

# **THE IMPACT OF SUSTAINABLE AGRICULTURAL PRACTICES ON COFFEE SMALLHOLDER MARKET ACCESS: THE MEDIATING ROLE OF CERTIFICATION AND THE MODERATING ROLE OF COOPERATIVE MEMBERS**

**Hongyan Zhao**<sup>1\*</sup>

**Suprawin Nachiangmai**<sup>2</sup>

**Ling Qian**<sup>3</sup>

**Xuelong Zhang**<sup>4</sup>

**Zhi Hui Li**<sup>5</sup>

<sup>1-5</sup> Innovation College, North-Chiang Mai University

\* **Corresponding Author, E-mail:** g676302023@northcm.ac.ch

**Abstract:** This study used market access as the dependent variable, sustainable agricultural practices as the independent variable, certification as the mediating variable, and cooperative membership as the moderating variable. A core conceptual framework was constructed by introducing age, education level, farm size, geographic location, and type of coffee grown. The study attempts to analyze the differences in the mean perception of sustainable agricultural practices, certification, cooperative membership and market access among the subgroups of the respondents' demographic variables, and to explore the influence of the independent variables on the dependent variables. The study proposes the following research hypotheses: 1. Sustainable agricultural practices have a positive impact on market access. 2. Certification plays a mediating role between sustainable agricultural practices and market access. 3. Cooperative membership moderates the impact of certification on market access.

This study takes the northern region of Thailand as a case study. Among the smallholder coffee growers, a stratified random sampling method was used to calculate a sample size of 500. A total of 500 questionnaires were distributed and 500 were returned, for a response rate of 100%.

This study found that: 1. Sustainable agricultural practices have a significant positive impact on market access. 2. Certification partially mediates the relationship between sustainable agricultural practices and market access, indicating that certification does play an important role in improving market access, but sustainable agricultural practices themselves also have a direct impact on market access. 3. Membership of a cooperative does not significantly moderate the relationship between certification and market access, indicating that membership of a cooperative does not significantly enhance or weaken the role of certification in improving market access. This means that cooperatives may provide other independent advantages in terms of market access, but they may not further amplify

the role of certification. The conclusions of this study are of great practical significance for promoting market access for smallholder farmers, optimizing agricultural sustainability policies, and improving the effectiveness of certification systems.

**Keywords:** Sustainable Agricultural Practices, Certification, Membership Cooperation, Market access

## **Introduction**

The coffee industry is one of the most representative high-value industries in the global agricultural trading system. According to statistics from the International Coffee Organization (2023), the annual global coffee trade exceeds 100 billion U.S. dollars, and coffee cultivation has become the main means of survival for millions of smallholder farmers in regions such as Africa, Asia, and Latin America (Hernandez-Aguilera, Gómez, & Jones, 2018). However, despite the sector's significant economic importance, smallholder farmers face a range of persistent challenges such as price volatility, limited market access, and climate change (Lee, Chang, & Sun, 2019). These issues not only constrain smallholder farmers' earnings growth, but also threaten the sustainability of their long-term livelihoods.

In response to these challenges, sustainable agricultural practices (SAP) are considered an important way to improve smallholder farmers' resilience and market competitiveness. SAP covers a wide range of farming methods such as organic farming, soil conservation, biodiversity protection and water management. Its core objective is to balance ecological protection and production efficiency (Hajjar, Newton, Adshead, & Bogaerts, 2019). With the increasing awareness of ethical consumption and green products among global consumers, there is a growing link between SAP and certification systems. For example, certification systems such as Fairtrade, organic certification, and the Rainforest Alliance have become the “admission ticket” for farmers to enter the international high-end market (Chiputwa, Spielman, & Qaim, 2015). However, the economic and technical barriers required for certification make it difficult for many smallholders to afford.

