, 2000).

Adaptive capacity is a further factor studied in this research with regard to the outcomes of technology diffusion and social capital. According to the IPCC, the term adaptation can be defined as "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates, harms, or exploits beneficial opportunities" (2001). The concept of adaptive capacity, which is linked to vulnerability and resilience, here refers to "the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (IPCC, 2001).

Following Berenyan (n.d.), "there is a large potential for social capital in the communities to shape their adaptive capacity particularly in times of crisis and generate bottom-up adaptation measures" (p.3). Drawing on previous research, Smit & Wandel (2006) point out that "Practical initiatives that tangibly address and improve societal adaptive capacity, thereby reducing vulnerability, are commonly expected to be evident at the community scale" (p.283); community is here defined as "some definable aggregation of households, interconnected in some way, and with a limited spatial extent" (2006, p.283) drawing on the term "locality" by Coombes et al (1988).

Stott & Huq (2014) suggest that "effective mainstreaming of climate change adaptation (CCA) into related policy and development initiatives relies on comprehensive knowledge sharing between multiple

stakeholders." (p.382). They posit that the facilitation of communication among global, national and local scales and the effective mobilization of knowledge is a critical part of CCA carried out by CBA practitioners. This mobilization consists of creating multidisciplinary knowledge access through the provision of "widely comprehensible content shared in an appropriate format" as well as as the "understandings of trust, priorities and power relations" in order to ensure the relevance of the knowledge shared by practitioners (p.382.) This "mobilization of appropriate knowledge", according to Stott & Huq, enables the mainstreaming of CCA through widespread comprehension of adaptation aims, and ensures that communities vulnerable to climate change impacts benefit from the resulting action.

In this conceptualization, communication of climate-related knowledge is crucial to the wider adoption of practises that enhance the adaptive capacity of communities and individuals. Furthermore, this adaptation must also include and involve members of local communities and respond to their economic and socio-cultural needs and environments. Both the transfer of knowledge and the implementation of projects to strengthen communities' adaptive capacity also rests on mutual trust and good communication pathways – in other words, the presence of high social capital is a critical component for both the short and long term success of community based adaptation as it informs the efficacy of the 'knowledge networks' in transferring and exchanging knowledge.

Vulnerability, Resilience and Adaptive Capacity

Over the last several decades, the terms of vulnerability, resilience and adaptive capacity have been used across a wide variety of disciplines and sciences, and have been conceptualised with an equal variety of meanings (Gallopín, 2006). This diversity of interpretations (ranging from highly similar to incompatible) necessitate a careful formulation of the definition of these concepts in this research.

This research defines vulnerability and resilience as being two ends of a spectrum, in which adaptive capacity acts a modifier on the level of resilience. This research deems it more productive to establish a parameter by which progress towards the more positive goal of 'resilience' has been achieved.

Vulnerability

Vulnerability is a term that has been used in a wide variety of research disciplines, without a definite consensus (Gallopín, 2006). According to Adger (2006), recurring conceptualizations of vulnerability include components such as sensitivity to external stress and perturbations, exposure to perturbations, and the capacity of the unit of analyis to adapt to these processes. Gallopín posits that rather than being an outcome of these processes and events, "vulnerability is also thought of as a susceptibility to harm, a potential for a change or transformation of the system when confronted with a perturbation" (2006, p.294).

The IPCC offers the following definition within the context of climate change: "Vulnerability [...] refers to the propensity of human and ecological systems to suffer harm and their ability to respond to stresses imposed as a result of climate change effects" (IPCC, 2007). This definition furthermore adds that "the vulnerability of a society is influenced by its development path, physical exposures, the distribution of resources, prior stresses and social and government institutions." The latter part will also be incorporated into the definition used in this research due to its usefulness in adressing the socio-economic determinants of vulnerability within the SES.

RESILIENCE

Resilience, vulnerability and adaptive capacity exhibit complex and inter-related relationships within the literature, with varying conceptualizations. The relationship between vulnerability and resilience can be defined either as being either as two ends of a spectrum, or with resilience being a component of vulnerability (often interchanged with adaptive capacity). This diversity of literature requires a careful examination of which conceptual definitions will be most useful to the context of this research. [Define Level Of Resilience as the term for spectrum between vulnerability and resilience). Gallopín defines the relationship between the three concepts as the following: "vulnerability is a function of the system's sensitivity and capacity of response, and the transformation suffered by the system is a function of its vulnerability, the properties of the perturbation, and the exposure of the system to the perturbation" (2006, p.296).

According to Benson & Garmestani (2011), "[r]esilience theory moves society away from previously held assumptions of equilibrium and toward approaches that embrace the complexities of social–ecological systems." (p.392). Benson & Garmestani base their definition of resilience on the work of Holling (1973), defining it as "the capacity of an ecological system to absorb internal and/or external change while exhibiting a similar set of structures and processes (i.e., remaining within a regime) (2011, p.392.) (check context of quote).

These complexities imply that while vulnerability and resilience may be on a spectrum, a unit or system may be resilient in one area, but more vulnerable in another.

ADVERSE IMPACTS: SHOCKS, PERTURBATIONS, STRESS & HAZARD

Gallopín (2006) also explores the definitions for the sub-components of vulnerability, which are most often listed as consisting of shocks, perturbations, stresses & hazards; each of them referring to a different impact and scale of an adverse impact on the unit or system in question.

Following the definition of Turner et al (2003), the concept of hazard forms the overarching concept for adverse impacts that form a threat to a system. They s consist of perturbations and stress, the latter being caused through stressors. Stress is defined as in the literature as "a continuous or slowly increasing pressure

commonly within the range of normal variability, [...] often originates within the system, and stressors often reside within it. (Gallopín, 2006, p.295, based on Turner et al., 2003).

Perturbation in the literature has been defined as "major spikes in pressure (e.g., a tidal wave or hurricane) beyond the normal range of variability in which the system operates" (Gallopín, 2006, p.295; Turner et al., 2003); conceptually, this type of event is in this research therefore also conceptualized as 'shock', as it presents 'stress' that occurs in a relatively short time-span with a high impact.

In his 2000 article exploring the relationship between social and ecological resilience, Adger defines social resilience as "[...] the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change" (2000, p. 347, which is very similar to the definition of Holling (1973). On the other side of the spectrum, Adger defines social vulnerability as exposure to stress of groups or individuals due to environmental changes.

In Gallopíns (2006) model exposure and the associated stressors are not direct components of vulnerability but rather serves to 'reveal' the weak spots of a system. Social vulnerability therefore is more appropriately defined in this research as the degree to which a human system – in this case, cafficultural rural communities– is unable to cope with adversities stemming from multiple hazards. Environmental vulnerability therefore refers to the degree to which environmental systems are unable to cope with hazards, furthermore involving situations in which "thresholds of potentially irreversible changes are experienced through environmental changes" (Adger, 2000, p.344).

EXPOSURE

Gallopín posits that exposure forms a relational property external to vulnerability, with the latter being a property of the system that is revelead upon exposure to perturbation. Vulnerability therefore forms a system attribute that exists before the hazard/event, with the system's history of disturbances often an important related property that further acts as a modifier (Gallopín, 2006).

SUSTAINABILITY TRANSITIONS

Within the sustainability literature, one theoretical approach that has received increasing interest from scholars in recent years is that 'transition studies'. The most prominent frameworks therein are those of Transition Management (TM), Strategic Niche Management (STNM), Multi-Level Perspective on Socio-Technical Transitions (MLP), and Technological Innovation Systems (TIS). This theoretical framework used for the analysis will focus chiefly on the Multi-Level Perspective framework within the limited scope of this paper and the focus on the role of the 'sustainable coffee' niche within the wider regime.

The conceptual frameworks of transition studies were chosen as the study focuses on evaluating the structure and outcomes of a regime shift within the coffee sector, specifically from 'conventional' coffee to 'sustainable' coffee.

Socio-technical Systems

One of the fundamental concepts of this area of research is that of socio-technical systems (STS). According to the literature, they consist of several components and the networks they form. They are formed by actors, institutions, material artifacts, and knowledge (Markard, Raven & Truffer, 2012). Actors in the socio-technical system are "individuals, firms, other organizations and collective actors" (ibid, p.956). Institutions encompass "societal and technical norms, regulations, standards of good practice" (ibid, p.956).

A socio-technical transition (STT) can be defined as "a set of processes that lead to a fundamental shift in socio-technical systems" (ibid, p.956). Throughout the transition, there is an emergence of new products, services, business models, and organizations which partially complement and partially substitute existing counterparts (Markard, Raven & Truffer, 2012). A STS is characterized by combining shifts in the technological dimension with regulatory and cultural structures, such as user practises and institutions (Markard, Raven & Truffer, 2012). Furthermore, STS incorporate complementary technological and non-technological innovations, such as complementary infrastructures (Markard, Raven & Truffer, 2012).

A sustainability transition is defined by as "long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption" (ibid, p.956). According to Smith et al (2005), sustainability transitions are characterized by the specific role that guidance and governance assume as part of the shift taking place within the 'socio-technical regime' (ibid); in such a guided transition, Markard et al remark note that "political actors, as well as regulatory and institutional support can be expected to play a major role" (p.957), further highlighting the importance of the policy environment or 'landscape' within the regime shift. This plays a major role as existing sectors exhibit strong path-dependencies and lock-ins, and established technologies are intertwined to a high degree with user practises and value chains as well as regulatory and institutional structures (Markard et al, 2012).

Strategic niche Management

One of they key concepts in transition literature is that of the niche. It is conceptualized as the micro-level from which radical novelties emerge (Geels & Schot, 2007). Niches functions as 'protected spaces' that allow the development of radical innovations without subjecting them to the prevailing regime's selection pressures (Kemp et al, 1998). These innovations are "initially unstable sociotechnical configurations with low performance" which are "carried and developed by small networks of dedicated actors" (Geels & Schot 2007, p.400), with the niche acting as incubation rooms for these innovations (ibid).

Synthesizing institutional theory, evolutionary economics and sociology of technology, Geels and Schot develop their concept of the 'socio-evolutionary process.' They argue that there are two kinds of endogenous processes of rule changes: "(1) evolutionary-economic, where rules change *indirectly* through market selection of product variations and (2) social-institutional, where actors *directly* negotiate about rules in communities" (ibid, p.404).

In order to count the 'niche-driven bias' of strategic niche management theory, Geels & Schot combine the socio-evolutionary aspects of such a transition with Suarez & Olivia's landscape-change typology. In this typology, Geels & Schot characterise two aspects of the interaction between the different levels (landscape, regime, niche) within the direction and outcomes of transition pathways – the timing and the nature of interaction. With regard to timing, they argue that the degree to which the 'niche' has developed (with regard to stability) at the point of external landscape developments and landscape-level pressures is crucial, as this determines whether it can take advantage of windows of opportunity for a transition or not.

To assess the stabilisation of a viable niche innovation that have the potential to make a wider breakthrough, they developed the following indicators: "(a) learning processes have stabilised in a dominant design, (b) powerful actors have joined the support network, (c) price/performance improvements have improved and there are strong expectations of further improvement (e.g. learning curves) and (d) the innovation is used in market niches,which cumulatively amount to more than 5% market share" (Geels & Schot 2007 p.405, based on Kemp et al., 1998).

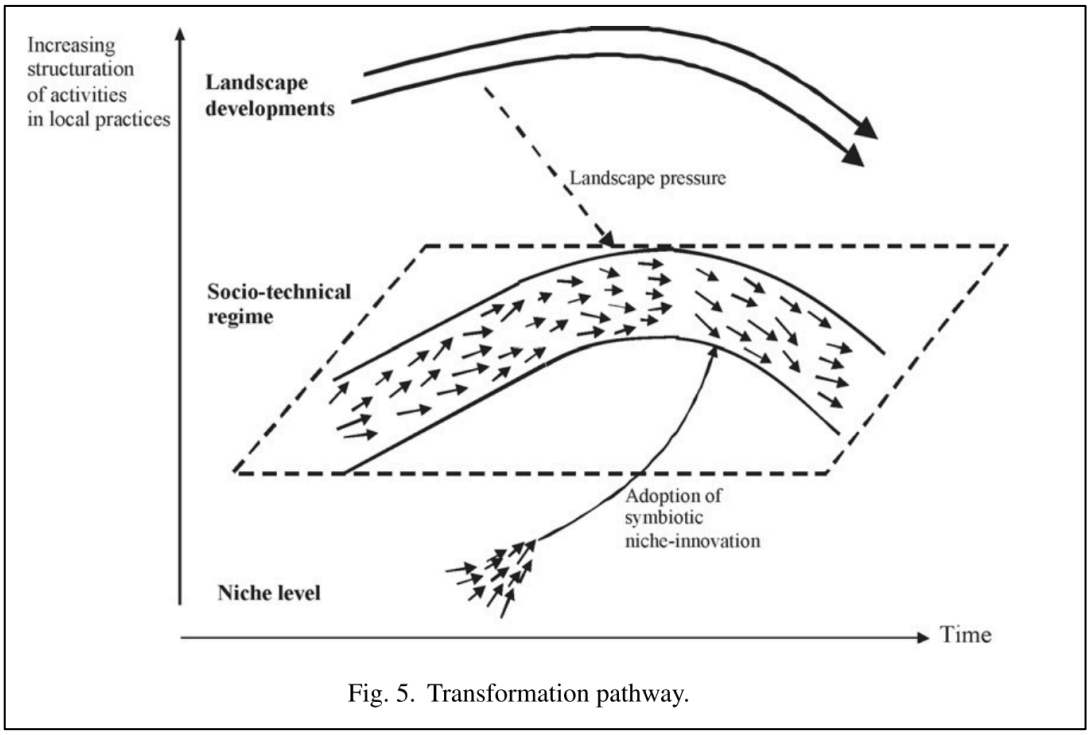


Fig. 5. Transformation pathway.

Figure 4 The transformation pathway for shifts in the socio-technical regime (Geels & Schot 2007, p. 413).

The transformation pathway in this typology deals with disruptive change. In this pathway, moderate pressure is exerted early on in the landscape change and result in reorientation by regime actors. Furthermore, due to being insufficiently developed, niche-innovations are not poised to take advantage of these landscape-regime pressures. Regime actors then respond by "modifying the direction of development paths and innovation activities" (2007, p.413).

Outsiders take on the role of translating landscape pressures to regime actors and drawing attention to (often neglected) negative externalities (Van de Poel, 2000, 2003); these groups can consist of societal pressure groups and movements (public opinion, lobbying), professional scientists and engineers (specialist knowledge, technical critique) and outsider firms, entrepreneurs and activists (alternative practises and technologies). Drawing on a research in the organic foods sector by Smith (2006), Geels & Schot argue that "the demonstration of viable alternatives may change perceptions of regime insiders and lead to reorientations of (innovation) activities" (2007, p.413), and that in this example, niche actors took on the role of 'front-runners' "whose routines and practices gradually trickled down and changed regime rules" (ibid).

Ultimately, this process assumes the path of change from within, as regime actors survive through utilizing their adaptive capacity and new regimes grow out of old ones. In this pathway, niche-innovations have a symbiotic relationship with the regime, as they add to and transform it instead of being competitive and aiming to replace it entirely. The authors also posit that climate change may become a 'disruptive landscape change', which could trigger further transition pathways depending on the amount of pressure exerted and the degree to which regime actors are able to 'adapt' adequately and niche-innovations are developed.

Innovation and Technology Diffusion

Technology diffusion is the mechanism through which a technology or innovation is spread from the originating point to be adopted by organizations and individuals. Attewell (1992) distinguishes between two different types of communication or information involved in the process of technology diffusion, through which innovations are adopted by organisations. The first type identified is signalling, through which potential adopters learn of the existence of the new technology. The second type is the exchange of the innovation/knowledge itself, through communication and learning. This, according to Attewell, "places far greater demands on potential users and on supply-side organizations" (1992, p.5) than signalling does if obtaining technical knowledge is slower and more problematic, due to the level of detail and information involved.

Attewell states that the implementation of complex new technologies requires learning at both the invididual and organizational level. Attewell states that individual learning "involves the distillation of an individual's experiences regarding a technology into understandings that may be viewed as personal skills and knowledge (1992, p.6). This individual learning subsequently forms the basis for organizational learning; however, the organization is only able to 'learn' to the extent that the insights and skills aquired by individuals "become embodied in organizational routines, practices, and beliefs that outlast the presence of the originating individual" (ibid.) – in other words, become institutionalized within the organisation thereby informing future practises and pathways for the adoption of new knowledge and technology.

According to Fromm & Dubon, "there is evidence that small producers can thrive in the global economy, but only if they are highly competent" (2006, p.2). Because competition is strong, producers must meet

certain criteria in order to integrate themselves into the chain. As a result of the increasing coordination & monitoring from buyers in developed countries, suppliers must be competent in order to perform the tasks required to meet these criteria; those that are not considered competent "require either more supervision through standards or they are at risk of losing a contract". This link further calls to attention the role of standards to intermediate between buyers and suppliers, as well as bringing to the fore the buyer-driven nature of the coffee chain.

In their study on coffee pruning in Peru, Weber (2012) examined the relationship between social learning and technology adoption. They find that the peer environment of producers and the proper incentives play an important role in determining the adoption of new technologies and the success of knowledge diffusion. In their research they find that "being surrounded by other low-income growers who passively manage their farms (no pruning, for example) can decrease the likelihood that any one grower adopts a different, more intensive management system", adding that "if no one innovates, growers cannot learn from each other to improve yields and incomes" (2012, p.83).

Furthermore, the empirical evidence of the study suggets that selective rewarding of centrally located members for experimenting with innovative methods is the most expedient approach to incresse the rate of knowledge diffusion. However, cash incentives were found to be a potentially insufficient incentive for continued technology adoption. The pruning project studied by Weber relied on a "consistent presence in the communities of the participating growers" (2012, p.84) Weber posits that "gaining credibility with potential early adopters may play a more important role" (p.84). This evidence, according to Weber, suggests that the social capital of organizations involved in diffusing technology could play an important role.

According to Berenyan (n.d.), "there is a large potential for social capital in the communities to shape their adaptive capacity particularly in times of crisis and generate bottom-up adaptation measures" (p.3). Stott & Huq (2014) suggest that "effective mainstreaming of climate change adaptation (CCA) into related policy and development initiatives relies on comprehensive knowledge sharing between multiple stakeholders." (p.382). They posit that the facilitation of communication among global, national and local scales and the effective mobilization of knowledge is a critical part of CCA carried out by CBA practitioners.

This mobilization consists of creating multidisciplinary knowledge access through the provision of "widely comprehensible content shared in an appropriate format" as well as as the "understandings of trust, priorities and power relations" in order to ensure the relevance of the knowledge shared by practitioners (p.382.) This "mobilization of appropriate knowledge", according to Stott & Huq, enables the mainstreaming of climate change adaptation through widespread comprehension of adaptation aims, and ensures that communities vulnerable to climate change impacts benefit from the resulting action.

Fromm & Dubon (2006) find in their research on the knowledge networks of small-scale coffee farmers in Honduras that they have the possibility to expand their knowledge and skills due to their interaction with various other actors in the chain, such as local processors and exporters.

They highlight the role of standards with regard to the knowledge aquisition of producers, stating that "the implementation and compliance with standards provides opportunities for learning and acquiring skills and knowledge." These new skills and knowledge are of crucial importance in order to acquire a competitive position on the market and within the coffee value chain, which allows cooperatives to become more profitable and capture higher shares of the product's value.

CHAPTER 4: METHODOLOGY

THE WIDER RESEARCH GAP

This research identifies 3 key research gaps that it aims to adress:

Research gap 1: The impacts and risks of climate & market variability on coffee production in the Southern American production context (specifically Peru).

In the coffee literature, there is a very high representation of Meso-American coffee producing countries such as Mexico and Nicaragua, covering the impacts of climate change and market dynamics on coffee production and the related small-scale producer livelihoods, as well as the development of impact of certified coffee production in these regions. However, during the preliminary literature analysis, very few papers regarding case studies on these topics were turned up within the South American context. Specifically, despite being ranked among the ten major coffee producing countries globally, there is little research done on these topics in the Peruvian context; as such, this paper identifies it as a research gap.

Research gap 2: Although there is a large and growing body on certification which has accumulated over the years, there is a lack of strong evidence regarding its impact.

Along with the proliferation of standards, the risks of coffee production and the benefits of certifications in addressing these have been the subject of numerous publications. However, many of these publications focus on evaluating the primary monetary mechanism offered by certifications – the price premium. The evidence regarding this mechanism suggests that it only has a moderately significant impact on farmer incomes, calling into question whether they can be seen as sufficient compensation for the reductions in yield farmers often face due to less intensive production.

Research also suggests that adopting voluntary standards can pose a risk for farmers, especially those those who are economically weakest (Valkila, 2009). A further remaining question is whether the 'agro-ecological' principles adopted by certifications to differing degrees are able to reduce farmer vulnerability in the long-

term, or instead expose him to new risks and vulnerabilities due to for instance a restriction on agro-chemicals and fertilizers to increase production and respond to threats to the plants.