In this context, the role of cooperatives has gradually become more prominent. Cooperatives not only provide smallholder farmers with a platform for technical training and resource sharing, but also reduce the certification threshold through collective action, thus facilitating smallholder farmers' entry into more competitive markets (Gashema, 2021). However, there is currently a lack of systematic research in academia on the triple relationship between SAP, certification and cooperatives. In particular, there is still insufficient discussion on the mechanisms of how certification mediates the relationship between SAP and market access, and how cooperatives moderate the effect of certification. Therefore, this paper uses northern Thailand as the research background and proposes a theoretical framework that integrates SAP, certification, and cooperative membership, aiming to systematically analyze how these variables jointly affect smallholder farmers' market access.

The promotion of SAP is one of the key strategies for achieving agricultural sustainability and

increasing the added value of agricultural products. In the field of coffee cultivation, common SAP include organic farming, soil conservation techniques, biodiversity protection, and efficient water management. Organic farming improves ecosystem stability by reducing reliance on synthetic chemicals, and also significantly improves soil structure and microbial activity, thereby enhancing farm productivity (Maguire-Rajpaul & Rajpaul, 2020). More importantly, organic coffee often receives price premiums in the international market due to its high quality and lack of pollution, which has become an important means for smallholder farmers to increase their income.

Meanwhile, soil conservation techniques such as terracing, ground cover and mixed cropping have also been proven to significantly reduce soil erosion, improve soil fertility, and thus increase coffee yields and the production stability of farms (Dietz, Estrella Chong, & Grabs, 2020). Shade-grown systems, as an expression of biodiversity conservation, not only protect tree diversity and enhance the ecological resilience of farms, but also improve the flavor of beans, thereby gaining higher market evaluation (Grabs, Kilian, & Hernández, 2016). In addition, the efficient use of water resources is also particularly critical. Techniques such as drip irrigation, rainwater harvesting and wastewater treatment not only reduce irrigation costs, but also effectively reduce environmental degradation (Snider, Sibelet, & Faure, 2017).

Despite the potential benefits of SAP, its adoption among smallholder farmers faces significant barriers. These barriers stem from a lack of technical support, high initial investment and long payback periods. Therefore, how to use certification systems to translate the ecological value of SAP into market benefits has become the key to promoting sustainable agriculture.

Certification plays an important intermediary role in connecting production with the market in sustainable agriculture. Certification mechanisms support environmentally friendly production methods by setting clear production standards and auditing mechanisms, so that consumers can trust the source of the product (Jena & Grote, 2022). For coffee growers, obtaining certifications such as organic, fair trade or Rainforest Alliance not only increases the added value of their products, but also allows them to enter more stable and high-priced international markets. Previous studies have shown that certified farmers are able to sell their products at higher prices and are more likely to secure long-term partnerships with high-quality buyers, thereby reducing income uncertainty caused by market price fluctuations (Chiputwa et al., 2015). In addition, certification can also improve the reputation and bargaining power of farmers, helping them gain more initiative in the market.

However, certification systems also have significant entry barriers. Smallholder farmers often face the following challenges during the application process: high economic costs, lack of knowledge about the complex compliance process, and lack of ability to maintain certification status (Subervie & Lemeilleur, 2020). Even if a few farmers successfully obtain certification, if they lack stable market connections, the premium effect brought about by certification will be difficult to realize. This reality highlights the important role of cooperatives in promoting the implementation and practical benefits of

certification systems.

Cooperatives are becoming increasingly important in agricultural organizations, and they have an irreplaceable function, especially in promoting the participation of smallholder farmers in certification systems and access to high-value markets. Through collective action mechanisms, cooperatives not only share the economic and management burdens brought about by certification, but also provide key resources such as technical training, experience sharing and market information (Akenroye, Kumar, Dora, & Ihua, 2022). In addition, cooperatives play a bridging role in collaborating with governments, NGOs, and international agencies, which helps to introduce external resources to support smallholder capacity building.

Cooperative members are more likely to obtain certification than independent farmers because they can share the cost and manage the certification process collectively. Research has found that cooperative members can respond more quickly to market changes, access high-quality buyer resources, and obtain more favorable sales prices through collective bargaining through internal coordination mechanisms (Gashema, 2021). This not only enhances the bargaining power of smallholders, but also reduces their dependence on intermediaries. However, not all cooperatives can effectively perform their functions. Some cooperatives have deficiencies in their governance structures, such as centralized leadership, unfair resource allocation, and insufficient financial transparency, which can lead to a crisis of trust among members (Lemeilleur, Subervie, & Presoto, 2020). Therefore, improving the governance and institutional norms of cooperatives is the key to ensuring their role in certification promotion.

In recent years, northern Thailand (such as Chiang Mai, Chiang Rai and Lampang) has gradually developed into an important Arabica coffee producing area due to its superior altitude and climate conditions. The Thai government is also actively promoting high-quality coffee cultivation, hoping to improve smallholder incomes and market influence through sustainable agriculture (Thailand Coffee Association, 2023). Nevertheless, the market participation ability of smallholder farmers in this region is still weak, the certification coverage rate is low, and the development level of cooperatives is uneven, which limits the promotion of sustainable development strategies.

Field research shows that many smallholders lack knowledge of certification requirements and have insufficient access to infrastructure and technical resources. Even if they are willing to adopt SAP, they often find it difficult to obtain price premiums due to a lack of market connection mechanisms, which to some extent dampens their enthusiasm for sustainable operations. At the same time, some cooperatives have difficulty achieving synergies due to poor internal management. Therefore, policy intervention and institutional innovation are of practical urgency in order to improve the efficiency of certification, improve cooperative governance, and strengthen market access mechanisms.

This study proposes the following three measures to strengthen the integration capacity of smallholder farmers in the sustainable coffee market:

First, the government should provide certification subsidies and microcredit schemes to lower

the financial threshold for smallholders to enter the certification system, and set up certification incentives to increase their enthusiasm for participation (Ortiz-Miranda, 2015). Second, the government should work with NGOs and universities to provide agricultural technology training to enhance smallholders' understanding of sustainable agricultural technology and certification requirements and improve their ability to comply independently (Schader et al., 2019). Third, the development of cooperatives should be promoted in accordance with the rule of law, the democratic nature and transparency of the governance structure should be enhanced, equitable resource allocation should be ensured, and cooperatives should be encouraged to establish stable cooperative relationships with buyers, thereby improving market integration.

In summary, this paper constructs an analytical framework that integrates sustainable agricultural practices, certification and membership in cooperatives, based on institutional theory and the resource-based view, to explore its impact mechanism on smallholder farmers' market access. In the region represented by northern Thailand, smallholder farmers can effectively improve their market entry ability and obtain higher price premiums by adopting SAP, participating in certification and joining cooperatives. However, the entry barriers of the certification system and the governance issues of cooperatives remain constraints. Future policies should focus on institutional innovation and the construction of collective support mechanisms to ensure that the results of certification and SAP can be translated into actual economic benefits. This study not only enriches theoretical research in the field of agricultural sustainability, but also provides theoretical support and an empirical basis for practical interventions.

### **Research Objective (s)**

This study aims to explore the relationship between sustainable agriculture practices (SAP) and market access for smallholder coffee growers, focusing on the mediating role of certification and the moderating role of cooperative membership. The growing global demand for sustainably produced coffee and the structural constraints that smallholders face in accessing premium markets highlight the need for a nuanced understanding of how sustainability-related interventions can improve smallholder market access.

Market access is a key determinant of smallholder economic sustainability. Farmers who successfully access high-value and premium markets can enjoy better prices, stable trading relationships and higher incomes (Dietz, Estrella Chong and Grabs 2020). However, numerous barriers – including lack of market information, weak bargaining power, high certification costs, and stringent compliance requirements – limit smallholder participation in global value chains (Grabs, Kilian, and Hernández 2016). Sustainable agricultural practices have been identified as a potential solution to overcome some of these barriers, as they align with consumer preferences for ethical and environmentally friendly coffee products. Furthermore, certification and membership in cooperatives are key institutional

mechanisms that help bridge the gap between smallholders and global markets.