This brings us to the following knowledge gap: the existing literature does not adequately adress the relationship between certification and resilience. Specifically, it is unclear which factors contribute to the resilience and/or adaptive capacity of coffee farmers, and how these are related to the the efficacy of standard adoption at the co-operative level.

Research Gap 3: The linkages between multi-level stakeholder networks, knowledge access and resilience of coffee production within the sustainability context

A further link between the market and the producer that has received little attention in the literature is the importance of associativity in the form of membership in and management of producer organisations. These organisations, to which around one third of Peruvian producers belong, pose an important governance tool for farmers. This research therefore wishes to investigate which types of access to knowledge, skills and ultimately resilience membership in these organisation grants to farmers, and how they connect farmers to other horizontal and vertical networks in the coffee production chain as well as other governance stakeholders.

RESEARCH GOALS

Deriving from these research gaps, the research in this thesis aims to:

A. Identify pathways as well as policy gaps regarding the future-proofing of coffee production in Peru.
B. Clarify the impact of coffee producer's network linkages to other stakeholders on resilience
C. Clarify the the impact of horizontal and vertical network linkages of coffee producers on their resilience and adaptive capacity in the face of market and climate variability
D. Clarify the relationship between network social capital in the form of linkages between coffee producers and the different stakeholders in the coffee, human capital in the form of knowledge and skills releveant to different management aspects of coffee production, and the subsequent resilience of coffee production systems and producer's livelihood assets.

CENTRAL RESEARCH QUESTION

The central research question guiding ther research in this thesis is the following:

What is the impact of network linkages in the form of cooperative membership and voluntary standard certification on the resilience of coffee producer livelihoods?

RESEARCH SUB-QUESTIONS

1. Which climate-related risks and impacts to their livelihood assets have producers experienced between 2011 and 2017?
2. To what extent does network participation increase the management knowledge of producers?
3. To what extent does network participation increase the adaptive capacity of producers?
4. What is the role of trust and network access in determining the performance of the cooperative?
5. What has been the impact of voluntary standards on the governance of cooperatives?
6. Which challenges and opportunities for coffee production and relevant governance can be identified?

Research ethics: For all data collection (written and recorded), permission was attained from the relevant parties, and they were informed of the anonimity in the research analysis.

QUANTITATIVE DATA COLLECTION METHODS:

As part of the quantitative data collection of this research, 53 surveys were carried out with members of 4 different entities, 3 cooperatives and 1 of private company, situated in Jaén and San Ignacio.

In order to gain access to the farmers, a snowballing method was used whereby contact was made with various cooperatives, both before entering and while in the field. Subsequently, for each organisation the researcher accompanie technical assistants to field workshops for 2 to 3 weeks per organisation. In the case of one cooperative, data was also collected on the site of the cooperative headquarters for 2 weeks as producers were coming in to deposit their coffee harvest and receive their earnings cheque from the cooperative.

There were 3 iterations of the survey, with minor changes with each new version adapted to the local context to ensure the most concise and clear collection of data. The surveys were designed to capture the experiences of farmers with the coffee-crisis since 2012/13 (characterised by falling prices and ruined harvests) in a comparable format. It also aimed to elucidate their own assessment of the role of their respective cooperative, local organisations and various voluntary standards in this crisis, specifically with regard to their adaptive capacity and resilience.

QUALITATIVE DATA COLLECTION METHODS

A range of semi-structured interviews were also conducted in tandem with the quantitative surveys. At the producer level, group interviews were conducted after the surveys were administered, on the occasion of the technical assistance workshops.

Further interviews were conducted with technical assistants of the cooperatives and managing staff of the cooperatives and companies, certification representatives, as well as local government officials. These interviews were conducted in order to get a deeper understanding of the situation 'on the ground' facing producers, co-operatives and their staff as well, insights on the relationships between different actors in the coffee value chain, and the broader policy landscape in which they operate. A total of 15 in-depth interviews were conducted with various actors and groups of producers

CHAPTER 3: CLIMATE IMPACTS ON COFFEE FARMERS IN JAÉN AND SAN IGNACIO

The topic of this section is the impact of climate change-related processes on coffee production and the livelihoods of coffee farmers in Peru that depend on coffee as their primary income. This section focuses specifically on the climate-related risks and impacts to their livelihood assets that coffee farmers experienced between 2011 and 2017. The local context of these impacts will be explored with regard to the national level (Peru) and the local level (the provinces of Jaén and San Ignacio in the Department of Cajamarca), in order to give the reader an understanding of the relevance of this research and the existing evidence in the literature. Subsequently, the results of the field research will be presented and discussed.

WHAT IS THE IMPACT OF CLIMATE CHANGE ON PERU?

The Second National Communication on Climate Change by the Peruvian Government classifies the country as particularly vulnerable to the effects of climate change within the characteristics set out in the UNFCC (Government of Peru, 2010). This is in line with other research, which classes Peru as among the most climate change-vulnerable countries on the planet (IRG, 2011). This vulnerability is composed of

various factors, some of which result from structural conditons whereas others are related to climate change either directly or indirectly (Government of Peru, 2010). The report puts forward several growing threats.

The projected direct impacts of climate change on Peru include: shifting temperatures, irregular increases of temperature and precipitation, irregular decrease of temperature and precipitation, as well as the delayed or premature onset of seasons (Government of Peru, 2010; IRG, 2011). Climate projections for Peru by 2050 predict a summer temperature increase of 1.3°C, and an increase of days with frost during summer. Precipitation is also set to be reduced by 10%, 14% and 19% in the Northern, Southern and Central parts respectively. Changes in the surface temperature and salinity of the oceans as well as rising sea levels are also projected impacts of climate change. Furthermore, climate change is set to increase the frequency, intensity, duration of extreme weather events and events associated with them, such as (flash) floods, drought, frost, avalanches, landslides and others, as well as increasing the impact of the El Niño/Niña phenomena.

Peru is among the countries most affected by El Niño, and 72% of natural disasters stem from related hydrometereological phenomena such as droughts, heavy rains, flooding and hailstorms, the frequency of which have increased six-fold between 1997 to 2006 (Government of Peru, 2010). Furthermore, the frequency of the ENSO events is set to increase as well, along with rising sea levels and ocean surface temperature increase along the coastal regions. The impacts of ENSO in Peru are both increased droughts as well as changing precipitation patters, resulting in crop yield reductions and higher occurences of disease that spell out livelihood threats for the country's many rural agricultural producers, including coffee farmers.

According to Peru's second national climate communication (2010), the mountainous regions of the country will experience rainfall reductions between 10-20%, while the Northern and Central forestal regions will experience reductions around 10%. Meanwhile, the Northern coastal and Southern forestal regions will experience rainfall increases of 10-20%, a clear shift in precipitation patterns. These precipitation changes are "expected to have a significant impact on highland populations that rely on rain-fed agriculture" (USAID, 2012), as only 28% of the agricultural surface is irrigated (IRG, 2011). Temperature increases are set to occur chiefly in the Northern coast and forest as well as the central sector, and partially in the Southern andean regions, with an increase ranging between 0.4 and 1.4 degrees Celsius (Government of Peru, 2010).

CLIMATE CHANGE, RURAL AREAS AND AGRICULTURE

Peru is sensitive to climatic changes both environmentally and socio-economically. In 2009, around 36% of the country's population was classified as 'poor', and there is a large gap between rural and urban areas when it comes to poverty. Furthermore, around 90% of the population lived in arid, semi-arid and sub-humid zones in 2007, with roughly 55% living in coastal areas, all of which are especially vulnerable to projected impacts of climatic changes. On top of this, 30 % of the active working population of the country is active in the agricultural sector, a figure that rises to 65% in rural areas; agriculture also makes up around

7.5% of the country's GDP (Government of Peru, 2010). The agricultural sector is set to be affected especially, through reduced quality and availability of water resources, shifting or diminished ecosystem services; shifts in agriculturally suited territories into sensitive areas is likely to compound existing ecosystem pressures, notably on forests and hydrological resources.

Rural populations are both more exposed to these impacts, as well as more vulnerable due to their often lower education levels and assets, as well as their reliance on healthy ecosystems and natural resources. Furthermore, it can be seen that agriculture in Peru finds itself at several intersecting issues, as on the hand it performs an important role for the national and rural economies as well as the country's food security, while on the other being one of the main factors increasing pressures on the country's natural resources and biodiverse ecosystems, which in the long term also negatively affect the country as a whole and the rural poor in particular; in 2000, agriculture was also the sector with the highest water consumption, followed by mining (FAO, 2000).

CAJAMARCA – CLIMATE VULNERABILITY PROFILE

In 2016, around 33% of Cajamarca's surface had climates that were suitable to the production of coffee (R2017), and is currently grown between 500 and 2500 m.a.s.l. These sites are located primarily in the provinces of Jaén, San Ignacio, Cutervo and Chinchipe, and situated in the basins of the rivers Chamaya and Chinchipe as well as the interbasin of the Marañon IV river. However, the province is projected to lose up to 13% of its coffee-suitable area, chiefly in the current main production areas in the north such as the districts of Jaén and San Ignacio (Robiglio et al, 2017).

As a result of the increasing unsuitability of the lower zones for coffee production (below 1200 meters above sea level), many farmers are set to either abandon coffee as their main crop or migrate to other, higher areas to pursue their livelihoods there. However, Robiglio et al (2017) assert that this will result in increased anthropogenic pressures hydrological resources and forests in both protected and unprotected areas in the south of the province, where the largest shift towards coffee suitability will take place and result in them becoming 'migration zones' (2017, p.46).

Coffee-based Socio-Ecological Systems are facing severe setbacks in the coming decades due to climate change, many of which are already being experienced by producers, who bear the brunt of these hazards within the chain due to their relatively weak position. Coffee is highly sensitive to conditions such as light, temperature, humidity and rainfall, while factors that affect the direct and indirect impact of climate change range from the interactions of the climate with the topography and soil of the growing regions, the availability of water resources, and furthermore differ between the various strains of the coffee plant (Da Matta et al., 2007; Robiglio et al, 2017).

According to Robiglio et al (2017), between 13% to 40% of the area currently under coffee production in North-Eastern Peru will lose its suitability for sustained coffee production by 2030; furthermore, only 23%

to 36% will be able to maintain its current crop suitability (2017, p.12). The North-Eastern provinces of the country consist of Cajamarca, Amazonas and San Martin, which together also represent 40% of the national area under coffee cultivation with 170.000 hectares under production (2017, p.10). Between 45% to 85% of coffee producers will be required to undertake adaptive measures, ranging from incremental to systemic changes to production patterns in order to secure future viability of coffee farming (2017, p.10).

Producers in these regions have already experienced a variety of climatic changs in recent years that is affecting production across the board. Currently, coffee is chiefly affected by three pests and diseases, which are aided by increasingly favorable conditions with regard to humidity, temperature and precipitation changes in many coffee production areas in the regions studied (Cajamarca). These are Hemileia Vastrix (Leaf Rust), Mycena Citricolor (Leaf Spot) and Hypothenemus Hampei (Coffee-Berry Borer).

The following environmental changes linked to climate change and resulting impacts listed in Robiglio et al (2017) are summed up here:

1. Reduced Productivity: as a result of the degradation and diminishing of the necessary resources on which the plant depends, the plants cannot produce the yields necessary to meet the production costs of the farmer.
2. Loss of Quality: Shifting temperature and precipitation patterns are reducing maturation times of the crop, reducing cup quality; the introduction of varieties with lower cup quality but higher resistance to rust has also affected quality.
3. Increase in pests, diseases and ailments: Occurences of novel pests and diseases, higher incidences of known crop threats, and unhealthy plants due to higher temperatures are also set to to be outcomes of shifting climatic conditions. Other impacts inlcude less 'recuperation time' due to faster flowering and longer harvest seasons as a result of the aforementioned temperature / precpitation shifts (intermittent dry/wet periods) can also weaken plant health and resistance (Baca et al, 2017).
4. Soil Erosion: As a result of increasingly severe and frequent hurricane-like storm event, research predicts a loss of soil as well as directly affecting crop productivity due to fall-off as a result of storms.
5. Processing and Logistical Difficulties: due to prolonged rainfalls, drying and transport of the product will be affected as roads become more difficult to traverse.

In the case of the important coffee-producing district of San Ignacio, Cajamarca, Robiglio et al encountered the following climatic impacts on coffee production:

1. Quality Impacts: Quality is affected especially in the lower zones of this district through extreme weather and increased incidences of pests

2. Productivity Impact: During the dry season, when temperatures rise, the incidences of the Coffee Berry Borer (CBB) have increased, resulting in a loss of crops. During the rainy season, the farmers experience incidences of Coffee Rust, Black Root Rot, and others. The droughts also affect coffee by increasing the amount of coffee cherry fall-off and dryness during the dry season.

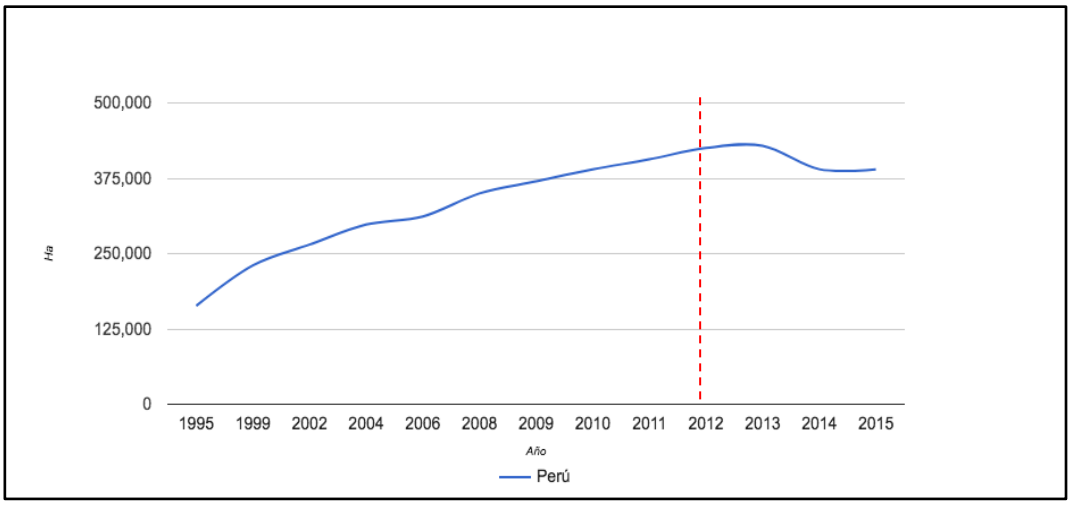


Figure 6 Total hectares under coffee cultivation in Peru, 1995-2015. Red line shows onset of coffee rust epidemic in Peru (adapted from: Ceincafe 2017a; modification by researcher: red line indicator.)

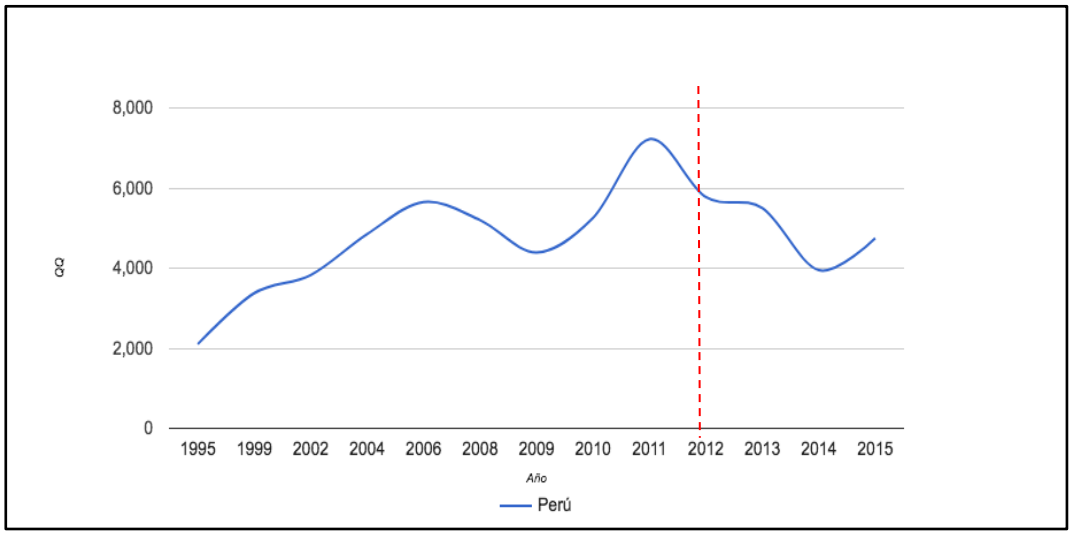


Figure 5 Total quintals (100kg) produced in Peru, 1995-2015. Red line shows 2012 onset of coffee rust epidemic in Peru (adapted from: Ceincafe 2017b; modification by researcher: red line indicator.)

RESEARCH FINDINGS

In the survey conducted throughout Jaén and San Ignacio as part of the field research for this thesis, coffee farmers were asked to self-report which environmental hazards to their livelihood they had experienced since 2011, and to report how severe they perceived the impact of these hazards on their coffee plantations.

Furthermore, farmers were asked to indicate the altitude zone in which their primary coffee production was located. For this, three options were available: the 'low zone' (n=14): 800 to 1200 meters above sea level (masl), the 'medium zone (n=23)': 1200 to 1600 masl, and the 'high zone' (n=15): 1600-2000 meters.

Subsequently, it was calculated which percentages of producers in each altitude zone had experienced which impact severity. Impact severity was divided into the categories 'slight-to moderate' to assess the general frequency of 'lower' impacts, and 'high-severe' impacts were put into one category to assess the frequency of 'higher' impacts. This was done in order to measure to how big difference of the impact of environmental hazards in the form of pests, diseases, extreme weather and soil degradation were across the altitude zones, in order to assess the impacts and degree of climatic sensitivity across growing zones.

PESTS & DISESASES

The most frequently reported hazard was the Coffee Berry Borer (Hypothenemus hampei), with 92% of producers reporting being impacted to some degree. This was closely followed by Coffee Leaf Rust (Hemileia vastatrix) which impacted 88% of coffee farmers in this study. A further 21% had been impacted by 'other' pests or diseases, which included the American Leafspot (Mycena citricolor) or Black Root Rot (Rosellinia bunodes).

A higher percentage of farmers reported being impacted by Rust in San Ignacio (97%) than in Jaén (78%). In the case of coffee borer impact percentages, a slightly higher percentage of farmers in Jaén reported being impacted (96%) than in San Ignacio (90%). In both cases, a vast majority of farmers had experienced some degree of impact from these two plagues. Other pests and diseases were reported more frequently in San Ignacio (28%) than Jaén (13%).

PESTS & DISESASES BY ALTITUDE

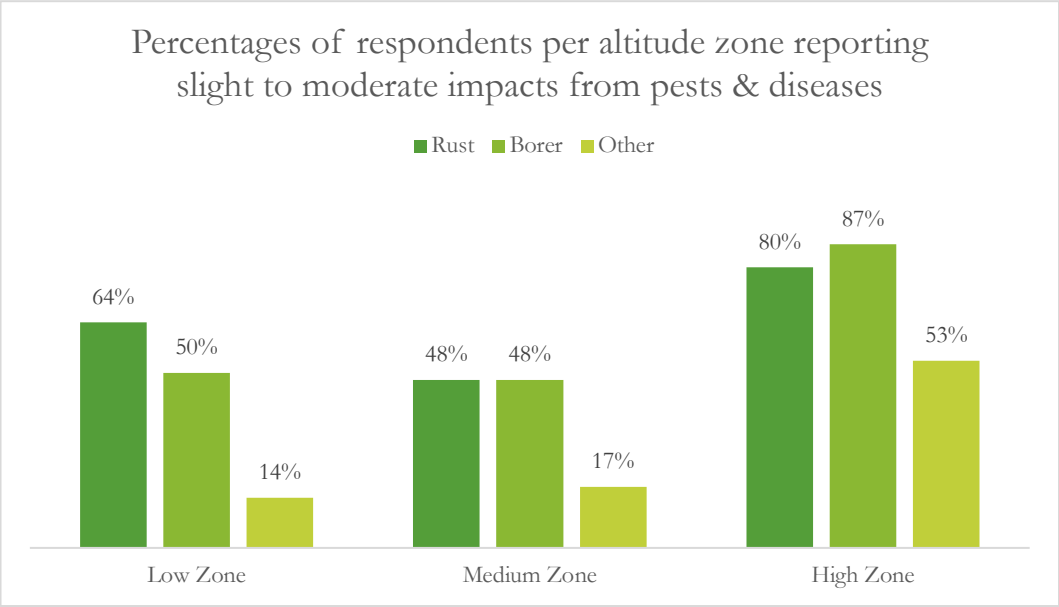


Figure 8 Percentages of respondents per altitude zone reporting slight to moderate impacts from pests & diseases

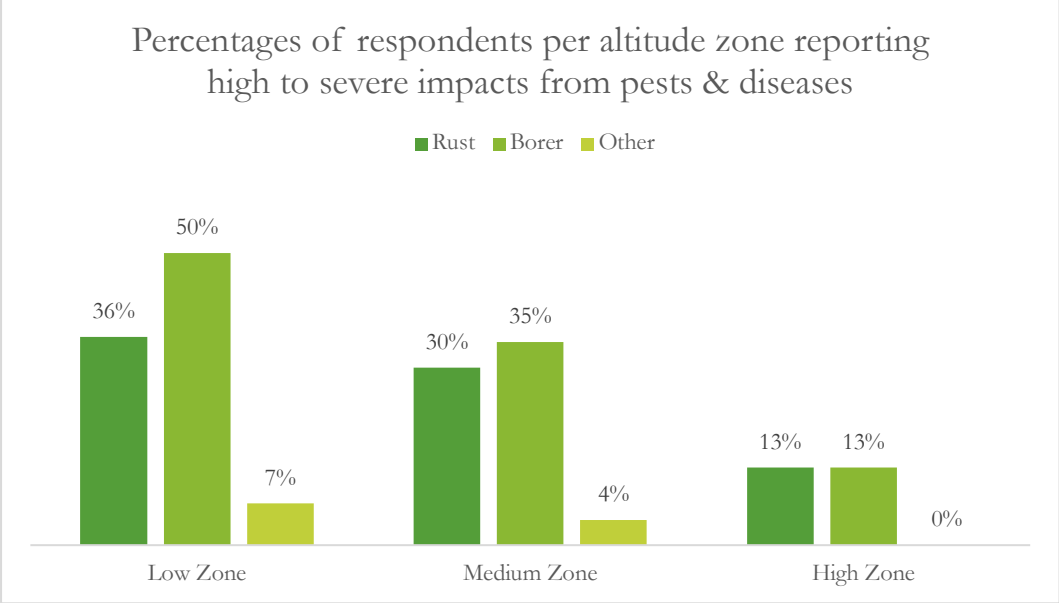


Figure 7 Percentages of respondents per altitude zone reporting high to severe impacts from pests & diseases

COFFEE RUST

Coffee rust affected farmers in the low zone most severely, with a total of 36% reporting an impact in the categories of 'high – severe'. In the medium zone, 30% reported 'high – severe' impacts, while in the high zone only 13% reported impacts in this category by comparison. Impacts in the categories of 'slight –

moderate' due to coffee rust were reported by 64% of producers in the low zone, 48% of producers in the medium zone, and 80% of producers in the high zone.

Coffee Berry Borer

Farmers in the low zone were also affected most severely by the coffee borer, with 50% reporting 'high-severe' impacts, compared to 35% of producers in the medium zone and 13% of producers in the high zone. An impact severity of 'slight-moderate' was reported by 50% of producers in the low zone, followed by the medium zone with 48% impacted, and 87% of producers in the high zone being impacted in these severity categories.

Other Pests & Diseases

In the case of other pests and diseases, such as American Leafspot or Black Root Rot, the incidence of the more severe impact categories was relatively low compared to the two coffee-plant threats listed above. This can be seen in the fact that only 7% of producers in the low zones reported 'high-severe' impacts and 4% in the medium zone did likewise. No producers in the high zone reported such impacts from other plant-threats. However, producers in the high zone reported a far higher incidence of 'slight-moderate' impacts from other plant-threats with 53%, compared to 17% in the medium zone and 14% in the low zone.

Extreme Weather

Drought

Drought affected producers in the low zone most severely, with 21% reporting a 'high-severe' impact, compared to 4% in the medium zone and 0% in the high zone. In the lower impact categories, 36% of producers in the low zone reported a 'slight-moderate' impact, compared to 21% of the medium zone and 20% of producers in the high zone.

Flooding

Flooding, on the other hand, only affected 7% of low zone farmers in the 'high-severe' categories, and no farmers in the medium or high zone. However, farmers in the high zone had the highest percentage of reports in the 'slight-moderate' category, with 33%. Comparatively, only 7% of producers in the medium zone reported such impacts, and no farmers in the low zone did.

Frost

Only 7% of farmers in the high zone reported incidences of frost with 'high to severe' impacts, and were the only ones to report in this category. However, they also had the highest percentage of producers reporting 'slight to moderate' impacts at 33%, followed closely by low zone producers with 29% reporting such impacts. By comparison, in the medium zone 13% of producers reported similar impact levels.

Storm

Overall, only high zone producers reported 'high-severe' storm impacts, with 7%. Of the low zone producers, 14% reported a 'slight-moderate' impact, followed by 13% in the high zone; no medium zone producers reported any impacts.

Soil Health

Soil Erosion

Producers in the high zone suffered the highest percentage of impact, with 27% reporting 'slight to moderate' impacts. This was followed by low zone producers with 14% and medium zone producers with 4%. No producers reported 'high to severe' impacts.

Soil Infertility

In the case of soil infertility, both low and medium zone producers reported the same percentages of impacts, with 7% reporting 'slight to moderate' impacts and 4% reporting 'high to severe' impacts in both zones. No high zone producers reported any impacts in the form of soil infertility.

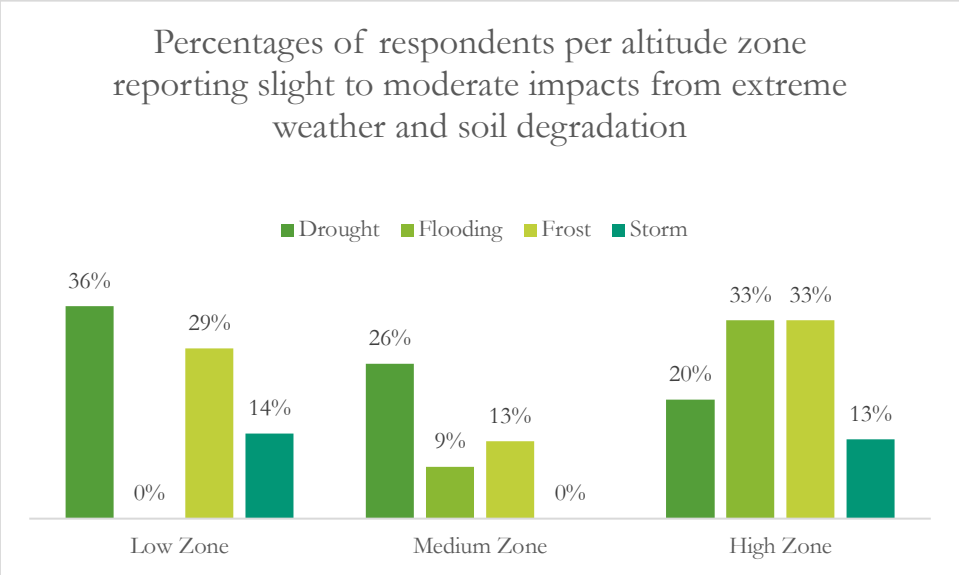


Figure 9 Percentages of respondents per altitude zone reporting slight to moderate impacts from extreme weather and soil degradation

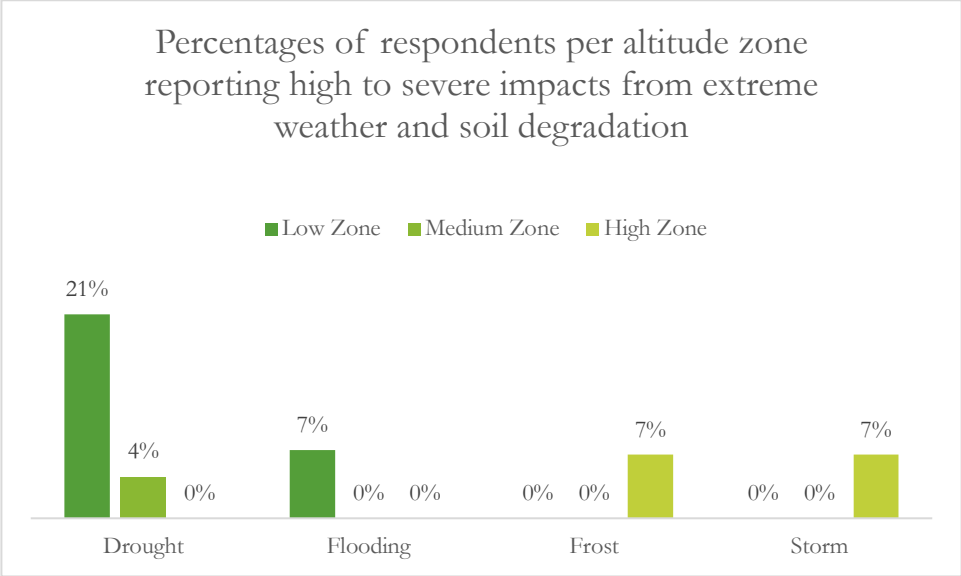


Figure 10 Percentages of respondents per altitude zone reporting slight to moderate impacts from extreme weather and soil degradation

The results of the field research show farmers in the lower zones have experienced the most severe impacts from phenomena linked to a changing climate, which follows the current findings and predictions in the literature. Farmers in this altitude zone reported the highest impacts from coffee pests and diseases as well as drought. Similar impacts were felt by producers in the intermediate zone when it comes to the impacts of pests and diseases – however, farmers in this zone reported far less incidences of being affected by extreme weather events. On the other hand, while producers in the high zone reported overall being less severely affected by pests and diseases than farmers from the other zones, it appears that other environmental challenges exist for them in the form of far higher incidences of severe and moderate impacts from flooding and frost damage to their crops.

With regard to pests and diseases, the threat to coffee producer's livelihoods has not yet abated. Although the epidemic of coffee rust that plagued Peru and other coffee-producing Latin American nations seems to be slowly abating, it cost the sector overall and the producers in particular dearly, as many plants had to be replaced, causing many coffee-farmers to be forced into taking on debt in order to keep what remained of their livelihood going. Furthermore, other pests such as the coffee berry borer have been increasingly occurring in the last two years.

The impact of coffee rust can also be seen in the total hectares under coffee production in recent years, as shown in the graph below. Effectively, the coffee rust epidemic came at a time when the sector was economically vulnerable due to the post-2011 price 'crash'. As such the widespread destruction of many coffee plants came at an extremely inopportune moment, and the sector is still only slowly recovering from the multiple impacts. Furthermore, the rehabilitation paths for their farms also puts many farmers into a difficult position when it comes to market demands.

Many farmers opt for rehabilitating their farm with hybrid strains that are more resilient to coffee rust, but yield lower quality coffee. The replanting of coffee plantations with the more resistent strains such as "Catimor" has also been a focus of the recent government interventions during and after the coffee rust crisis in both Peru and Cajamarca.

A possible consequence of this is that while their production overall has become more resilient, this may mean that the revenue from their crop over the coming years will remain low, due to the current market developments that increasingly demand quality, which consequently could result in farmers not being able to cover production costs for their production due not being compensated by a premium for the lower yields of their organically or sustainably managed farms.

Adding to this recent epidemic is the increasing impact from the coffee-berry borer, which shows a strong impact in the low and intermediate zones, but has also been felt in the higher zones with less severe impacts. This has further required investments from cooperatives and producers to find and apply solutions to this new pest, and the appropriate integrated pest management technologies and techniques formed a central part of the workshops attended, showing that cooperatives were already responding to this new threat.

However, the manager of Inprocafe spoke about the mixed impacts of climate variability on his cooperative in the recent years. For him, one of the main issues with climate variability is the unpredicability and subsequent uncertainty it brings with regards to harvest projections in terms of yield and quality. These projections are highly important to the administrative and financial components of the cooperative as they determine pre-payments, loans as well as prices. According to him, projections for this year were on the lower end due to the ongoing threat from coffee berry borer as well as predicted droughts in several areas. However, these areas experienced heavy rainfall instead, which caused a faster maturation and thus an earlier end to the harvest. Furthermore, the impacts of coffee borer were less severe than anticipated due to preventive measures aimed at optimizing pest management, and both the quality and the yield of the harvested beans was also higher than anticipated.

> "In 2016, the coffee borer was already everywhere. Little by little, everything was attacked, and in the end I was only able to harvest 3 quintals. I didn't bring them here [to the cooperative warehouse] because it would not have been profitable. What will 3 quintals bring me?"

Farmers continue to struggle with the two chief pests, coffee rust and coffee borer, with the latter becoming an increasing threat to them over the last years. Furthermore, the experiences across different regions with regard to climatic events and shifts also vary greatly. One farmer from Jaén pointed out the differences experiences of farmers across height zones, stating that "In the high zone, we actually need less shadow due to the heavier rains; if there is too much rainfall, we get poor flowering and low quality beans [...] so

we need less shade in the high zone. In the low zone however we need more shade [...] so that the plant is more resilient if there is a strong summer. [...] But, if we have good rains and shade, we have a great harvest, the maximum harvest." He added later, "in the high zone, when we have a strong [warm] summer, the plantations yield more."

Regarding the success of coffee-farming since 2011, he stated that "in 2011 we had a high productivity and high prices, so we could buy ourselves some things, buy some land, invest in our coffee." However, a technical assistant argued in another interview that many farmers did not invest the high revenues into their coffee-production, but rather into the purchase of consumption goods which left them ill-prepared for the difficult years following 2011.

According to another farmer, while 2017 has been a better year than the previous one, coffee borer and rust continue to be key threats: "The rust also hasn't gone away, it actually resurged in the harvest month. This especially affected the Pache and Caturra plants we have, which have a better aroma than Catimor [...] it affected the leaves and the maturation process." Catimor is a hybrid strain that is more resilient to coffee rust, but offers lower cup quality. Speaking of one of coffee plantations he had aquired in 2016, he said "[the impact of coffee berry borer] was very extensive. [...] In 2016, the coffee borer was already everywhere. Little by little, everything was attacked, and in the end I was only able to harvest 3 quintals. I didn't bring them here [to the cooperative warehouse] because it would not have been profitable. What will 3 quintals bring me?"

A farmer from Chirinos, also with Sol y Café, also reports disastrous impacts from rust and coffee berry borer, and highlights the important role played for him by membership in the cooperative and associated knowledge resources in making his production more resilient, particularly in the form of integrated pest management techniques such as alcohol-based traps against coffee borer.

Regarding the recent pest epidemics, he recounts: "I was highly affected by the coffee rust, it affected all the plants and beans, they were all dried out, as if burnt. This was a big problem for the coffee farmers, there was not much left to cover our living costs, for the education of our children [...] We were also affected by the borer last year, in 2016. Thank God this year [2017] was a bit better, we had a better production, and there was also less impact from pests due to better controlling, since we installed the biological traps [for the coffee berry borer]; this I believe has helped and strengthened us greatly."

For him, the cooperative "has helped us with our business, with some organic fertilizers, it has really helped us strengthen our coffee production." Specifically, he highlighted that the cooperative had benefited from new members joining, and that he in turn had benefited from being an associated producer. In his account, the example of biological traps can be seen as an important 'technological transference' from the cooperative to its producers, which for the farmer played an important role in securing his livelihood and making it more resilient against the highly threatening pests. However, he also points out that the impacts

and experiences of farmers can vary greatly across different zones: "It is different across the zones; I was telling you about the situation for me in Chirinos, but its again different in Tabaconas. Its not the same as there are different climates in different zones." This variation can be seen as both an opportunity and a challenge. As coffee production overall is divided across different zones with differing microclimates, climatic changes and specific weather events associated with these do not have a uniform impact on the region as a coffee-producing entity as a whole. As larger cooperatives are also spread across several zones, this could mean that they are more easily able to compensate and adapt to these challenges.

What becomes apparent is that events the overall temperature and rainfall in one year, which are set to shift towards higher intensity, have varied impacts across the altitude zones. Specifically, one zone's gain may be another zone's loss, as rainfall is desirable in the lower zones whereas it can harm the floration of the plants in the higher zones. Conversely, warm summers are welcomed in the higher zones, whereas it can mean that farmers face droughts in the lower zones.

Summary:

- Farmers are reporting increasingly shifting temperature and precipitation patterns, which impact their livelihoods. While the data suggests that farmers in the lower-intermediate zones are affected most, these impacts will vary from district to district.
- Pests and diseases are the main concern of farmers when it comes to environmental impacts linked to climate change, as the increased rains in some areas as well as increased temperatures provide ideal breeding grounds for coffee leaf rust, coffee berry borer and other diseases.
- Especially the coffee berry borer has been having a heavy impact in the last 2 years, attacking farmers who were still dealing with the impact of the coffee leaf rust epidemic. However, several farmers also argued that membership in the cooperative and access to know-how such as optimized management such as pruning and traps had enabled them to respond more effectively to this recent threat, which was now abating somewhat..

CHAPTER 4: THE IMPACT OF NETWORK PARTICIPATION ON KNOWLEDGE TRANSFER AND ADAPTIVE CAPACITY OF COFFEE FARMERS

This section will explore the historical role of cooperatives and the impact of certification on the development of the coffee cooperatives, guided by the the following research question: What has been the impact of certification on the governance and performance of cooperatives? Furthermore, this section will explore the impacts of participating in the association network on the knowledge, adaptive capacity and attitudes of producers, as well as the differences and overlaps in impacts on knowledge and learning that can be ascertained between association and certification.

COOPERATIVISM IN PERU

The cooperative as an organisation and its performance as a knowledge network forms a focal point of this dissertation. As such, it is necessary to explore what cooperatives are, how they function, as well as how they have been analyzed in the social capital context thusfar in the literature.

A cooperative can be defined as, "enterprise collectively owned by many independent farmers as input suppliers in a production chain" (Feng and Hendrikse, 2011, p.242). Specifically, they can be seen as hybrid organisations that combine aspects of voluntary associations and commercial enterprises such as firms (Levi and Davis, 2008; Bijman and Hendrikse, 2003).

Cooperatives are established with the aim of reducing transaction costs and overcoming market failures as well as addressing issues arising from asymmetrical information flows (Levi and Davis 2008, Bijman and Hendrikse 2003). According to Kurjańska (2015), small farmers are able to capture more profitable and capital-intensive positions in global commodities chains such as that of coffee by forming cooperatives.

Ruben & Heras (2012) argue that "farmers involved in global supply chains tend to face high transaction costs, have limited access to finance and input markets, and can thus individually hardly overcome binding commercial and technical constraints.", and are furthermore vulnerable due to being hit easily by price fluctuations and their access to profitable market outlets.

Subsequently, producers form cooperatives with the aim of advance the interests of its members through creating economies of size, bringing them gains from vertical and horizontal coordination, risk reduction as well as auxiliary services (Deng 2015). Members join because they seek to enhance their position on the market and improve their bargaining capacity as well obtaining advantages from shared input access and product decision coordination (Blokland and Gouet, 2007; Di Falco et al., 2007). Furthermore, cooperatives often function as important actors and agents in socio-economic development in the agricultural-rural sectors (Deng, 2015; Kurjańska, 2015), due to the services, resources and market access that they offer.

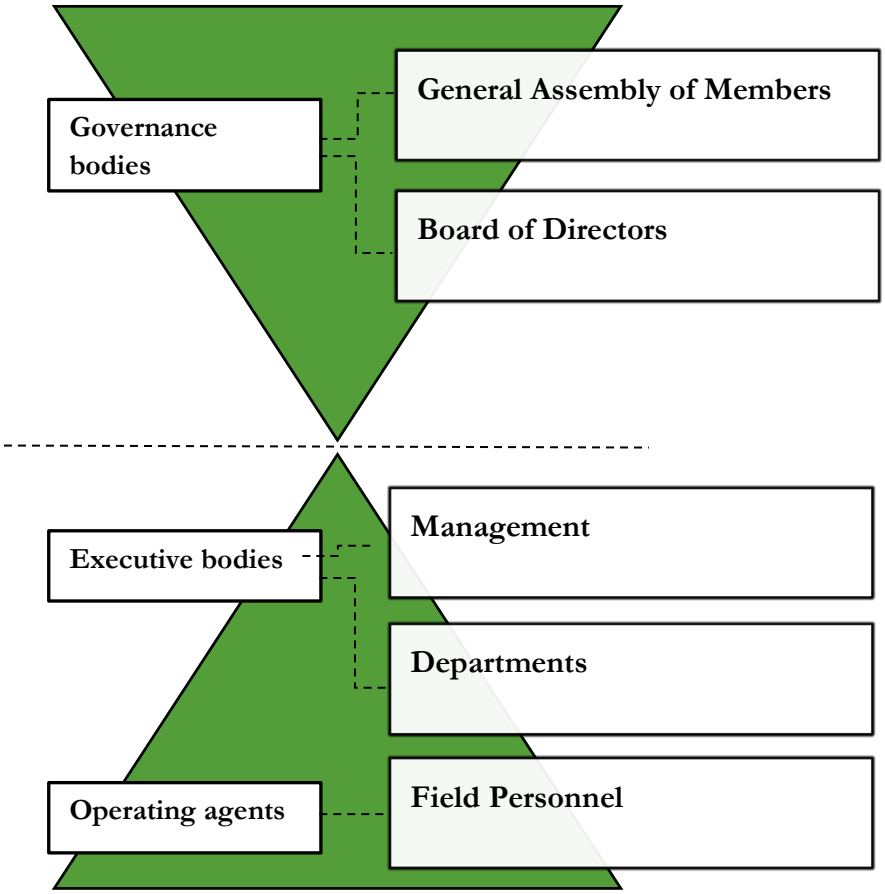


Figure 11 The social-political (top pyramid) and organisational-entrepreneurial structure (bottom pyramid) of the Peruvian cooperatives.