To provide a comprehensive understanding of these dynamics, this study established three specific objectives: first, to assess the impact of sustainable agricultural practices on smallholder coffee growers' market access; second, to analyze the mediating role of certification in the relationship between sustainable agricultural practices and market access; and third, to assess the moderating effect of cooperative membership on the relationship between certification and market access. By achieving these objectives, this study provides empirical evidence that contributes to agricultural economics, sustainability science, and rural development research, and provides actionable insights for policymakers, cooperatives, certifiers, and coffee producers.

Objective 1: To assess the impact of sustainable agricultural practices on market access for smallholder coffee growers

The first objective aims to assess the direct impact of sustainable agricultural practices (SAPs) on market access for smallholder coffee growers. The potential of SAPs to improve farm productivity, soil health, climate resilience and coffee quality is widely recognized (Jena & Grote 2022). However, their role in facilitating market access is less well understood. Growing consumer demand for ethically produced and environmentally sustainable coffee has prompted large buyers and multinational coffee companies to set sustainability standards for their supply chains. Farmers who adopt sustainable agricultural practices are more likely to meet these standards and access high-value markets that prioritize sustainability and social responsibility (Njeru, Garnett, and Girkin 2024).

Sustainable agricultural practices in coffee farming include organic farming, which does not use synthetic pesticides and fertilizers but instead uses compost and natural pest control; soil conservation techniques such as mulching, terracing, and cover cropping to prevent soil erosion; water management practices including rainwater harvesting and drip irrigation to optimize resource use; agroforestry and biodiversity conservation to promote ecosystem diversity and maintain tree cover. Each of these practices has potential economic and market advantages for farmers. For example, shade-grown coffee is increasingly popular in the specialty coffee market because it aligns with biodiversity conservation goals (Grabs & Kilian 2016). Similarly, organic coffee often sells for a premium price, providing a better source of income for smallholder farmers. However, the costs and technical knowledge required to adopt sustainable agricultural practices can be barriers to widespread adoption, limiting their potential benefits in terms of market access.

Empirical studies suggest that while sustainable agricultural practices can improve coffee quality and sustainability, they do not automatically guarantee better market access. Many smallholders still struggle to establish connections with high-income buyers, even if they practice sustainable agriculture. This suggests that additional mechanisms, such as certification and membership in cooperatives, may be necessary to translate sustainable agricultural practices into actual market benefits. This study therefore explores whether the adoption of sustainable agricultural practices alone is

sufficient to gain market access, or whether additional interventions (such as certification and cooperatives) are needed to facilitate this process.

Objective 2: To analyze the mediating role of certification in the relationship between sustainable agricultural practices and market access

The second objective aims to investigate whether certification plays a mediating role between sustainable agricultural practices and market access. Certification programs (e.g., Fairtrade, Rainforest Alliance, and organic certification) act as market mechanisms that verify and signal compliance with sustainability requirements to buyers and consumers (Chiputwa, Spielman, and Qaim 2015). These certification labels enhance trust in sustainability claims, provide farmers with a stronger market position, and enable them to access higher-priced market segments in the coffee industry.

Certification programs offer multiple benefits to smallholders, including price premiums, stable buyer relationships, market differentiation, and access to training on best agricultural and sustainable practices. Research suggests that certification increases economic and market opportunities for smallholders by providing access to niche markets that value ethical sourcing (Van Rijsbergen et al., 2016). However, there are also significant challenges to certification adoption, particularly for small-scale and resource-constrained farmers. Many find it difficult to afford the costs of certification, meet the complex documentation requirements, and comply with certification standards over the long term.

Given these constraints, certification alone may not ensure market access, especially for independent smallholders. This raises the question of whether external support mechanisms (e.g., cooperatives) can improve the accessibility and effectiveness of certification. This study therefore explores how certification mediates the relationship between sustainable agricultural practices (SAPs) and market access, and whether membership in a cooperative strengthens this mediation.

Objective 3: To assess the moderating effect of cooperative membership on the relationship between certification and market access

The third objective examines whether cooperative membership moderates the effect of certification on market access. While certification has been shown to improve price premiums and buyer relationships, farmers' ability to fully leverage these benefits depends on their organizational capacity. Cooperatives are a key institutional mechanism that facilitates certification adoption and market participation by providing financial support, technical training, and market linkages (Gashema 2021).