In Peru, both governmental (foreign and national) as well as non-governmental organisations have played a highly important role in the resurgence and rebuilding of the cooperative sectors since the mid-1990s.

The origins of cooperatives in Peru lie in the 1950s, in which there was a 'struggle for land' between farmers and the hacienderos, wealthy landowners who collected rent from the farmers for using the land on their private estates in the 'hacienda' estates system (Interview with Director of National Coffee Board of Peru, 2 August 2017). Subsequently, as a result of several political parties taking up this cause, popular land reforms were initated in the 1960s which resulted in the transfer of land from the hacienderos to the peasants (Interview 2 August).

As a consequence of the increasing amount of new landowners, the cooperatives developed government-backed iniatives to organise these new landowners and with the goal of improving agricultural producer's position on the agrimarkets (Martín, Casado, and Ordieres 2007; Kurjanska 2015; Interview 2 August). Specifically, this improvement of their position entailed stronger bargaining power when negotiating with exporters and aimed at increasing the prices received by producers while reducing the amount of intermediaries (Interview 2 August).

The governmental support for cooperatives was increased further in the late 60s to mid 70s under the military dictatorship led by Juan Velasco Alvarado (1968–1975) through renewed land reforms, resulting in a growth of the cooperative sector. These reforms saw the elimination of all private landholdings, which were converted into cooperatives owned by the workers that had previously been employed on the estates, with the sociopolitical purpose of fostering a more cooperative society in order to devise an alternative to capitalism (Hudson, R. A. & Library Of Congress, 1993), following the socialist government's views.

Exports were centralized under state-run companies that gave priority to the agricultural cooperatives with regard to exports such as cotton, coffee, sugar and others (Interview August 2), and cooperatives received a privileged legal status (Kay 2002). These years also saw the creation of financial institutions for agricultural and rural development, in the form of funds and banks (Acevedo and Delgado, 2004); this was also the case for the coffee sector, where a coffee bank was developed similarly to the Colombian coffee-bank model of the time (Interview August 2).

However, while cooperatives had been responsible for up to 80% of agricultural exports in the 60s, this declined to 50% in the 80s due to the emerging liberalization of the market (Interview August 2), which were the beginnings of intense liberal economic reforms Peru has been undergoing since the stabilisation of Peruvian politics (Kurjanska, 2015). The 90s further saw the agricultural cooperatives and their members under increased pressure from markets and governments. The deregulation of the coffee industry in 1989 following the collapse of the International Coffee Agreements, as well as the turmoil and civic unrest caused by the terrorist group Shining Path had a devastating impact on the country and the cooperatives (Kurjanska, 2015; Martín, Casado, and Ordieres 2007; Interview August 2).

A further consequence of the neoliberal reforms was the closing of previous financing mechanisms for the coffee producers and the cooperatives, most notably in the closing of the then-existing iteration of Agrobanco (rural/agricultural development bank of the state) under the Fujimori government and the devaluation of the coffee fund (Interview August 2), referred to by the Director of the Board of Cooperatives as a 'breakdown of institutionality' (ibid.)

The 90s saw a continuation of the neoliberal political reform, but also several important changes for the cooperatives. In 1991, the Ley General de Cooperativas was passed, standardising the basic structure of the cooperatives (Kurjanska 2015). This law enshrined the general assembly of the cooperative's members as the chief governing body. However, while the power was thus officially in the hands of the members with the right to elect the cooperatives representatives and approve their actions, the 'de facto' control passed to the governing bodies consisting of the administrative board (consejo de administracion), the board of overseers (consejo de vigilancia), and the general manager (gerente) (Kurjanska, 2015). The administrative board is tasked with governing the cooperative, while the board of overseers monitors its financial activities; the general manager in turn is tasked with overseeing the daily activities of the cooperative (Kurjanska, 2015).

In 1993 the remaining coffee cooperatives re-united to begin the process of 're-activation' of cooperativism, followed by the formation of the Junta Nacional del Café, the National Coffee Board in 1996 with 12 cooperatives – a number that has since grown to 130 cooperatives (Interview August 2). Following its ongoing pursuit of the strategic reactivation of the cooperatives "widespread cooperativism among coffee farmers re-emerged in the twenty-first century" (Kurjanska 2015, p.311). However, in the newly liberalized market and without its previous 'privileged' legal status and against the backdrop of unstable markets and financial access, the cooperatives of today face numerous challenges, including the threat of climate change that threatens to disrupt their ability to produce and the challenges for effective governance of the cooperatives within the existing political and economic environment of Peru as well as the global markets.

COOPERATIVE PROFILES

During the field research, four different cooperatives were visited and interviews conducted with managing and technical staff as well as their producers. Each of these cooperatives had a different organizational 'foundation'. The 'pure' cooperatives of this study are Cenfrocafe, Sol y Cafe, and Inprocafé, while Comercio y Cía represents a 'corporate cooperative' formed within the larger structure of a large national company that emulates some of the governance structures of a cooperative through their 'Programa Familia' (family program). Furthermore, several members of Comercio y Cía were also members of the relatively new Inprocafe cooperative, indicating overlapping or multi-cooperative membership.

Central Fronteriza del Norte de Cafetaleros (Cenfrocafe)

Cenfrocafe was founded in 1999 in the district of Tabaconas, San Ignacio, as the result of 11 associations with a total of 220 producers joining forces into a Central de Asociaciones, a centralized association. In 2000, it began its organisational activites, and in 2001 initiated relationships with various organisations in order to access financial and technical services.

In 2003 it became an associate of a cooperative alliance together with the CEPICAFE cooperative of the neighbouring province of Piura, which enabled it to access export markets in Europe and the United States. Following this, in 2009 the association was consolidated as a direct exporter, and as a result of rapid growth in membership and sales, it was decided that the transformation into a cooperative was necessary in order to become more "business-oriented". In 2010, the association officially became a cooperative and initiated restructuration process towards the new business model.

Today, the cooperative is made up of almost 2000 coffee-farming families organized across 84 'bases' (local associations) in the provincial districts of San Ignacio and Jaén (Cajamarca province) and Bagua (Amazonas province).

Sol y Cafe

The foundations of this cooperative were laid down through the "Poderes" project, carried out by the Catholic relief organisation Caritas and financed by the US government through USAid from 2003 onwards, which had the aim of organising producers in the region and giving them access to better nutrition (Strategic Plan Sol Y Cafe, 2015). It was officially consolidated with 27 'bases' in 2005, then as an association under the CEPICAFE cooperative following a similar path as Cenfrocafe, and in 2008 officially became a cooperative in its own right. Fair trade certification in 2011 allowed the cooperative more direct access to the markets of Europe, Canada and the United States (ibid). Currently, the cooperative is partnered with the Dutch foundation Agriterra, which focuses on the professionalisation of agricultural cooperatives and organisations, providing them them with access to advisory/knowledge services (examples) as well as funding through credits and loans.

Inprocafe

Inprocafe is the youngest of the organisations visited as part of the field-research. It was founded in 2014, after farmers in several hamlets of the district Las Pirias, Jaén province, when around 30 farmers came together to discuss the challenges facing them them as coffee producers and what solutions the cooperative model might offer. Subsequently, after a period of outreach to other producers, the cooperative was consolidated, and now has over 200 members organised across 15 'bases' or committees.

Comercio y Compañía

The 'Programa Familia' (Family Program, PF) of Comercio y Compañía, initiated in 2003, is not a cooperative in and of itself, as Comercio y Compañia is a fully commercial company that is part of the MOLICOM group and thereby does not fall under the regulation of cooperatives. Rather, the PF is a network strategy employed by Comercio y Cía in order to benefit from a cooperative-like network for its supply-chain. This strategy is seen as necessary by the company to be able to create the necessary knowledge and resource pathways that allow their producers to become certified (primarily for the Organic markets) and have a higher quality coffee production.

For this purpose, the company requires a well-organized and documented network of participants, for the primary purpose of bringing them together in workshops for trainings and implementation. These workshops fall into two categories: the 'talleres de planificación' (planning workshops) aimed at organizing and training community leaders and to generate interest and knowledge in better agricultural practises and sustainable management, and to demonstrate the additional benefits obtained through the technical assistance and credit access of the Programa Familia. This is complimented by 'talleres de implementación' (implementation workshops); in these workshops, is is intended that the farmers learn in groups how to implement 'socio-environmental' practises in their farm to achieve an 'organic-sustainable' production. According to the company's field training manual, the aim of these workshops is to give the producers

appropriate technology and the know-how to implement these standards within a given time-frame in order to pass the inspections required for certified production.

According to the manager of Comercio y Cía, the impulse for the creation of the program was in reaction to natural resource degradation in the form of soil infertility, rather than coffee prices. As a result, the company's technical assistants came together to discuss the best way in which to appropriately transfer the necessary technology to rehabilitate the farmer's plots and give them the necessary training to overcome issues of quality and productivity.

INTERNALLY AND EXTERNALLY DRIVEN ORGANISATIONS AND THEIR GOVERNANCE

Donovan et al. (2008) distinguish between 'externally' and 'internally' driven rural community enterprises (RCEs), which include cooperatives. Internally driven RCEs develop in reaction to shocks, such as price fluctuations or environmental hazards such as natural resource degradations, and are usually based on local or traditional institutions. Externally driven RCEs are the result of interventions from NGOs or government agencies in the pursuit of objectives such as sustainable resource management or poverty reduction.

In their research on social capital in coffee cooperatives, Ruben & Heras find that cooperatives in which there is a higher share of social capital among members have the following characteristic as they are 1) "better able to build a communitarian response to critical external constraints", 2) "present stronger resistance against adversities" and 3) "are more capable of recovering access to resources" (p.471). Woolcock & Narayan further state that "the social networks of the poor are one of the primary resources they have for managing risk and vulnerability, and outside agents therefore need to find ways to complement these resources, rather than substitute for them" (2000, p.17).

Different crucial components inform the success of cooperation, and research has found that trust, reciprocity, networks and sanctioning play key roles in overcoming collective action restraints (Ruben & Heras 2012, p.467). The cooperative functions by providing services and market outlets to their members, who in return commit to selling their produce through the cooperative. As a result, the performance of the cooperative – the degree to which it can fulfill its stated aims – depends on the ability of the cooperative to "establish and maintain trust, confidence and commitment among members" (Ruben & Heras, 2012, p.467). Ruben & Heras subsequently argue that that "without receiving (in)tangible benefits, successful cooperation is either unlikely to occur or be very cost-ineffective" due to the cost of reducing opportunism becoming too high" (2012, p.467).

Donovan et al stress the importance of mutual understanding among managers, boards of directors and members pointing out that trust and consensus building is often hampered due to low investments in communication. They furthermore find that for both options of organisation-drive, "membership

commitment can be maintained by effective mobilization and governance based on principles of democracy and accountability and clear expectations about entry conditions and potential benefits" (2008, p.18). They find that whereas externally driven RCEs can exhibit tendencies of dependency and ignorance of local structures on the part of their donors, "internally driven approaches often require investments in building capacities, where learning is often based on trial and error" and can take many years to several decades to reach maturity (ibid.) which can be problematic in more demanding market environments that place higher requirements on quality and volume, of which the coffee market is an example. This capacity-building remains a large challenge for the cooperatives, yet is crucial to be able to survive and thrive in the demanding coffee market.

The cooperatives studied as part of this research cannot all be classified according to one category or the other, but rather showcase that RCE's often need to find a way to combine both internal 'drive' with 'external' support. This can also be seen in the light of 'internal' social capital that is responsible for regulating conduct and trust among members within the cooperative, and 'external' social capital that allows the cooperative to form wider networks of knowledge exchange and access to markets through connections.

Cenfrocafe and Inprocafe can be seen as more 'traditional' internally driven cooperatives, as they were both formed over time by the producers themselves from local, small-scale farmer's associations. On the other hand, Sol y Café can be seen as an initially externally driven association that matured and became more 'internally driven' while maintaining links to external actors for support in further growing their organisational capacities. The role of 'outside' specialist organisations in further growing the entrepreneurial, productive and organizational capacities of the cooperative can be seen in its current alliance with AgriTerra.

In their case studies of different RCEs across the developing world, Donovan et al find that external support, including long-term technical assistance, subsidies and upgrading of production and marketing skills played a critical role in their organization. In the case of the Kuapa Kokoo cocoa cooperative from Ghana they stress that both the 'timing' of the intervention in that "external support was available at the right time for growth and expansion" (2008, p.43); furthermore, pre-existing high social capital appears to have been a factor in success as well.

Comercio y Compañía (Comercio y Cía) can be seen as an 'internally' driven network structure in the sense that the 'parent organisation' constructed it in order to make their coffee production base more 'efficiently managed' and sustainable in order to improve production and access to differentiated markets as well as rehabilitating the natural resource base; however, the impetus for organisation did not come from directly from the producers themselves, and financial decisions and profits lie in the hands of private shareholders. The participants of the Programa Familia are therefore more 'passive' recipients of technical assistance and credit rather than 'active' members of the network with their own investments into the cooperative itself.

The 'farmer network' being constructed within Comercio y Cía is therefore externally driven in the sense that the impetus for its birth came from the company rather than the producers. The investments it makes into the organisation of the producers and their technical capacitation can therefore be seen as a form of internal supply-chain upgrading, in that the knowledge network forms the pathways for technology transfer that enable improving the production. Specifically, the manager of the company highlighted that their approach had to focus on the 'autodesarollo', or self-development, of the farmer by the farmer in order to achieve a self-sustaining program as the company could rely less on outside donors, unlike the more socially operated cooperatives that could rely, according to him, more on government and non-governmental aid in their supply-chain development programs.

THE GOVERNANCE LANDSCAPE: SUSTAINABLE COFFEE DEVELOPMENT INITATIVES

Currently, there are several initiatives that have been launched in the recent past aimed at the sustainable development of Peru's coffee sector. These initiatives include a host of actors, including national and regional government agencies, private interest groups of the industry and the farmers, foreign development cooperation agencies as well as (international) non-profit NGOs and coffee labels.

The Junta Nacional de Café (JNC, National Coffee Board) is Peru's largest cooperative umbrella organisation. It was founded in 1993 by 5 cooperatives with the aim of creating an organisation that would represent the interests of the coffee farmers organised in the cooperatives. It has now grown to represent a total of 56 coffee-farmer organisations which represent a total of 70.000 families in the coffee sector in 14 coffee-growing zones of the country (JNC, 2017).

The Camara Peruana del Café y Cacao (CPCC, Peruvian Chamber of Coffee and Cocoa) was founded in 1991 by the largest private enterprises in the coffee and cocoa sector of Peru, and currently represents 16 companies that are responsible for 70% of the national export for these products, forming the country's industrial organisation for coffee and cocoa (CPCC 2017a, b).

These two organisations formed the Alianza para el Café Sostenible (Sustainable Coffee Alliance) in 2016, thereby creating a platform for cooperation between the large private-sector companies and producer-organisations with the aim of improving the coffee supply-chain and strengthening the governance and institutions in the coffee landscape (Agronegocios Peru, 2017; SCAN, 2016). At the time, the platform was set to be funded with 1,5 million Peruvian sol or 4,57,380 US dollars through various channels, including the World Bank.

The CPCC and the JNC both respectively have their own sustainability initiatives as well. In 2016, the CPCC initiated their 'Café y Clima' program, aimed at promoting a 'climate-smart' agriculture in the coffee sector from a value-chain perspective and working together with the Sustainable Commodities Assistance Network (SCAN) and the international network organization Solidaridad (SCAN, 2016).

The JNC is responsible for the 'Modelo de Desarrollo Sostenible para el Café Peruano' (Sustainable Development Model for Peruvian Coffee) in 2012, which involves 37 coffee-producer organisations as well as companies affiliated with the CPCC. This project was born from proposals from both SCAN and the JNC to the Interamerican Development Bank, and has several core components aimed at the development of tools for sustainable development of the coffee sector, create a catalogue of best practises for communication and learning, improve the supply of services for the sector and promote the development of innovative technologies (JNC, n.d). Furthermore, with its Café Corecto program, the JNC has also launched an initiative aimed at formalizing and improving labor conditions for rural (seasonal) workers.

SCAN is an organisational network created by the Sustainable Commodity Initative (SCI), which in turn is a joint initative launched by the United Nations Conference on Trade and Development (UNCTAD) and the International Institute for Sustainable Development (IISD), and is currently partnered with 18 organisations that include several agricultural labelling organisations such as UTZ Certified, IFOAM and Rainforest Alliance as well as other NGOs active in sustainable finance, international standards setting and sustainable development.

Furthermore, 2017 also saw the launch of the planning stages for a "National Coffee Action Plan", led by the Ministry for Agriculture and Irrigation (MINAGRI), sponsored by the UN Development programme with the support of the Swiss development and cooperation agency, and facilitated through the multi-stakeholder National Coffee Platform being constructed by the Global Coffee Platform (GCP). The plan is set to be launched in the first quarter of 2018, and aims to accomplish its goals by the year 2030. This National Action Plan is, like the other iniatives, also focused on increasing the productivity and quality of peruvian coffee through technological innovation while also mitigating and adapting to climate change impacts. It further seeks to strengthen socio-economic development in the coffee sector, develop a multi-stakeholder governance model and strengthen the 'brand' of Peruvian coffee on the global marketplace to increase its recognition and competitiveness (Minagri, 2017b).

Between 2013 and 2014, in response to the coffee rust epidemic, the regional government aided the farmers through the distribution of synthetic fungicides as well as giving assistance with regard to replanting farms with more resistant strains and optimized management practises such as pruning; regarding the latter it was stressed by the local agricultural agency manager that good care and proper fertilization were key to controlling the fungus.

In 2015, the project 'improvement of the provision of agricultural services' was implemented, which was not aimed specifically aimed at just the coffee supply chain. However, according to the district manager, this project did include a focus on expanding the associativity following the cooperative model in the region. In this project, there was an important cooperation between the cooperatives and the government with regard to giving farmers access to more technical assistance and other services, and also instituting

workshops for technical and managing staff in the coffee sector such as through the 'Agroideas' program (which the researcher observed for one session).

Currently, a major project aimed at improving the productivity and access to services for organisations and producers in the coffee sector is currently in the final stages of planning finalisation, awaiting the technical evaluation and public financing approval. The regional government, through the Regional Agricultural Directorate (DRAC) connected to the Ministry of Agriculture, devised this plan in 2015 for the coffee-producing provinces of the Department of Cajamarca, with the aim of improvement of access, coverage, quality and auxiliary services to the coffee production chain.

The project can be said to have three major goals. Firstly, the project seeks to improve the institutional capacity of local government agencies working in the field with producers and organisations. The second major goal is to improve the technical capacities of producers, referring to tools and knowledge to improve their production, complimented with improved infrastructure at the communal level and value-adding services to improve the productive assets and output of the region's producers. The third major goal is to enable and incentivize non-organised producers to enter the cooperative sector, with the aim of increasing the number of producers who utilize good agricultural practises. Ultimately, the project seeks to modernize, upgrade and streamline the production base of of coffee in Cajamarca and increase the associativity between producers.

Within the plan, there is a specific focus on certifications and cooperatives. The plan seeks to implement a program of farm certification with the aim of creating the necessary basic conditions and 'good agricultural practises' required for achieving a certificate (from one of the voluntary standard organisations), which in turn functions as an indispensable requirement for producers in order to be able to integrate into the cooperative model.

A further component of the project has the aim of equipping and incentivizing beneficiaries to join some form of consolidated organisation, and through this integrate them into the cooperative model. To this end, it will be necessary to create a map of potential beneficiaries, and that these form new associative networks after a process of forming learning-teaching groups and receiving permanent technical assistance and capacitation. Crucial to this component is the participation of producer organisations that have expressed their interest of taking part in the project. The cooperative sector, especially younger organisations, is set to further benefit not only by the influx of new producers but also through the joint formation of a technical roundtable, intended as a space to manage the growth of the coffee-cooperative sector of the region.

As current challenges to the implementation of such projects, the manager of the local agricultural agency identified the lack of funds of many smallholder farmers to pay the 20% of the total cost of i.e. fertilizers required by government programs. Another issue identified was the long time it takes for government programs to be properly implemented at the level of the producer, which he attributed partially to issues of bureaucracy also within the cooperatives; this delay, he argued, resulted in mistrust among the farmers in these programs as they did not see results as quickly as they expect or require them.

CERTIFICATIONS AND GOVERNANCE

It therefore becomes apparent that a multitude of actors, both government and non-governmental, are active in the shaping of the Peruvian coffee sector. Within this governance landscape, special attention needs to be paid to the non-profit labelling organisations and the differentiated markets they have created, as they not only form an important 'external' link to markets in Europe, the United States and Asia, but also have an 'internal' role in the cooperatives through the standards they set acting as governance guidance tools and also acting as knowledge nodes through for instance offering services and training to the technical assistants of the cooperatives.

Certifications are a form of voluntary arrangements incorporating a set of standards and emerged as a consequence of de-regulation in the agro-food sectors following the implementation of neoliberal policies, proliferating in an attempt to fill the 'regulatory vacuum' that had formed regarding the ethical, environmental and health-related dimensions of agro-food production (Raynolds, Murray, & Heller, 2007). Gereffi et al. termed the system of these new labels, standards, and certification institutions as "transnational private governance" (Gereffi et al., 2001: 56).

The formulation of such a 'sustainable' coffee along these pillars by for instance the First Sustainable Coffee Congress in 1996 led to roasters and marketers realizing "unexploited niche markets" based around selling purportedly socially and environmentally supportive coffees (Rice 2003, p.237).

These new institutional structures excise regulatory power not through the state but instead do so through the promise of market shares, consumer loyalty as well as price premiums (Raynolds, Murrary & Heller, 2007). Voluntary sustainability standards require conformity to a certain set of practises and regulations within the supply-chain and in return give the producer a 'certificate' that signals to buyers and consumers the circumstances under which the product was produced. Their increasing popularity can be attributed to the fact that they unite "valued traits related to global poverty, environment, and health outcomes into a single bundle", which allows consumers to express ethical preferences through purchases of everyday goods (Barham & Weber, 2012, p. 1269).

For the co-operatives and farmers that receive the certification, advantages promised include access to a niche market with more stable and higher price, which is achieved partially through a price-premium mechanism that ranges from freely negotiated in the case of UTZ to a fixed 'social' premium used for

community development project funding (Barham & Weber, 2012; Bacon, 2005; Murray, Raynolds, & Taylor, 2003). Furthermore, certification can also provide links to new markets, management practises and products through the information exchange between the different actors along the supply chain (Barham & Weber, 2012). Frequently mentioned economic benefits put forth by promoters of this type of farming to the producers increased productivity of low-input agricultural system as well as new market opportunities, among others (Kilian, Jones, Pratt, & Villalobos, 2006).

In the paper "Is Sustainable Agriculture a Viable Strategy to Improve Farm Income in Central America? A Case Study on Coffee", Kilian et al (2006) note that "a conversion from conventional to certified sustainable production is perceived and promoted as a viable opportunity to differentiate products and therefore to achieve substantially higher prices" (2006, p.322), and that sustainable – and particularly organic – farming is promoted due to positive social, environmental and economic impacts.

However, the published evidence on certification has produced mixed results regarding impacts, with cross-literature evidence further hampered and therefore weakened through a lack of rigor (Blackmore et al, 2012; Nelson & Martin, 2011). This can also be seen in the niche of organic coffee certification, among the first and oldest on the market, where the Committee on Sustainability Assessment (COSA) reports that "very divergent results are commonly reported even for the same crop and country" (COSA, 2013, p.13).

This is also indicated by meta-level studies such as the one carried out by DeFries et al. (2017) which analysed 24 case studies of certified products including coffee. From their analysis, they conclude that they are only able to distinguish a moderately positive impact across the "pillars of sustainability" – ecological, economical, and social impacts. The DeFries study as well as others, such as Barham & Weber (2012) argue that the significant methodological differences between the various case-studies on the efficacy of certifications make the detection of significant results difficult.

In the case of organic production, Kilian et al identify the following challenges for farmers to obtain the pre-requisite quality and thus also the premiums: 1) farms with low investment from the farmer are certified and labelled as organic without undergoing major changes or adaptations, resulting in quality deficiencies and 2) farmers are faced with greater challenges with regard to achieving sufficiently high yields and qualities. A related critical aspect that they point out is the gap between earnings and production costs for organic production, where "with respect to current price levels, there is a gap between production costs and final product prices" (2006, p.327).

Kilian et al stress that as more farmers adopt organic and/or sustainable certification, a new market equilibrium will be reached. According to them, the development of the sustainable markets competition would increase, resulting in decreasing price premiums for certified coffee, and oblige famers to improve their productivity and quality to maintain their income. They argue that while during the coffee crisis of the early 2000s certification served as a short-term economic strategy, "these certification processes alone,

without other changes in quality, productivity, export, and production, will not be the answer the region needs." (2006:330). This is echoed by Auld (2010), who find that coffee has the largest certified production share with 40% of all production being compliant with some standards – yet only 12% are sold as such.

Certifications played an important role in the resurgence of the cooperative model in Peru, and continue to play an important albeit shifting role in relation to cooperative governance and marketing. During an interview, the director of the country's largest cooperative umbrella organization – the Junta Nacional de Café, or National Coffee Board, described certifications as playing an important role in the 'reactivation' of the cooperatives during the late 90s. He argued that for the Peruvian cooperatives they represented 'niches' that offered new opportunities and through which the cooperatives were able to formulate and commence their reactivation plans. During this interview, the importance of certifications as 'springboards' to international market access for smaller enterprises (such as the cooperatives) was highlighted, as they "gave the cooperatives a higher degree of autonomy amidst unfavorable policies from the state and opposition from from the big business owners to the cooperatives".

In this research, coffee certification labels were grouped into two main categories: organic and sustainable. Organic labels are those that are part of the IFOAM network (International Federation of Organic Agriculture Movements) and thus require a strictly organic mode of production. Together with the FairTrade concept, organic represents the first certifications applied to coffee, with Organic certifications starting in the 1960s and experiencing their first large 'boom' during the coffee price recession in the early 90s. The organic labels include USDA Organic, the Japanese Agricultural Organic Standard (JAS), as well as several European labels such as EU organic certification and the German Demeter label.

The 'sustainable' labels represent a development of the niche and thus more recent additions to the label landscape. They started out with the first certifications of Rainforest Alliance based on the standards developed by the Sustainable Agriculture Network (SAN), and now include labels such as the Smithsonian Bird Friendly label, developed by scientists at the Smithsonian Migratory Bird Center in 1997; UTZ Certified, which started out in 1997 as a joint initiative between coffee producers and industry and is now an NGO; the 4C Common Code, begun in 2003 through a public-private partnership; and the CAFE Practises (Coffee and Farmer practises) program of Starbucks, developed with the NGO Conservation International.

All these standards, although grouped here into 'organic' and 'sustainable', vary in the specific areas that their standards focus on, with organic production being highly focused on the exclusion of non-organic inputs into the crop, Bird-Friendly and Rainforst Alliance focusing on the presence of shade trees on the plantation, UTZ Certified having a specialized traceability system and FairTrade institituting a minimum price threshold for certified producers.

Many farmers are multiply certified, with one third (30%) of the 53 producers surveyed producing both for 'organic' and 'sustainable' labels. Organic remains dominant, with with few reporting that they produced only along 'sustainable' standards.

Furthermore, the certifications manager of Cenfrocafe explained that their labels are usually managed by districts, meaning that different districts of Jaén and San Ignacio in which the cooperative operated would respectively have different combinations of labels. The reason given for this was to make inspection more efficient and thereby less time-and money consuming, as it would already be known to the cooperative which farmers would have which labels.

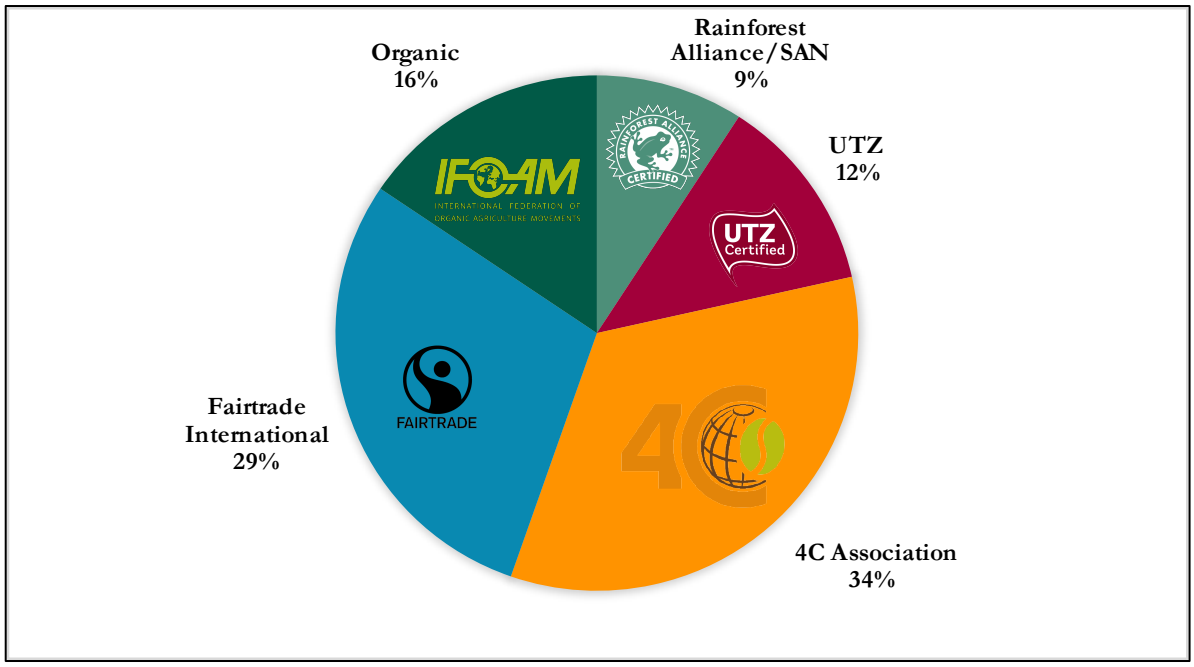


Figure 12 Shares of total certified production in Peru in 2015 by label. (Ceincafe, n.d.)

The different labels represent both their own advantages and costs for the farmers. One farmer commented that "Rainforest Alliance has more norms that inform us compared to Organic only, even though [Organic] are sometimes a bit stricter." With regard to organic certification and production, one farmer remarked that it sometimes created difficulties for her because the price/cost relationship varied.

Another difficulty for producers are the strict standards of the organic and sustainable labels which either forbid or significantly curb the use of chemical agents to combat these threats, which requires farmers to invest significant amount of time as well as money in purchasing these agents and subsequently applying them appropriately, in the expectation that these investments will result in higher economic gains through access to the differentiated markets, reducing their exposure to contaminants and creating a healthier environment.

The certifications manager of Cenfrocafe also remarked that the rise of the 'sustainable' labels, such as FairTrade, UTZ and Rainforest Alliance, had represented a further evolution of the certification niche for his cooperative and its producers. His organization saw the certification market since 2005 as "a great market opportunity, for the producers to get better prices for their product". However, in the case of organic production, producers had soon come up against production-related limitations, specifically regarding lower yields and high labor investments. "Organic only allows the authorized inputs, which give lower yields while the producer wants more, and with a sustainable agriculture we've been able to double the productivity", he said, highlighting that organic producers in his cooperative had experienced a trade-off of yields for the organic premium, while premium was growing smaller, which is in line with the trends predicted by Kilian et al.

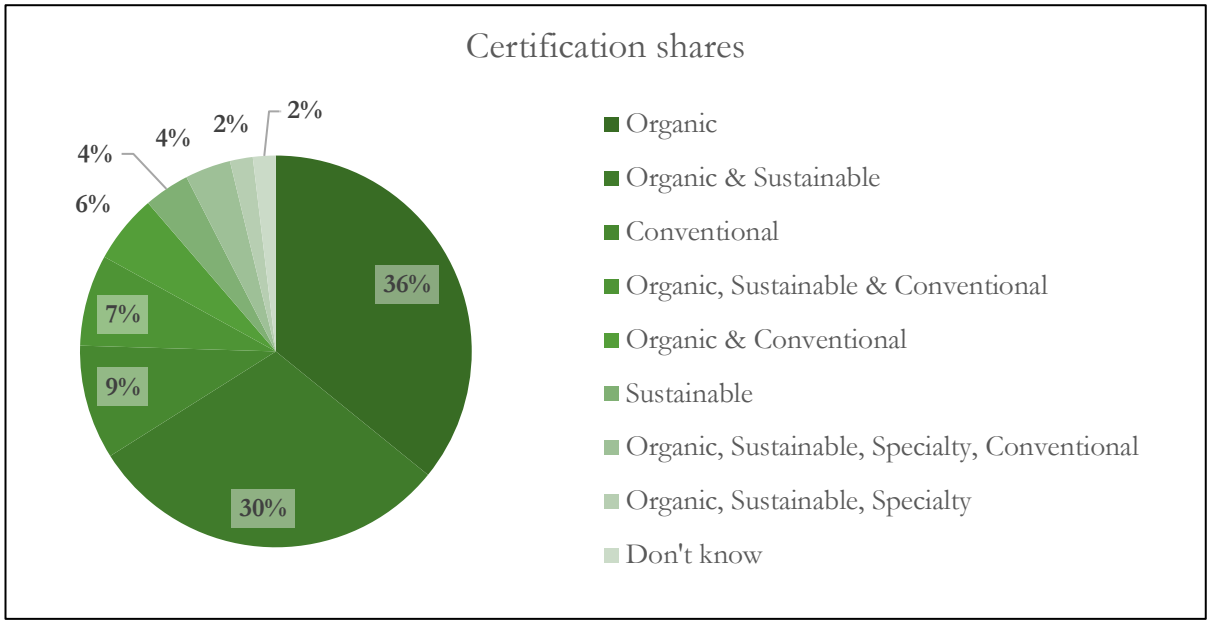


Figure 13 Shares of coffee labelling types for coffee sold after the last harvest (n=53)

He added that as a result of the newer 'sustainable' voluntary standard programs, "we've opened up a new avenue for producers; for me as a professional, I think its important to use this opportunity to further improve the lives of the producers." For him, "sustainable agriculture goes beyond organic agriculture as it also includes more of the social aspect and not just the environmental aspect, and is thus more in line with

the overall objectives of the cooperatives", signalling the shift to more a more 'holistic' approach to certification.

For the manager of the Inprocafé cooperative, the certifications have helped improve the cooperative as well as its members livelihoods and production 'little by little' due to the system of continuous improvement in steps. According to him, the combination of norms in the various spheres – social, economic, environmental – has had an 'interesting' impact. He especially highlighted the impact it had on the member's living conditions, such as improvements to health and safety in the kitchen due to norms and regular inspections.

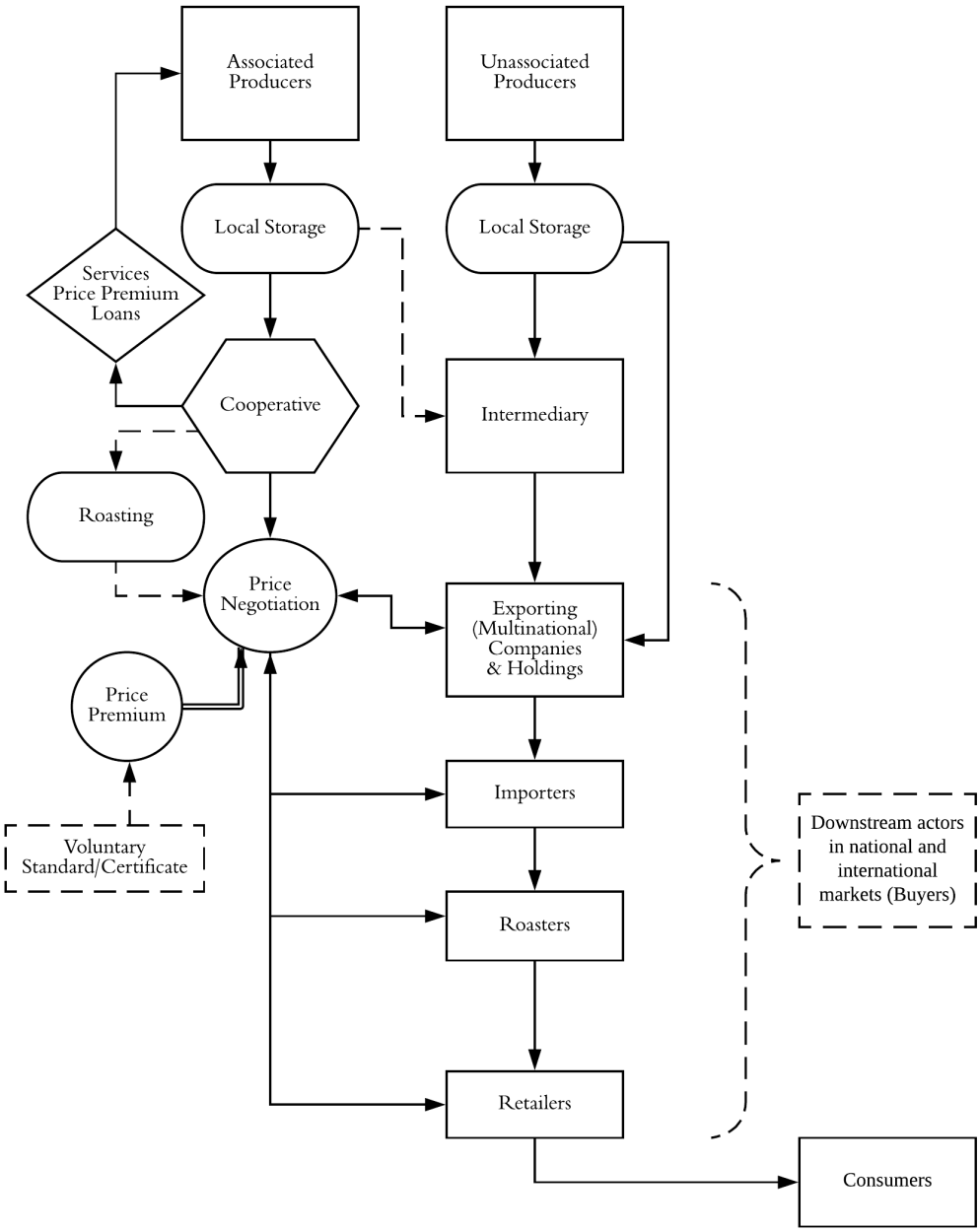


Figure 14 The coffee value chain for associated and unassociated producers

Figure 13 depicts the coffee value chain, showing the different processes and pathways occurring in the chain for associated and unassociated coffee farmers. After the harvest, unassociated producers store their crops in local storage facilities, often their own, small-scale storage options. Subsequently, the product is bought by a local intermediary or directly by the large (multi)national companies operating in the region, with the farmer being paid directly 'at the gate', in his locality. The price is negotiated individually between the intermediary or companuy and the farmer. The product is then sold down the line to other downstream actors that play important roles in the value chain and the market, such as importers in consuming countries in the North. It is then bought by coffee roasters who 'create' the product as most consumers know it, since coffee is chiefly sold as 'green' product; roasting turns it into the final product, now ready to be sold to retailers, who then sell it to the consumer.

In the case of the associated producers, the product is stored locally as well. However, in many cases there will be a collective coffee storage facility of the cooperative for farmers to store the product temporarily. Farmers also bring their product to the cooperatives larger warehouse, located in the urban coffee trading hubs, for quality testing and final payment. However, apart from this payment, the cooperative also gives the farmer access to services such as technical assistance, distributes the premiums gained from certification, and gives farmers access to loans which many are not able to obtain otherwise as their often untitled land cannot be used as a collateral for the banks. The cooperative is also responsible for negotiating the contracts and sales to the downstream buyers. Smaller cooperatives will often supply larger cooperatives or in some cases companies, due to their lacking capacity to export directly to the international markets. The farmers benefit from the cooperatives' overall access to specialised buyers as it can yield higher prices as well as a more secure income.

CERTIFICATION AS GOVERNANCE TOOLS FOR THE COOPERATIVE

Presently, through the concomitant set of standards, market access and other services, certification can fulfill multiple 'roles' within the cooperatives. It does so chiefly through a) the standards it requires for obtaining the certificate and b) the network of experts and contacts in the field that organise and train inspectors and cooperative staff that work with the certification and its themes.

Firstly, it can function as an 'external' tool that allows the cooperatives to gain better footholds on the (differentiated) international coffee markets, through creating new 'streams' in which cooperatives can participate and in which there is a more direct connection to downstream actors (buyers). The premium associated with the various standards also serves as an additional income for producers and the cooperative, which can be used to finance expenses and projects.