Cooperative membership offers smallholders several advantages, including sharing of certification costs, access to training programs, collective bargaining power, and market networks. Empirical evidence suggests that cooperative membership significantly improves the benefits of certification. Certified farmers in cooperatives are more likely to sell their products at a premium, secure long-term contracts, and benefit from economies of scale than independently certified farmers (Schoonhoven-Speijer & Ruben 2015). However, not all cooperatives operate effectively. Some cooperatives suffer from poor governance, uneven benefit distribution, and financial mismanagement,

which limits their ability to support certification and market access (Lemeilleur, Subervie, and Presoto 2020).

This study aims to assess whether cooperative membership can amplify the benefits of certification, providing empirical insights into the role of cooperatives as market facilitators. By understanding the moderating role of cooperatives, policymakers and certification bodies can design interventions to increase smallholder farmers' access to global coffee markets.

By addressing these research objectives, this study contributes to sustainable agriculture, market access theory and rural development research. It provides actionable recommendations for smallholder farmers, cooperatives, policymakers, and certifiers to ensure that sustainability-driven interventions translate into tangible market benefits. The findings have the potential to inform strategies to improve the accessibility of certification, strengthen cooperative governance, and optimize the adoption of sustainable agricultural practices for market access within the global coffee supply chain. Ultimately, this research aims to bridge the gap between sustainability commitments and economic opportunities for smallholder farmers, ensuring that the benefits of sustainable agricultural practices translate into tangible improvements in livelihoods and market participation.

## **Literature Review**

Smallholder farmers, as the main producers in the global coffee industry, face multiple structural constraints to market access. Sustainable agricultural practices (SAPs), sustainability certification systems, and cooperative organizational mechanisms are widely regarded as key ways to improve the economic resilience of smallholder farmers and achieve equitable market participation (Chiputwa, Spielman, & Qaim, 2015; Donovan & Poole, 2014). This section aims to lay the theoretical foundation for this study by systematically reviewing relevant research results at home and abroad, identifying theoretical progress and practical challenges, and pointing out key gaps in research.

Sustainable agricultural practices generally refer to a series of agricultural technology systems with positive externalities in terms of environmental friendliness, resource efficiency and social responsibility (Hajjar et al., 2019). International institutions such as Unilever (2010) define it as a production method that is “economically viable, environmentally sustainable and in line with community conditions,” emphasizing the triple balance of society, economy and ecology. Domestic scholars have also defined its scope from different perspectives. Xiao Yanheng (2003) emphasizes the technical integration of energy efficiency, ecological protection and biological control, while Zhang Juyong (2005) divides it into three categories: promoting ecosystem productivity, sustainable use of resources and pollution control.

In the coffee industry, typical sustainable agricultural practices include organic farming, water-saving irrigation, soil protection, and shade-grown coffee (Dietz, Estrella Chong, & Grabs, 2020). These techniques not only help improve ecosystem services and farm productivity, but also become an

important threshold for entering the boutique market due to the rising consumer demand for ethical and environmentally friendly products (Chiputwa et al., 2015). However, due to limited financial capacity and technical knowledge, many smallholders find it difficult to effectively adopt sustainable agricultural practices, and may face a decline in yields and investment pressure during the initial transition (Grabs & Kilian, 2016). This makes institutional support crucial to the success of sustainable transitions.

Market access determines whether smallholders can effectively participate in regional and even global value chains, as evidenced by stable buyer relationships, bargaining power and price access levels (Donovan & Poole, 2014). In the traditional coffee trading system, smallholder farmers rely on intermediaries for sales, which is constrained by information asymmetry and low bargaining power, resulting in limited profit margins (Van Rijsbergen et al., 2016). Although the specialty market and direct trade offer the potential for high premiums, the high technical, quality and certification thresholds have resulted in low participation rates among smallholders.