Secondly, it also functions as an 'internal' guidance tool for the cooperative, which can align its socio-economic development goals with the standards offered by the various (often overlapping) certification standards. The different certification labels employ different methods, but usually there are different sets

of standards with regard to social, economic and environmental fields that need to be met over successive years in order to attain certification.

The implementation of these norms is monitored and evaluated through usually by licensed third-party inspection companies, which evaluate whether or not the certificate holder or aspirant is compliant with the requisite standards. These norms and the concomitant control mechanisms can be important as guidance tools for the cooperatives. According to the certifications manager of Cenfrocafe, "the certification standards help us prioritize areas for improvement, and to then relay to the technical assistants that the producers need to improve in these areas".

Furthermore, through the assessments carried out by the inspectors, cooperatives also gain insight into the strengths and weaknesses of their organisation. The information regarding areas of (non)-compliance and future improvement with regard to standards implementation "helps with the productivity, with the marketing, and for projects that we are doing as it gives us data about productivity statistics, which we can then discuss in meetings" the Cenfrocafe manager argued. Through the availability of productivity information such as the number and location of producers with 'older' (and thus less productive) coffee plantations, they can cross-reference requests for renovation loans by producers to verify the state of their coffee plantations and help the producers increase efficiency while more effectively managing the cooperative's finances.

However, as DeFries et al stress, certification is "no panacea" (2017, p.9). As obstacles to long term contributions to sustainable development, they identify the supply-demand imbalance at the market-level as well as the 'usurpation of governance responsibilities' by Northern actors (2017, p.9). While certifications can offer cooperatives certain benefits, the 'differentiated' markets they offer access to also represent an additional market environment which cooperative managers need to navigate, which has also changed over the past years as these markets have matured.

During the research, further evidence could be discerned for a trend identified by Kilian et al (2006). In their study, they find that in the case of coffee, certification alone does not result in price differentials with the exeption of the European organic market, and that the price is rather a function of quality and certification. In this model, "quality can be seen as a more basic prerequisite for a price premium and the certification as a tool to differentiate and to underline the outstanding performance of the product". (2006, p.352), adding that "[s]uperior coffee quality proved to be more important in achieving a higher coffee price." (2006, p.352).

CHALLENGES FOR COOPERATIVES: SHIFTING MARKET EQUILIBRIUM AND COSTS

In the workshops given by the technical assistants of the cooperatives, the differences among the certification were adressed also with regard to the trade-offs between production type and premium. Special attention was also paid to the importance of quality during the workshops, with producers being informed

of the 'cup quality' system and how this determined the price paid on the market for different qualities, and the importance of careful management for increasing the bean's quality. According to the interviewees, not only was quality crucial to securing market outlets and good prices, but that furthermore they were investing their cooperatives and thus the producers in producing ever higher quality of coffee in order to remain at a competitive advantage.

As all interviewed cooperatives had been certified for several years under multiple voluntary standards, this points strongly to the role of quality superceding even other advantages that voluntary standards bring, in that even within already differentiated market outlets, quality competition remained highly important to secure producer incomes in the first place. In the words of the director of the JNC, "quality and efficiency are what the market demands and what the cooperatives need to deliver to make the difference."

The manager of Inprocafé pointed out that these 'differentials' or price premiums have decreased over time, especially so in the case of organic certification. [make this a summary/conclusion bulletpoint: reduction of premiums and confirmation of Kilian's trend projection. For him, this is caused either by an oversaturation on the supply side, or a reduction in demand. He cites FairTrade as being one of the certifications that have helped his organisation immensely, as they can count on the minimum price threshold guaranteed by FairTrade in times of low market prices. The Inprocafé manager also remarked on the market shift towards quality, regardless of certification. According to him, in order for buyers to buy coffee at FairTrade price levels, they also demand a high cup quality of 82 or above and thus classified as specialty coffee. This sentiment was also echoed by the manager of Cenfrocafé, who also remarked that organic premiums had been on the decline for several years now and that improving quality was critical to the cooperative's ability to sell coffee.

Optimized farm management was identified by cooperative management and farmers as a critical factor for success. The primary and most effective tool against the rise of pests & diseases, according to several producers and managing staff, was improved management. For the producers, this meant that following the certification's guidelines allowed them to more effectively manage their natural and economic capital. Ideally, farmers are able to increase their yields through the specific management practises learnt through the cooperative such as coppicing trees to increase an aging plant's productivity, and reducing harvest losses by applying integrated pest management techniques such as mycopesticides and traps.

One farmer pointed out that "the cooperative, through trainings, has helped us greatly against the pests and diseases", adding that "[better] management of the plants has helped resists the different problems that affected us". The cooperative, for him, was "helping them always to fight the different pests and managing the farm better."

Another farmer highlighted the importance of certification norms for his environmental adaptive capacity, arguing that "thanks to the certified management we know how to react to the prests and threats to our

production." During a farm visit to a farmer that was a member of Sol Y Café, in San Ignacio, when asked what the most important factor was in maintaining a healthy coffee plantation, he also cited 'better management' as the key ingredient, highlighting that even though he was an organic producer, in the end the overall degree of care for and investment in the farm are more important than any specific production 'type'.

The manager of Comercio y Compañía also highlighted the role of optimized farm management his organisation's approach, stating that "in our approach, we work towards rehabilitating the farms and towards an efficient farm as for us this efficient farm solves the problem of productivity and quality".

THE ROLE OF TRUST & SOCIAL CAPITAL

Trust and social capital were identified as critical components of succesful long-term viability of a cooperative during the research, and are important components especially in internally driven cooperatives.

Several of the interviewees highlighted the importance of trust in cooperative performance. The director of the National Board of Cooperatives remarked that a cooperative has to be "efficient and transparent in order to compete, and to gain the trust of society, the market and its members", highlighting the importance of trust both with actors on the market as well as between the members. The manager of Cenfrocafe further pointed out the role of trust with regard to honest communication between cooperative staff and producers, saying that "when it comes to interacting with the people, the important thing is that you do not mislead them. The people in the rural areas have a lot of trust, but if you deceive them only once they will never believe you again. So we have created a trust with the producers, and this has helped greatly in the topic of sustainability. [...] Trust is very important."

Another technical assistant (TA), who had previously worked for the government, pointed out that trust between cooperatives and farmers remains a challenge. According to him there was also a degree of distrust in co-operatives among the general farming populace due to corruption and malgovernance in the past decades, leading to the collapse of many in the last decade and the resurgence of new ones being built from the ground up in the last 5 years. This was also echoed in conversations with other technical assistants during conversations in the field. [certification helped build trust?].

A further issue this TA pointed out was the lack of trust between producers and governmental institutions, stating that there was "no confidence", and that as a result the producers also do not use the resources that the governmental institutions do provide. An example he cited was that when there was an attempt at organising a workshop by the government for coffee producers, very few if any showed up, compared to the dozens which usually come to workshops organised through the co-operatives.

WHY DO COOPERATIVES FAIL?

Managing and technical staff highlighted the importance of organizational capacities in effectively and sustainably running a cooperative, and the difficulties faced by cooperatives in achieving these capacities.

The capacity of a cooperative to effectively communicate knowledge and norms to its producers (and oversee and aid in its correct implementation) was associated by cooperative staff with the degree to which a cooperative could survive & thrive. According to a technical assistant of Sol Y Cafe, with whom an extensive interview was conducted, three pillars for the 'sustainability' of a cooperative can be identified: "A cooperative is strong if first of all, that at the base there is a solid know-how; the second important aspect is reinvestment, and the third is that the personnel is highly trained and have knowledge. Without these three pillars, a cooperative doesn't function."

Furthermore, several managing staff highlighted the recent upsurge in cooperative organizations in the region and the issues that have gone along with it. Cajamarca is the seat of several of the country's largest and most successful coffee cooperatives, and in recent years this success has caused more cooperatives to form. However, in doing so, it has also revealed that some components are crucial to 'sustaining' a cooperative, components which many 'new' cooperatives often lack. In an article in the regional Agricultural Review, 'Viva El Agro', the technical assistant Gerardo Medina writes: "In the coffee-producing regions of the center and north of Peru, hundreds of cooperatives and associations have formed with the primary goal of accessing the FairTrade and Organic markets, commonly known as FTO (Fair Trade Organic), along with other labels such as Rainforest Alliance, UTZ, Starbucks, etc. Furthermore, they formed in response to tax opportunities as well as some projects financed by the state such as the employment fund and various rural development agencies and programmes.

The Sol Y Café technical assistant argued that as only 30% of producers are organised, the remaining 70% are 'free' and therefore opportunities exist to form these new small organisations. According to Medina, the most visible new cooperatives are formed by well-known traders, as well as directors who felt unable to meet their personal goals in other cooperatives or saw inadequate management practises in their cooperatives. However, he pointed out, severe issues with poor governance, organisational capacity and even corruption plague these new organisations. According to him, many of these cooperatives easily attained FairTrade certification, but the benefits and premiums of these were not passed onto the farmers due to the lack of logistical and economic support for the producers as a result of poor governance.

In the article by Medina (2017), he asserts that this rapid surge in the number of cooperatives that often fail to achieve their commercial and social goals is causing a fragmentation of the cooperative sector. He argues that rather than than forming new cooperatives, producers should enter in the existing, larger cooperatives and stimulate growth within them, and thereby enhance the creation of economies of scale.

Furthermore, the Sol Y Cafe expert added that the coffee farmer's level of education made them more vulnerable for exploitation through 'corrupt' cooperatives: "they do maybe 2 or 3 harvests, and then these

cooperatives disappear, and then appear under another name in another district." However, such failures are not always due to intentional corruption but rather in the difficulty of administration and management at the staff level. "Its very difficult to begin, they do not have the capacities or economic support, and as a result its very difficult. So in one year they might exist, and the next they have disappeared."

Medina echoes this, writing that small cooperatives are limited through their difficulty to contend in the market due to low quantities of coffee sold and subsequent difficulties to provide their organisations with the necessary tools to grow: "Without exception, cooperatives that market less than 10,000 quintals, and which are part of the global markets (including the certified coffee markets), can only provide the services required of them by their producers with difficulty."

This opinion was also shared by the JNC director. He argued that the market demands capacities (such as knowledge and efficiency) that many coffee farmers do not posess. For the cooperatives, this capacitation and the specific logistics and approaches remain a challenge, the director argued, saying that "The farmer lives in a specific zone, his educational level is very limited and there is a lack of technical assistants with a shared social identity and knowledge".

Coffee farmers not only live geographically separated from many of the 'experts' and trained staff, but they also live in distinctive socio-cultural 'zones'; this gap "presents a large challenge for the cooperatives." It is important to note that here there is a special emphasis on the function of shared social identity in learning and disseminating knowledge. Furthermore, this was attributed this to the dominant focus in the places of higher education which are responsible for training professionals, as that universities chiefly train people to become professionals for large companies and not for social enterprises, according to director of the Coffee Board. "Ultimately", the Director argued, "these factors impact the organisational sustainability, efficiency and competence, and as a result organisations cannot compete in an increasingly innovative industry" due to the human resource shortfalls.

Following the political turmoil of the 90s, Peru is still in the process of building strong institutions that allow society to be governed according to established laws, rules and principles. In this context, the director of the JNC explained that "A further important challenge for us in the Peruvian context is the construction of institutionality". A word of the literal translation, 'institutionality' – describing the quality of an institution or set of institutions – does not exist in the english literature, but is highly salient to the socio-political of cooperativism and coffee-production in Peru.

During conversations and interviews with producers and technical as well as managing staff of the cooperatives, two key factors were identified as being highly important to the long-term success of cooperatives and more equitable coffee production as a whole: 'Cultura' (culture) and Institucionalidad (the quality of the institutions within a state that inform the conduct and practises of its subjects).

Institutionality, in Spanish-language sources, has been defined as "the set of beliefs, ideas, values, principles, collective representations, structures and relations which shape the conduct of the members of a society, thereby structuring and characterizing it."[2] Furthermore, such institutions rely on a systematic process of consolidation of conduct and ideas through organisations and norms with the aim of furthering a social good that is expressed in practise through applied values, thereby 'instituting' these conducts and ideas. It can therefore be said that institutionality constitutes the relationship between members of a society and collective 'goods' that enable more transparent and effective governance.

According to the JNC director, this institutionality was paramount to the effective distribution of a government's resources and implementation of policies. He argued that "a country without institutionality cannot invest adequately. We need an institutionality that permits alliances between actors in the value chain, with the state as a facilitating agent, and policies to aid in this process. [...] The state is still resisting this creation of institutionality" he said, adding that it performed poorly in this aspect to other South American coffee-producing countries.

One example of 'strong institutionality' in this regard can be found in Colombia, where the coffee cooperatives are all organized in one large 'federation' that oversees the revenues, investments and development of the coffee-sector and the livelihoods of its producers, forming a vital cornerstone in the governance of the coffee-sector and the organizational capacities of the producers there. During the ExpoCafe 2017, one representative from this federation was also invited to speak on the work of his organisation, and several technical staff also mentioned this federation as something that the Peruvian coffee sector should emulate to increase the collective power of the producers and improve the development of the sector and the producers.

'Cultura' can be taken to refer to both 'education' and 'knowledge', as well as a general set of attitudes of individuals or members of an organisation. In the context of the subject matter during the conversations and interviews, they were used in a way that suggested an interlinked conceptualization of the word, effectively describing it as the 'mentality' of a person that was based on their level of education and thus informed their way of thinking about the world from their situation. Both producers and staff of the cooperatives stressed the importance of culture in determining a sustainable performance of individuals and organizations.

Specifically, the cooperative staff stressed the fact that they believed that an important goal of the cooperative as an 'educational' network tool, through which farmer's livelihoods could be improved. This involved changing the 'mentality' or attitudes of farmers on more social, personal aspects as well as directly production-related issues. The cooperative staff highlighted that these changes in mentality were crucial to creating a successful and thriving cooperative through 'creating' successful and thriving producers.

[2] http://eldia.com.do/la-institucionalidad-en-el-estado/

Regarding the impact of certification, the *jefe de calidad* (quality manager) of another cooperative from San Ignacio, La Prosperidad de Chirinos, remarked that he did not associate certification directly with higher quality coffee, but instead argued that certification rather creates change at the 'mental' level, commenting that certification helps change the *ideología del productor* (in this context, the mindset of the producer), and thus the the way that producers perceive and accordingly act within their environment. Furthermore, he argued that certification had aided the cooperatives in organising the producers, a sentiment which was echoed by other managing staff members and will be explored in the relevant section on cooperativism and certification.

One farmer in Jaén commented that the cooperative had improved the producers mentality with regard to farm management, adding that "if we hadn't joined, we would still be like the traditional producers". Another farmer mentioned that especially the training he received from the association had increased his environmental knowledge, while the adoption of the certification standards has helped change the way they farmed as well as their 'living mentality' (the *ideología* or *cultura*). The comments of other farmers affirm this experience, with one farmer explaining that for him, "there was a strong impact due to certification" as it had created "a change in farming mentality, about the forests, water, soil conservation, and so on."

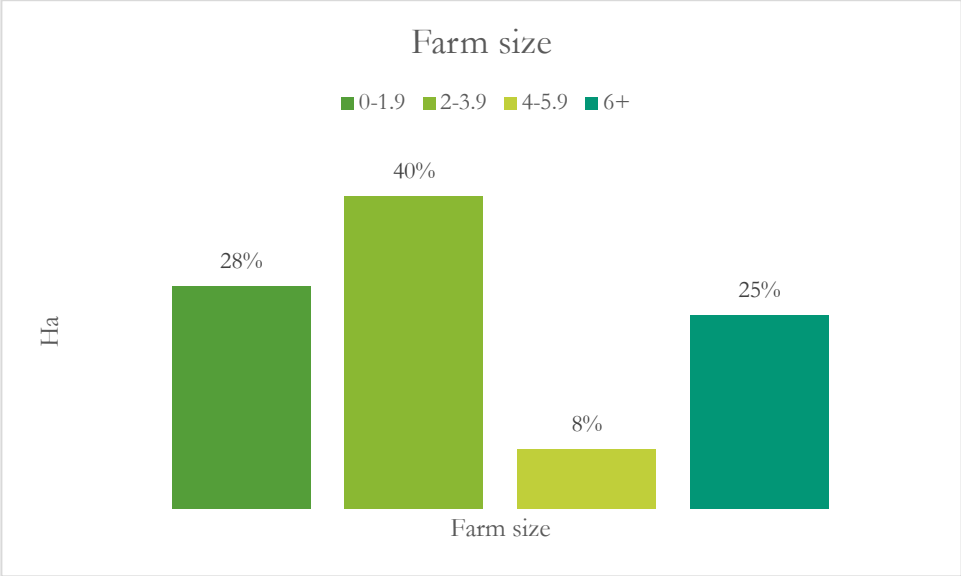
The manager of Comercio y Cía also gave his views on the outcomes of his company's Programa Familia. According to him, the most important outcome of the company's program of assistance and micro-credits, focused on making the intervention self-sustaining, was also the impact on the farmer's mentality as a factor that contributed to future success and gains for the farmer and the company in terms of productivity, quality and overall improvement of their natural and capital assets. He stated that "what we discovered is that in order to tackle the issues themselves, the farmers needed to gain self-confidence and self-esteem. Because once they had gained access to technical assistance and the micro-credits, they realised they did not have to rely on governmental aid or similar aid.".

During the field research, group interviews were conducted in 5 caseríos (hamlet, small village) in which producers of the cooperatives live, close to their coffee plantations on the steep hillsides of the highland. They were also the scope within which the different bases or 'base associations' of the cooperatives were founded, and the producers thus thereby also organised into local chapters. Further group and individual interviews with producers were also conducted at the Sol Y Café headquarters during the post-harvest period. The group interviews were conducted during the training and information workshops conducted by the cooperatives' technical assistants, which the researched observed.

Farmers were asked to self-report the impact they perceived from participation in a certain network on their commercial knowledge (prices, marketing of coffee) and environmental knowledge (crop and farm management, environmental hazard response). The available responses in the multiple-response survey were: no increase, slight increase, moderate increase, strong increase and very strong increase. In order to analyze the impact, the farmers reporting an impact were group into 2 categories: slight to moderate

increases were grouped together to assess the amount of impacts on the lower end of the spectrum, and high to very high increases were grouped together to assess the increases at the higher end of the spectrum as a whole, thus creating 2 'grouped' categories. The results are shown in the graphs below, and the section underneath elaborates briefly on the comparative differences and overlaps from the survey. This is followed by a section that analyzes these results within the results from the interviews conducted with cooperative managing staff and producers.

A total of 53 surveys were conducted with coffee farmers that were members of various cooperatives in the region. The median age of these coffee farmers was 42 years, and the vast majority of those present during workshops or at the cooperative headquarters was male (with 4 female interviewees). Furthermore, roughly one-third of producers had only completed primary schooling, with the remaining 66% having attained secondary education. The largest share of farmers (40%) reported the size of their farms to be between 2 and 4 hectares, follow by 28% who reported less than 2 ha. 8% reported farm sizes above 4 ha, and 25% reported that their farm exceeded 6 hectares. While these measures are self-reported, this indicates that the largest share of farmers in the cooperatives interviewed were smallholders with limited land assets.



Most farmers stated that they sold the bulk of their produce directly to the cooperative. Furthermore, farmers also frequently remarked that they also sold small amounts to traders or intermediaries for a different reasons. About 5% of the harvest is often of too poor quality to be sold to the cooperative according to the farmers, due to becoming damaged during the growing period, the harvest or post-harvest processing such as depulping or drying. This type of refuse coffee is also known as *coco*. This coffee is sold to local traders or intermediaries to be used for instance as fertilizer. In other cases, coffee was sold to such passing traders in exchange for cash that was required for the producer's short-term economic needs.

However, one farmer also commented that certification had aided them in reducing the amount of the coco or 'discarded' coffee.

COMMERCIAL KNOWLEDGE INCREASE

During the workshop observed as part of the field research, the technical assistants covered a range of informational topics in a relatively limited time-span, usually around 1-2 hours. With regard to commercial activities and certification, the technical assistants primarily informed the producers about the current premiums received for the various certification labels, as well as the price differentials created through the quality of the delivered product and knowledge such as crop management techniques and pest-treatment.

With regard to commercial factors, producers were informed about the 'cup quality' system, explaining how their coffee beans were analysed and graded in the laboratories of the cooperative, and which prices could be attained for the different quality grades. Special emphasis was placed on the importance of "careful management" in cultivating crops of good yield and quality during these explanations. This ties into the general attitude amongst management and technical staff that quality is of paramount importance for the cooperative and the producers to bring in sufficient revenues from the sales of the product, capturing and maintaing a good position on the market and in the value chain.

The strongest knowledge increase from the survey was reported in the case of the impact of certification on producer's commercial knowledge at 42% for strong-very strong. However, this only exceeded the percentage reported by producers (39%) in this category for the impact of association by 3%, and thus no significant difference can be discerned regarding a 'strong' impact between the two networks in the survey.

In the case of reports of 'slight to moderate', the margins were slightly higher between the two networks. For commercial knowledge increase, 51% of producers reported impacts in this impact category, compared to 39% of producers of producers for certification.

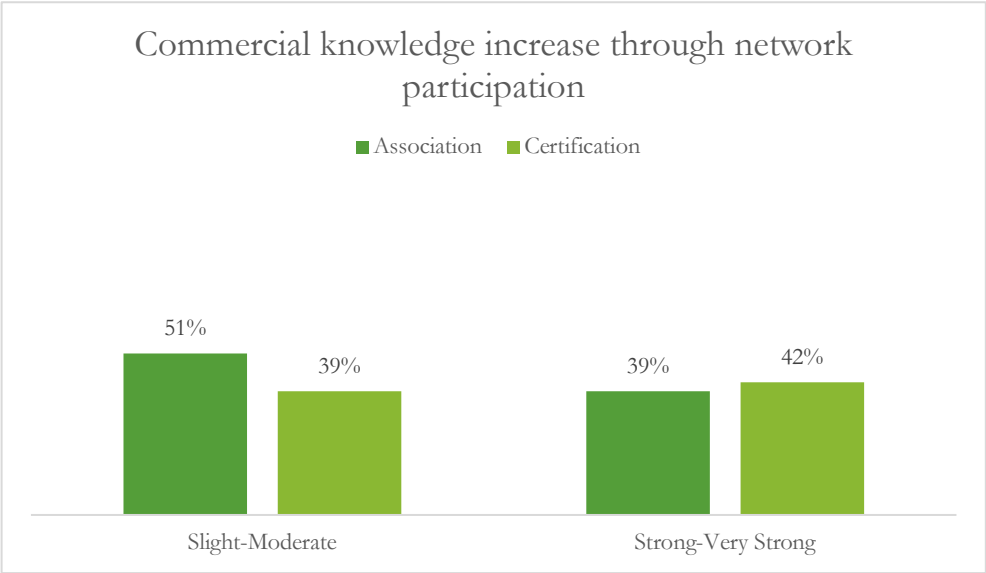


Figure 15 Commercial knowledge increase through network participation

On the subject of price knowledge and information, the responses varied both in the survey and the interviews. According to one farmer from Jaén, "before joining the cooperative [Sol y Cafe], we knew very little, but we've since been learning every year about financial services, quality, all these things about the coffee business." Another farmed argued that "we have access to better prices and price knowledge since joining the cooperative". The role of the cooperative as the primary knowledge access point for producers was highlighted by a producer who remarked that "with the co-operative, there is always someone we can ask about finances, plagues, that sort of thing."

However, some farmers reported not having a full understanding of the price structures of the market and how exactly their product was valued. One farmer in San Ignacio stated that he did not know how exactly the final price he received was calculated by the cooperative, and that he didn't know fully about the different prices of the market. Another farmer explained that "we don't really know exactly the difference in premium price for the separate certifications, as we receive one price including premium for all our certified coffee without such details as how much per certification." Furthermore, the relative isolation of many coffee producers from the larger population hubs in which the cooperatives are based can also add another barrier to price access, as one farmer from San Ignacio explained: "we are in the rural areas, so we are a bit out of the loop, but get this information when carrying the harvest to the cooperatives."

One farmer remarked that after joinining the cooperative and attaining certification, they had more knowledge on production and pricing than before. However, with regard to organic certification and production, she remarked that it was sometimes difficult because the price/cost relationship varied; an issue highlighted in the research done by Kilian et al (2006).

ENVIRONMENTAL KNOWLEDGE INCREASE

In the survey's strong-moderate increase category, there is a 6% difference between the association and certification, with certification being reported by 38% of producers followed by association at 32% as having had a strong impact on the producer's commercial knowledge. Environmental knowledge increases in this category were reported by 58% of producers, compared to 51% of producers for certification.

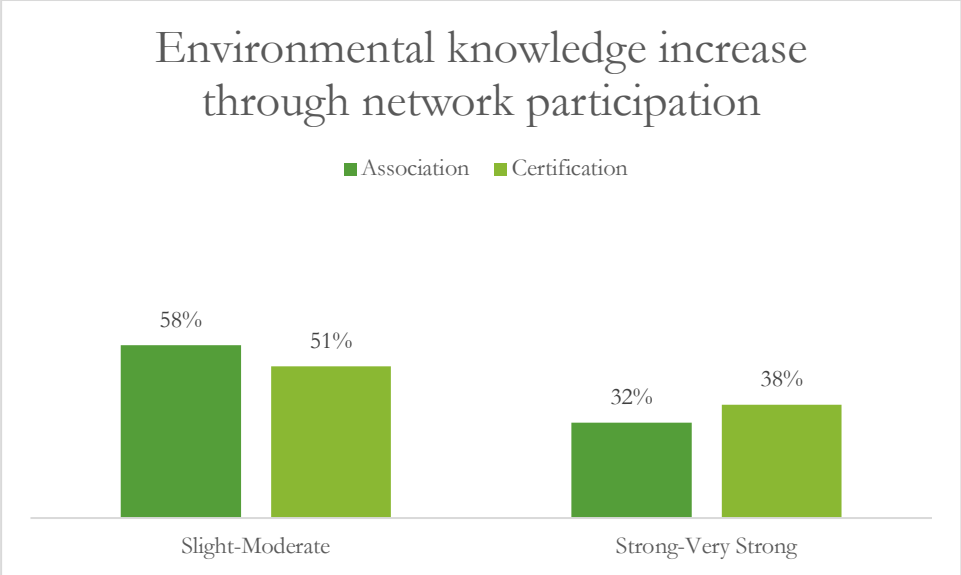


Figure 16 Environmental knowledge increase through network participation

COMMERCIAL ADAPTIVE CAPACITY NCREASE

The strongest increase in commercial adaptive increase, meaning the ability of coffee farmers to adapt to market variability and shocks such as price drops, was associated by farmers with association membership (40%), slightly more than certification (32%). However, no answers are available for 26% of certification responses.

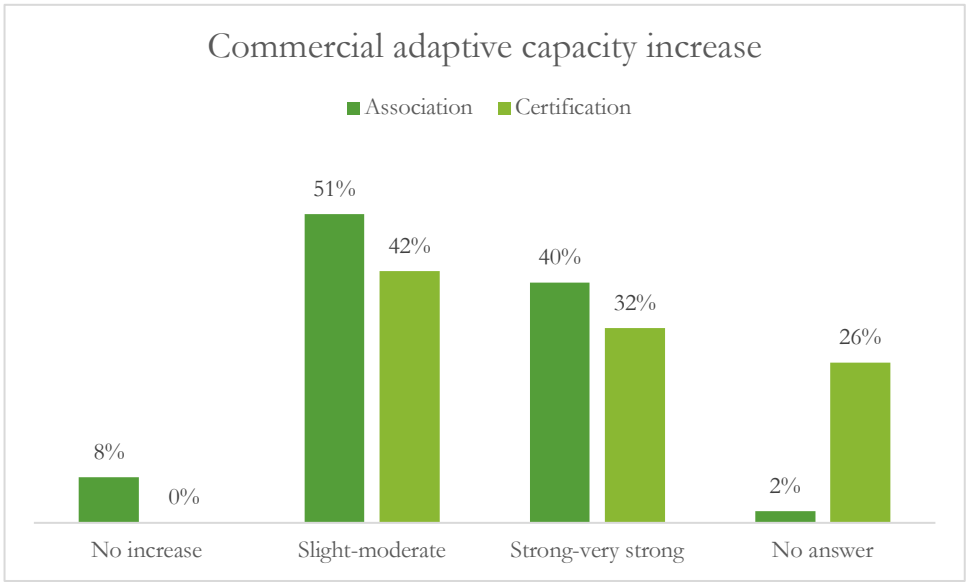


Figure 17 Commercial adaptive capacity increase

Environmental adaptive capacity increase

The strongest environmental adaptive capacity increase was reported in the case of the impact of certification at 38% of farmers, compared to 28% reporting such an impact for association. However, answers were not available for 36% of farmers for association and 38% for certification.

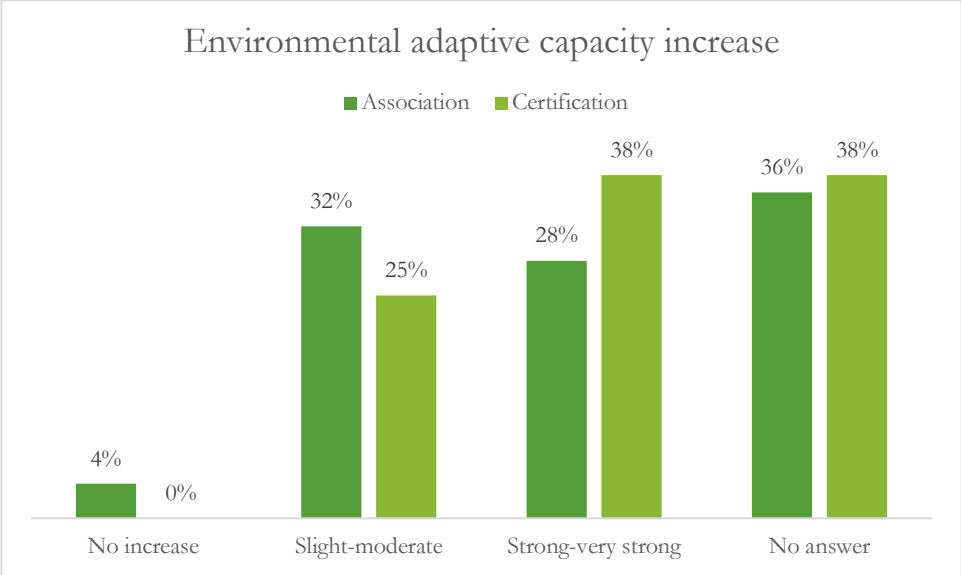


Figure 18 Environmental adaptive capacity increase

The Role of Education

In order to ascertain if the formal education of the farmers played a significant role in the increases of farmers knowledge and adaptive capacity, further analysis was conducted analysing the above results by educational level of the farmers, being primary or secondary school completion. Furthermore, it was tested to what degree education levels corresponded to farm size, and farm size to adaptive capacity.

In the sample of farmers from Jaén, 10 farmers were primary school educated (PSE), and 13 were secondary school educated (SSE). In San Ignacio, 25 farmers were PSE whereas only 5 were SSE. In total, 35 (66%) of surveyed farmers had attained primary level schooling, and 18 farmers (34%) had attained secondary school education.

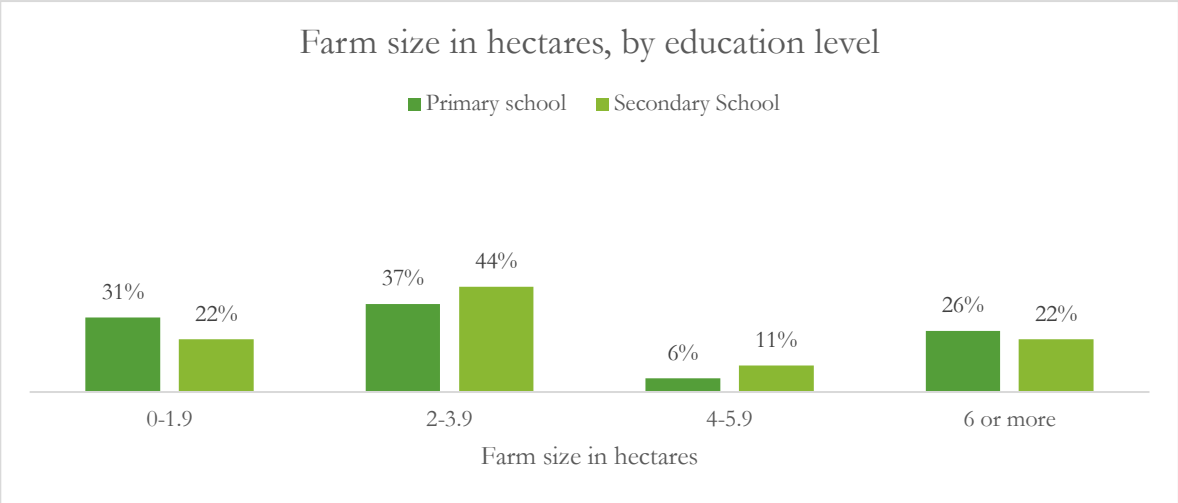


Figure 19 Farm size holdings in hectares by education level

When looking at the size of the farmer's productive holdings, no significant differences can be found between primary school (PSE) and secondary school educated (SSE) farmers. For both groups, the largest shares of farmers have farms between 2 and 4 hectares in size. Interestingly, farmers reported similar numbers for holdings below 2 hectares (31% PSE, 22% SSE) as for holdings above 6 hectares (26% PSE, 22% SSE).

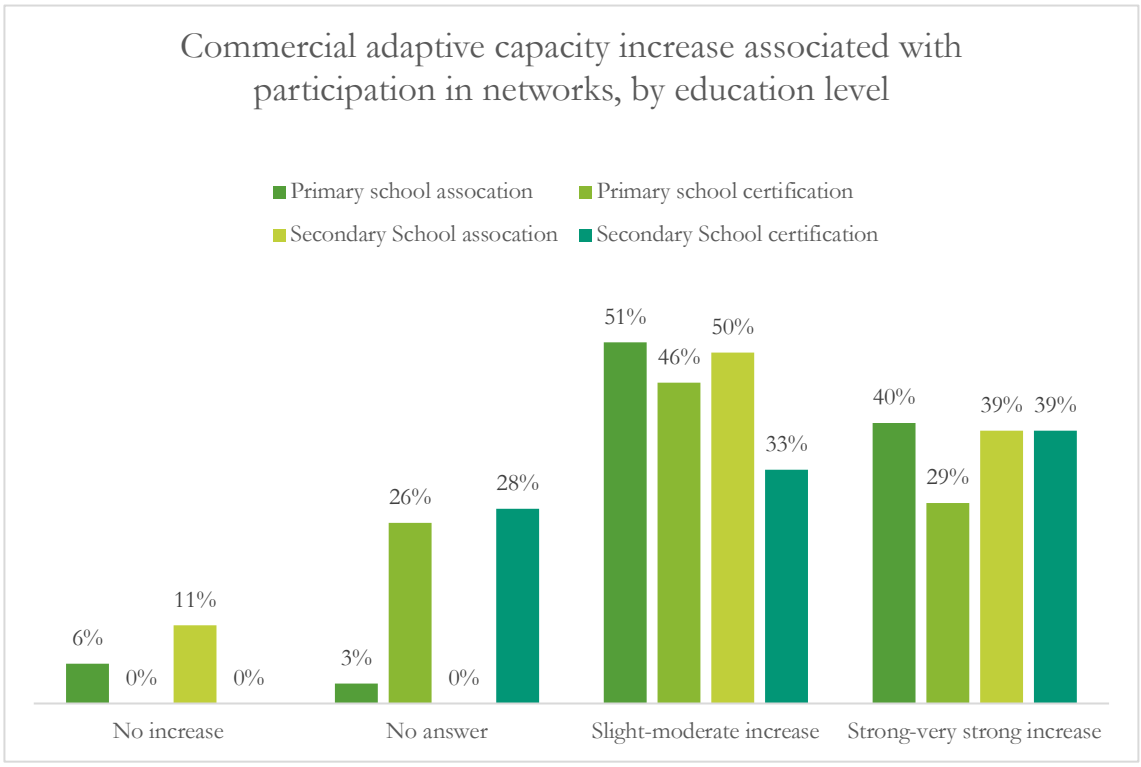


Figure 21 Commercial adaptive capacity increase associated with participation in networks, by education level

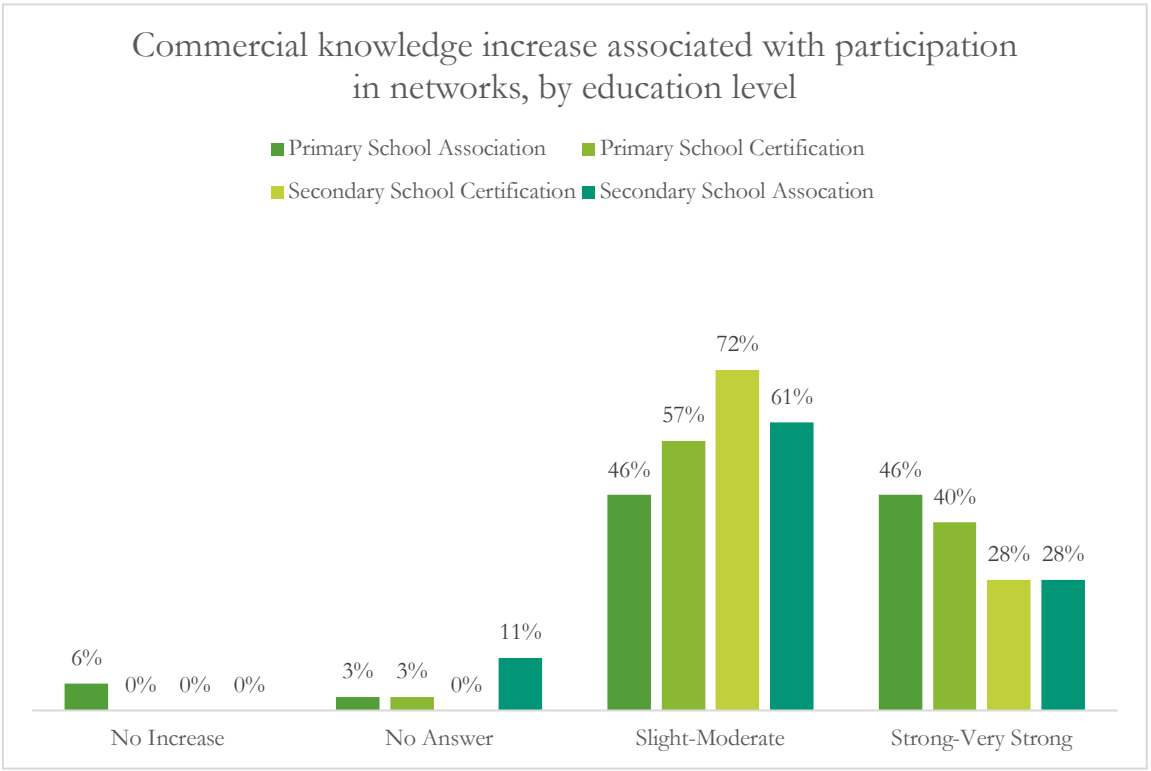


Figure 20 Commercial knowledge increase associated with participation in networks, by education level

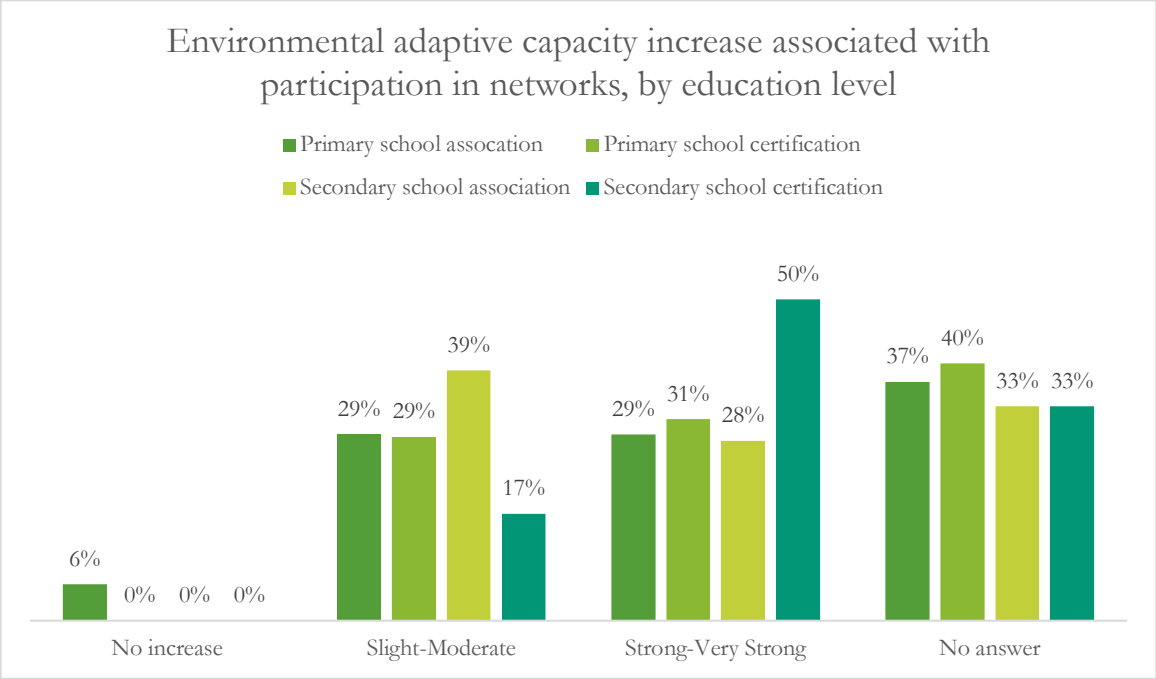


Figure 23 Environmental adaptive capacity increase associated with participation in networks, by education level