Lack of capital and transaction costs are considered to be among the most critical constraints. Smallholders generally lack working capital for agricultural inputs, post-harvest processing and market participation (Ferris et al., 2014), while the upfront costs, audit costs and documentation involved in certification further increase their financial burden (Subervie & Lemeilleur, 2020). In addition, information asymmetry also severely restricts their ability to integrate into the market. Most farmers cannot access real-time prices, consumer preferences and trade trends, which puts them at a disadvantage in negotiations and planting decisions (Schader et al., 2019).

In recent years, digital agricultural tools and e-commerce platforms have theoretically provided smallholders with more efficient ways to connect to the market (Anh & Bokelmann, 2019; Usman & Callo-Concha, 2021). However, the practical conditions such as weak network infrastructure and low digital literacy still face challenges in their application in remote areas.

Certification systems (such as Fairtrade, organic certification and the Rainforest Alliance) theoretically provide smallholder farmers with ways to differentiate and obtain a premium in the market through reputation endorsement and standardized processes (Jena & Grote, 2022). Fairtrade emphasizes a minimum price guarantee and a social premium for development (Chiputwa et al., 2015), organic certification focuses on ecological sustainability, and the Rainforest Alliance integrates ecological, social and economic dimensions (Hajjar et al., 2019). These systems have become important “passports” to high-value markets.

However, the actual economic benefits of certification are not consistent. Some studies have pointed out that while certification can enhance product reputation, it may not be able to stably obtain a premium, especially in situations of oversupply or insufficient consumer willingness to pay (Schader et al., 2019). The sunk costs, compliance burden and market uncertainty involved in certification often undermine its institutional attractiveness, and may even trap some farmers in a “certification trap” – a predicament in which huge investments are made but returns are difficult to obtain (Donovan & Poole,

2014).

Cooperatives are widely regarded as an important institutional pillar for enhancing the market power of smallholder farmers. They help farmers overcome market entry barriers through organizational coordination, cost sharing, collective bargaining and information sharing mechanisms (Gashema, 2021). Especially in terms of promoting certification, cooperatives can apply for collective certification, organize training and assist in compliance management, significantly reducing the certification threshold and administrative costs (Van Rijsbergen et al., 2016).

Cooperatives also enhance the income stability of their members by establishing direct links with ethical buyers and signing long-term contracts (Akenroye et al., 2022). At the same time, their information-sharing mechanisms enhance the market perception and responsiveness of their members. However, the institutional performance of cooperatives is also limited by their governance structure. In some regions, cooperatives have problems with centralised power, insufficient transparency and uneven resource distribution, which have resulted in their failure to fully benefit the most marginalised groups of farmers (Lemeilleur, Subervie, & Presoto, 2020).

This study is based on three theoretical frameworks. First, Institutional Theory views certification as an institutional mechanism that influences farmers' behaviour and market norms through standard setting (Jena & Grote, 2022). Second, the resource-based view (RBV) emphasises that cooperatives serve as a platform for strategic resources, which help to compensate smallholders for their disadvantages in terms of knowledge, capital and market information (Lemeilleur et al., 2020). Finally, market access theory emphasises the decisive role of institutions, infrastructure and power structures in determining whether smallholders can integrate into global value chains.

Although existing studies have provided insights into their respective dimensions, overall, there are the following key research gaps:

1. Lack of integrative research: Most studies examine sustainable agricultural practices, certification and cooperatives as independent variables, and have not revealed how the three jointly shape smallholders' market access capabilities (Chiputwa et al., 2015; Gashema, 2021).

2. The effect of certification is controversial: although certification has a potential premium, its high cost, market risks and uncertainty make it difficult to generalize its effect (Subervie & Lemeilleur, 2020; Van Rijsbergen et al., 2016).

3. Lack of cross-country comparisons of the moderating role of cooperatives: The role of cooperatives in different institutional environments varies, and their moderating mechanism between certification and market access has not yet been systematically understood (Lemeilleur et al., 2020).

4. Theoretical integration framework to be established: Current research lacks attempts to incorporate sustainable agricultural practices, certification and cooperative mechanisms into a unified theoretical framework, limiting an in-depth understanding of institutional synergies and policy intervention paths.