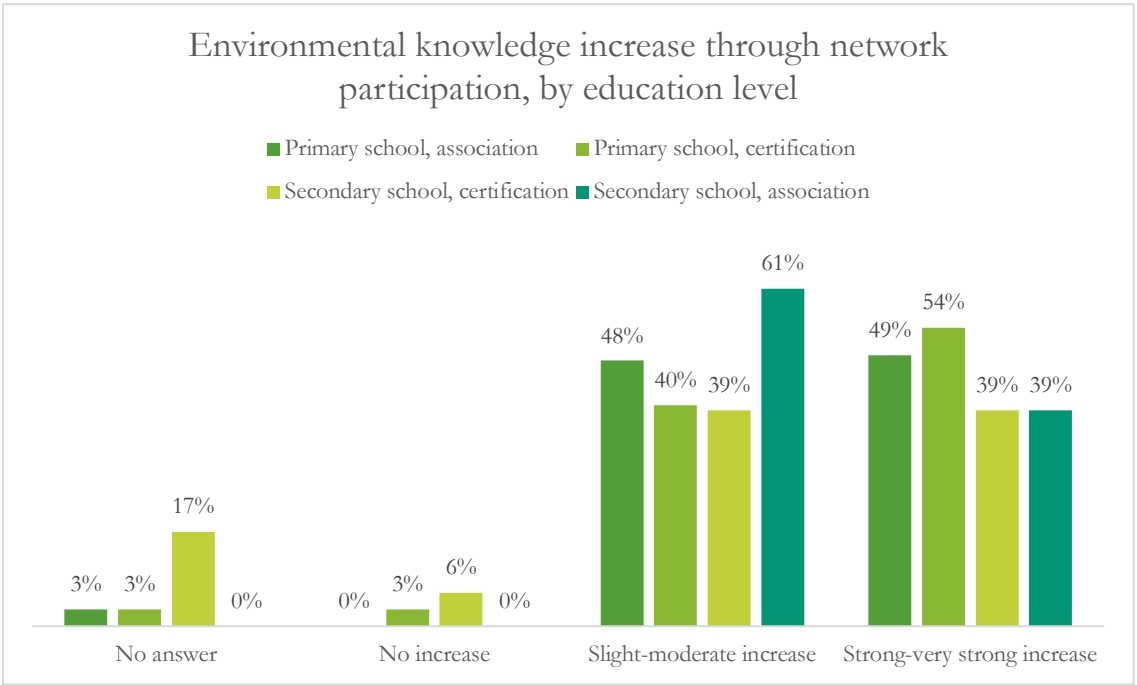


Figure 22 Environmental knowledge increase through network participation, by education level

The strongest increase in environmental knowledge was reported by primary school educated (PSE) farmers, with 54% for certification and 49% for assocation, compared to 39% of secondary school educated (SSE) reporting increases of this strength for both categories. Similarly, for commercial knowledge increase, PSE farmers cited the assocation (46%) and certification (40%) as strongly increasing their knowledge.

However, in the case of environmental adaptive capacity, secondary school educated (SSE) farmers reported the highest share of strong increase with 50% of this group reporting this level of impact in the case of certification. 31% PSE farmers also reported certification as having a strong positive impact on their environmental adaptive capacity. For commercial adaptive capacity, the strongest impact was reported by PSE farmers at 40%. However, for the adaptive capacity categories, around 30-40% of respondents did not answer the question on the survey. Despite a careful translation of the phrase and explanation of the concept, it could be that the unfamiliarity of the term necessitated further explanation or a different phrasing of the question, thus resulting in the relatively high numbers of farmers choosing not to respond to this particular question.

Furthermore, the relationship between knowledge increase and adaptive capacity increase was tested. In the case of association participation impact, 39% of farmers that reported 'slight to moderate' environmental knowledge increases primarily reported a slight to moderate adaptive capacity increase, with no answers available for 50% of respondees in this category and 7% reporting no increase. A 'strong to very strong' increase in adaptive capacity was reported by 58% of those who had reported a knowledge increase due to participation in the assocation in this category, followed by 25% who reported a lower 'slight to moderate' adaptive capacity increase, with no answers available for 17% of respondents.

For the relationship between environmental knowledge increase through certification adoption and environmental adaptive capacity, the results differ. While 33% of those who had experienced a 'slight to moderate' knowledge increase through certification experienced a similar increase of their adaptive capacity, 37% responded that they had experienced a strong to very strong increase of their adaptive capacity; 30 % did not respond. For those farmers who reported a strong to very strong knowledge increase through certification, 50% had experienced a similar increase in their environmental adaptive capacity, with 20% experiencing a lower (slight to moderate) adaptive capacity increase; 30% did not answer. Of those farmers who reported no knowledge increase, none answered the adaptive capacity question.

While the results regarding the correlation between the strong increases of knowledge/adapitve capacity are similar between assocation and certification (58% and 50%, respectively), they differ for the moderate increase categories, with 33% of those who reported a moderate environmental knowledge increase due to certification reporting an equal increase in adaptive capacity. For knowledge increases associated with the assocation, 39% of those reporting a moderate increase also reported a moderate adaptive capacity increase. However, in the case of certification, 37% of those reporting only a moderate increase in environmental

knowledge reported a strong increase in adaptive capacity, compared to 4% answering similarly for association.

Table 1 Environmental adaptive capacity increase correlation with knowledge increase (resulting from association)

Association				
	Environmental adaptive capacity			
Environmental knowledge	No increase	Slight-moderate increase	Strong-very strong increase	No answer
Slight-moderate increase	7%	39%	4%	50%
Strong-very strong increase	0%	25%	58%	17%
No answer	0%	0%	0%	100%

n=53

Table 2 Environmental adaptive capacity increase correlation with knowledge increase (certification)

Certification				
	Environmental adaptive capacity			
Environmental knowledge	No increase	Slight-moderate increase	Strong-very strong increase	No answer
No increase	0%	0%	0%	100%
Slight-moderate increase	0%	33%	37%	30%
Strong-very strong increase	0%	20%	50%	30%
No answer	0%	0%	0%	100%

n=53

For commercial adaptive capacity increase, the results are similar. In the data available for knowledge increase and adaptive capacity increase through association participation, 63% of those who reported moderate knowledge increases and 29% reporter strong gains; of the farmers that reported a strong knowledge increase, 67% also reported a strong adaptive capacity increase and 29% reported a moderate adaptive capacity increase. Although 100% of those who reported no increase in knowledge reported a slight increase in responsive capacity, it must be noted that this is a very small sample consisting of 2 out of 53 farmers.

The data for certification impacts sketches a similar picture. Of the farmers who reported moderate knowledge increases, 58% reported adaptive capacity increases in the same category, and 26% reported stronger increases (with no answers available for 16%). The majority of farmers who reported strong

knowledge increases also reported strong adaptive capacity increases, with 24% reporting weaker gains and no answers available for 24%.

Table 3 Commercial adaptive capacity increase correlation with knowledge increase (association)

Association				
	Commercial adaptive capacity			
Commercial knowledge	No increase	Slight increase	Strong increase	No answer
No increase	0%	100%	0%	0%
Slight increase	11%	63%	26%	0%
Strong increase	5%	29%	67%	0%
No answer	0%	67%	0%	33%

n=53

Table 4 Commercial adaptive capacity increase correlation with knowledge increase

Certification				
	Commercial adaptive capacity			
Commercial knowledge	No increase	Slight increase	Strong increase	No answer
No increase	0%	0%	0%	100%
Slight increase	0%	58%	26%	16%
Strong increase	0%	24%	53%	24%
No answer	0%	0%	0%	100%

n=53

Overall, this data suggests that stronger knowledge increases are correlated with stronger increases in adaptive capacity. In the case of certification, it is unclear why farmers would experience a more significant adaptive capacity increase despite lower levels of knowledge increase; unfortunately, further conclusions are obscured due to the unevenness of responses with regard to adaptive capacity.

DISCUSSION

The aim of this study was to evaluate the impact of producer organisations' networks on the resilience and adaptive capacity (adaptive capacity) of coffee farmers in Cajamarca, focusing especially on the role of social capital in determining the success of knowledge transfer for sustainable development. The study furthermore aimed to assess the impacts of climate-change related phenomena on the livelihoods of coffee farmers, which mitigation and adaptation measures were being implemented and which role the cooperatives and other actors played in formulating and implementing these.

Key Findings

1. Coffee farmers in Jaén and San Ignacio are facing adverse impacts from climate-related phenomena on their livelihoods

Coffee farmers in Jaén and San Ignacio report having been impacted by changing climatic conditions over the past couple of years. This chiefly manifests itself in two ways. Firstly, farmers and cooperative staff report that there has been an increase of extreme weather events, specifically drought; at the same time, unpredicted heavy rainy seasons have also occurred. These physical phenomena have often negatively impacted the quality of their crop, mostly due to either the lack of or an oversupply of rain at crucial times during the crop's growing process. In some cases, these events did have positive effects. Overall, farmers in the lower zones (800-1200masl) reported suffering the heaviest impacts.

Furthermore, farmers were also impacted by another phenomenon linked to climate change: increased incidences of pests and diseases that fouled their crop. Chiefly, these were coffee leaf rust and the coffee berry borer, but other diseases were also reported by farmers. As the temperature increases and precipitation patterns shift, the climatic conditions become more favorable to increasingly rapid growth and spread of these pests. These findings confirm findings and predictions in the literature, such as Robiglio et al (2017). Coffee farmers, especially in the lower regions, will most likely face intensifying and shifting rainfall and temperature patterns. While the cooperatives can offer them technical assistance and adaptation strategies such as more resilient strains and optimized management techniques, it is uncertain to what degree this adaptive capacity potential can keep up with the environmental changes. For those farmers that are not members of cooperatives, it is likely that their production will suffer even more, resulting in displacement and outmigration to the higher zones in which high-quality coffee cultivation remains far easier, despite some issues with flooding and soil erosion. This could increase the anthropogenic pressure on ecosystem resources.

2. Membership in a cooperative and adopting certification allow farmers important access to knowledge, technology and resources that allows for optimized management and increases adaptive capacity to environmental and economic hazards

Optimized management techniques – such as integrated pest management – were found to have been a highly crucial element towards mitigation of damage from these threats in the form of pruning, improved harvesting methods, and insect traps. Farmers were also found to be adapting to these new threats by adopting new crossbreed strains that offered a higher resilience against diseases, at the expense of quality.

For coffee farmers, the cooperative functions as the primary information access point through their network of technical assistants, workshops and meetings. Through the cooperative, the associated farmers have an increased access to information that is not readily available to other, non-associated farmers. The associated farmers receive know-how, technical assistance as well as access to financial and non-financial resources such as fertilizer from the cooperative.

The knowledge transfer within the cooperative also relies on high social capital in the form of trust and reciprocity; for this cultivation of trust, good management is highly important as it maintains the confidence of the farmer in the cooperative. Furthermore, through learning and adopting new technology to improve his livelihood, farmers also gain confidence in their own entrepreneurial and agricultural skillsets. Furthermore, the cooperatives, and especially the local association chapters, form spaces for social learning. While the technical workshops and assistance from the cooperatives are an important mechanism for knowledge transfer, farmers also often wish to see the successful implementation of a new technology or practise before applying it themselves. Through this social learning, technology transfer benefits from the 'embedded' exchange pathways that form the networks within the cooperative.

Coffee farmers reported similar impacts on their commercial knowledge (prices and crop diversification) as their environmental knowledge (integrated pest management and environmental health). Furthermore, there were also no significant differences reported for their perceived impact of being certified and joining the association in the quantitative survey. During the personal and group interviews, farmers did however speak about the particular impacts of either network. Mostly, these assocaited impacts of network participation were positive. For the coffee farmers, both the association and becoming certified were associated with changes in their management practises that improved their livelihoods and furthermore changed their 'attitude' towards coffee farming towards being more efficient and 'modern' when it came to their business.

Education also seems to play a role in the perceived impact of knowledge transfer. Overall, primary school educated farmers seem to enjoy a slightly higher increase of environmental and commercial knowledge than their secondary school educated fellows. This could be due to the relative 'knowledge gap' between PSE and SSE farmers in some areas being closed to some extent due to the knowledge gained from the cooperative, as PSE farmers experience an overall higher increase in knowledge due to their previously lower education levels.

Furthermore, knowledge increase – whether associated with certification adoption or cooperative membershop – also correlates to increases in adaptive capacity. Where data was available, farmers that reported slight to moderate knowledge increase also tended to report a corresponding increase in adaptive capacity; the same goes for strong to very strong knowledge increase.

Most coffee farmers reported some increase in their adaptive capacity. The data suggests that farmers experienced the strongest commercial adaptive capacity increase due to association membership, while associating increases in their environmental knowledge with certification adoption. These differences can be explained by the fact that the farmers may associate the cooperative's financial services such as credits, grants and other financial support mechanisms as particularly influential on their capacity to withstand crises in the market. On the other hand, in order to become certified, producers must familiarize themselves with the extensive rules and regulations of the different labelling certifications and adopt these practises; as most farmers produced for both organic and sustainable markets, this would imply that farmers associate becoming certified with learning more about environmentally friendly farming practises.

Certification standards and cooperative governance often overlap due to the fact that the cooperatives' technical assistants, who inform them about the required standards and also carry out inspections, form the primary point of contact with many rules & regulations. These rules and regulations are informed by the cooperatives own regulatory framework as well as those coming from the various voluntary standard legal and the state. Furthermore, the cooperatives themselves have often incorporated different standards into their social-entrepreneurial models, further blurring these lines.

For the farmer, the challenge is that of incorporating these slews of rules, regulations and laws into his short- and long term management practises, not only pertaining to environmental aspects but also requiring changes in his social and econonomic practises. For the cooperatives, in turn, the challenge consists in appropriately bringing the farmers into these regulatory networks in a sustainable manner. While Stott & Huq (2014) speak of a 'mobilization of appropriate knowledge', one might similarly speak of an appropriate mobilization of knowledge that is crucial to the long-term knowledge transfer and sustainable development being cultivated within cooperatives.

On the individual level, it was often remarked that 'culture' – in this context, the way of thinking and doing of many rural peasants – was an obstacle to improving and modernising coffee-production and the coffee communities, as it was described as feeding into often more short-term views on needs and the individual. This sentiment is also reflected in the lack of 'institutionality' described by cooperative and certification staff, which refers to the governmentality existing in much of the public and private sector. However, at the same time, while some elements of the aforementioned 'culture' and institutional attitudes create low social capital and high transaction costs, there is also the counter-development evidenced in the formation of associations and cooperatives.

The knowledge networks and programs formed by the cooperatives and the certification NGOs play an important role in the creation of both collective institutions that help guide organisations, as well as acting on a more individual level where farmers report a changed mindset when it comes to managing their farm and livelihood. These factors can be seen as contributing factors for the 'internal' social capital of the cooperative, where clear communication, shared values and trust among members reduce transaction costs and opportunism, thereby strengthening the network of the cooperative and also enabling better knowledge exchange that further contributes to the resilience of the producers and thus the cooperative.

At the same time, this situation also demands from the farmers that they adapt to the increased 'trickle-down' of specialized knowledge when it comes to their production and farm management, and therefore need to invest more time and personal resources into 'keeping up' with this increased information influx and the planning of the cooperatives that needs to focus both on the changing market environment towards ever-higher quality, and the changing environmental context which challenges every aspect of coffee production, from the selection of resilient species to plant, to the proper application of the right fertilizers and integrated pest management techniques, to the availability and use of adequate infrastructure to ensure the quality of the crop in the post-harvest processing period.

Certifications can be seen as allowing the formation of a niche that was highly important to the re-formation of the cooperative sector in the late 90s and early 2000s, amidst several coffee crises, allowing them greater freedom and growth. The role of the certifications has now shifted more towards tools that allow cooperatives to focus on optimizing management techniques, such as integrated pest management, and increasing quality through upgrading their regulatory framework in order to compete on the global market.

CONCLUSION

Agricultural cooperatives can represent important access hubs for farmers to access credit, technology and know-how to improve their resilience to external threats, through workshops, technical assistance, access to credits, social learning and changes to their approach to farm management towards more optimized practises. Furthermore, participation in differentiated markets through label certifications have allowed farmers to produce along clear guidelines in return for price premiums; the cooperatives benefit from more direct access to the market, governance guidelines for the social, economic and environmental spheres of coffee production, as well as access to some labels expert knowledge through workshops or programmes organised by different (non)-governmental organisations working together.

However, high social capital in the form of reciprocal relationships based on trust and to some extent a shared identity as coffee farmers play an important role in the governance and performance of cooperatives. Furthermore, the cooperative must have access to reliable staff and management, as well as adequate communication infrastructure in order to service the informational needs of its members, oversee the implementation of cooperative rules and regulations, and update members on current commercial and

environmental developments. This effective communication furthermore needs to be tailored to the educational level and social setting of the farmers.

The cooperative therefore needs to operate in such a way as to maintain the trust of its members as well as its clients. For this reason, the growth of cooperatives is often limited as they require a careful vetting process of members, as these need to be able to quickly conform to the needs of the cooperative that is operating within a highly demanding and shifting market environment and often is already hard-pressed for human resources and financial capital to invest into this process. Furthermore, this often requires external support at the right time in order for organisations to work towards becoming efficient and succesful and thus to grow in a 'sustainable' way. While certifications played an important role in guiding this cooperative development initially through standards and high price premiums, this has changed as the niche has evolved.

Both farmers and cooperative staff report that the more 'direct' benefit of certification in the form of premiums has declined, as the market has become more saturated and more farmers and cooperatives now compete on the differentiated markets. Cooperatives and farmers now view certification more as a tool that gives them access to these markets as well as knowledge to improve their production and coffee quality subsequently, this allows them to compete in terms of quality with other suppliers. However, this shift has also forced cooperatives to become much more focused on the commercial elements of their organisations, with a need to continually improve their production in terms of efficiency and quality.

While cooperatives can operate as important collective knowledge and resouce hubs that allow farmers better access to outside support and markets, they are internally constrained through the need for sufficient social capital and sustainable growth. However, cooperatives also still suffer from low outside trust from many farmers. Thus, the percentage of only 30% of farmers who are organised in such networks not only stems from internal constraints on 'member quality' and disposable resources, but also from mixed levels of trust from the farmers; in this case, the 'structural' social capital of cooperatives to other farmers can be said to often not be sufficient for these farmers to 'trust' the cooperative with the investments needed for membership. Farmers themselves are thus often limited in their ability to join a cooperative, as they also require the formation of a local association or chapter of the cooperative, requiring social capital in the form of trust and motivation for the institution of norms and values to achieve conformity with the cooperative's governance model and certification.

Furthermore, this building of 'trust' between the coffee farmers and the cooperatives are hampered by the lack of organisational capacities and the presence of opportunism; although new cooperatives are formed, many fail due to these factors as they are unable to build sufficiently performing organisations and thus, through such a 'fragmentization' of the cooperative sector and the failure of new organisations to establish thriving and transparent enterprises, the building of trust is further hampered. In turn, this therefore often

limits the provision of knowledge transfer and agricultural services to the existing successful cooperatives and their local networks, while many unassociated farmers remain without access to such networks.

While certification can contribute to farm income and improve living conditions, an optimized farm management appears to be a better strategy in the long due to the higher economic benefits offered.

Here, cooperatives play an important role through forming knowledge networks that represent pahtways through which knowledge and technology can be diffused and mobilized. Cooperatives represent potential networks for knowledge exchange and technology transfer; learning that takes place at the organisational level can be used to improve production and livelihoods at an individual level, allowing the farmers to adapt to or mitigate damage from climate change and absorb market shocks.

However, unless the cooperatives is able to 'upgrade' their supply-base effectively and expanding their organisational capacities, the commercial and financial risks of coffee production are not diminished and resilience is not increased. Furthermore, the success of this upgrading is contingent on the degree to which a cooperative is able to muster the social and financial capital for effective communication, logistics and knowledge access. Therefore, it is necessary that farmers get the necessary support needed to facilitate their entry into cooperatives; at the same time, the expansion of the existing, larger cooperatives should be promoted as new and smaller cooperatives often face large administrative and organisational hurdles to overcome should they wish to compete in the challenging global market and amidst an increased pressure regarding organisational learning in terms of quality and adaptation measures to climate change.

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