In summary, sustainable agricultural practices, certification and membership in cooperatives constitute the three core mechanisms that affect smallholder coffee growers' market access. However, their actual operational effectiveness is constrained by a variety of institutional, economic and environmental variables. Future research should construct an integrated analytical model to systematically identify the interaction paths and moderating mechanisms among the three, and test the applicability of the theory through comparative research across regions. Only in this way can we provide practical institutional support and policy recommendations for the sustainable agricultural transformation of smallholder farmers and their equitable market participation worldwide.

### **Methodology**

This study used a quantitative research design to investigate the relationships between sustainable agricultural practices, certification, membership in cooperatives, and market access among smallholder coffee farmers in northern Thailand. The rationale for using a quantitative approach lies in its ability to test structured hypotheses and investigate measurable causal relationships between variables within a statistically robust framework.

Given that most previous studies have examined these variables in isolation, this study adopts an integrated multivariate approach to explore their combined and mediating effects. Data were collected through structured questionnaires designed to capture the adoption of sustainable agricultural practices, certification status, membership of cooperatives and market access levels. The design facilitates testing of direct effects as well as mediating (certification) and moderating (cooperative membership) variables.

The study population is smallholder Arabica coffee growers in Chiang Mai, Chiang Rai, and Lampang provinces (the main coffee growing regions in Thailand), which are known for varying degrees of market integration, sustainable practices, and cooperative organizations. The analytical framework is based on three theoretical pillars: institutional theory (governance of certification), resource-based view (cooperatives as collective asset base), and market access theory (structural participation constraints).

**Sustainable agricultural practices:** These were assessed using a 15-item Likert scale adapted from Nguyen & Drakou (2021) to evaluate practices such as composting, water conservation, crop rotation, biological pest control, and biodiversity conservation. The scale ranged from 1 (strongly disagree) to 5 (strongly agree). The scale had a high internal reliability (Cronbach's  $\alpha = 0.922$ ).

**Market access:** Based on the study by Byrareddy et al. (2019), this 14-item scale assesses contact with different buyers, price stability, contractual agreements, use of digital platforms, and changes in income. The scale is scored using a 5-point Likert scale and reflects structural and perceived access to high-end and international markets (Cronbach's  $\alpha = 0.915$ ).

**Certification status:** measured as a binary categorical variable (certified vs. non-certified) and

cross-validated by reported program affiliation (e.g., Fairtrade, Rainforest Alliance, organic).

Cooperative membership: this variable was also considered a categorical variable to distinguish between cooperative and non-cooperative farmers and further used as a moderating variable in the model.

The following hypotheses were proposed in this study:

H1: Adoption of sustainable agricultural practices has a positive and significant effect on market access for smallholder coffee farmers.

H2: Certification moderates the relationship between sustainable agricultural practices and market access.

H3: Membership in a cooperative moderates the effect of certification on market access, thereby strengthening the relationship.

Stratified random sampling was used in this study to ensure representation of key farmer categories (certified vs. non-certified, cooperative members vs. non-members). This approach improves statistical power and comparability across subgroups. In addition, a geographical stratification was used, focusing on Chiang Mai (high certification penetration), Chiang Rai (emerging specialty market) and Lampang (market access development).

A minimum sample size of 384 was determined based on the Cochran formula. To ensure the robustness of the survey and account for attrition, 500 smallholder farmers were ultimately surveyed. Respondents had to be currently engaged in coffee farming and implement sustainable agricultural practices at least partially.

Data collection was digital, using a structured questionnaire distributed via a mobile platform (for on-site interviews), a self-service Google form (for farmers with literacy skills) and assisted data entry (for numerate or less-literate farmers). The questionnaire was pre-tested with 30 farmers before distribution to ensure clarity, and then reliability tested (Cronbach's  $\alpha$  for all scales was  $>0.7$ ).

The data collection process was divided into three key stages to ensure the accuracy, representativeness and security of the research data. First, the research team conducted a pilot test to check the logical structure and content clarity of the questionnaire. This stage identified and corrected problems such as logical jumps, differences in terminology understanding and project redundancies in the questionnaire through a preliminary survey of 30 sample farmers, thereby improving the feasibility and reliability of the formal survey.

The second stage was the main survey deployment. During this stage, the research team combined online and offline channels to widely distribute the digital questionnaire. To improve the response rate, researchers regularly sent text message reminders to respondents, and promoted and mobilized through the WeChat group of the cooperative, the Facebook page, and the social media accounts of local agricultural organizations. In addition, for farmers with low literacy or digital skills, the surveyors provided face-to-face assistance in filling out the survey to ensure the diversity and

integrity of the sample.

The third stage is data validation and cleaning. This stage includes procedures such as completeness checks, deduplication, and outlier identification and processing of survey data to ensure the statistical usability of the data and the credibility of the research results. The final data set was encrypted using advanced encryption technology after processing, and uploaded to a secure cloud database for storage to protect the privacy rights of participants and the long-term integrity of the data, laying a solid foundation for subsequent data analysis and paper writing.

The collected data were systematically analyzed using various statistical methods to test the research hypotheses and reveal the potential relationships between variables. First, descriptive statistical analysis was used to summarize the demographic characteristics of the sample, the adoption level of sustainable agricultural practices, the certification status, and the market access status. This analysis helped provide an overall profile of the research subjects, including the distribution of variables such as gender, age, educational background, and farm size, as well as the frequency and intensity of sustainable agricultural practice implementation.

Next, independent sample T-tests and one-way analysis of variance (ANOVA) were used to test for differences in market access levels between different groups. This part mainly compares the significant differences in market access scores between certified and non-certified farmers, and between cooperative members and non-members, to reveal whether institutional participation has an impact on the market performance of smallholder farmers.

In terms of exploring the relationships between variables, this study further implements correlation analysis. Depending on the type of variable and the data distribution, Pearson or Spearman correlation coefficients were selected to test the degree and direction of bivariate associations between SAP, certification, membership of cooperatives and market access, providing a basis for subsequent modeling.

Finally, the causal paths and moderating mechanisms in the research hypotheses were examined in depth using multiple regression analysis. First, the linear regression model was used to test H1 and analyze the direct impact of sustainable agricultural practices on market access. Next, Baron & Kenny's four-step approach and the Sobel test were used to analyze the mediating effect of H2 and examine whether the mediating effect of certification between SAP and market access was significant. Finally, the moderating effect of cooperative membership in the relationship between certification and market access (H3) was assessed by introducing an interaction term. Through the organic combination of the above analytical methods, this study aims to construct a comprehensive model that is both theory-driven and data-supported, revealing how sustainability interventions can jointly promote the market integration of smallholder farmers.

The internal consistency reliability of the questionnaire was assessed using Cronbach's alpha, with coefficients above the recommended threshold of 0.7. Exploratory factor analysis (EFA) was used

to assess structural validity and ensure that the observed indicators were consistent with the underlying variables. This methodological design ensured high reliability and representativeness of the research results, providing reliable empirical evidence for assessing the market access outcomes of smallholder coffee producers in order to evaluate the combined impact of sustainable agricultural practices, certification and membership of cooperatives.

## **Results**

This study is based on a field survey of 500 smallholder coffee farmers in northern Thailand. Descriptive statistical analysis, correlation analysis, one-way analysis of variance, multiple regression and mediation/moderation models were used to empirically test the relationship between sustainable agricultural practices (SAP), certification, membership in cooperatives and market access. The results are as follows:

In terms of the demographic characteristics of the respondents, the results show that the overall sample is representative and exhibits certain structural characteristics. First, in terms of farm size, more than two-thirds of the farmers operate on an area of more than 2 hectares, of which 33.0% of the respondents farm an area of 2 to 5 hectares, and another 32.8% of the farmers own more than 5 hectares of land, showing that the scale of coffee farming in the region is generally large. Secondly, the age structure shows a trend towards rejuvenation, with about 77% of the respondents under the age of 35, indicating that young laborers dominate the local coffee industry and have a strong ability to adapt to technology and market sensitivity.

In terms of planting varieties, 43.4% of farmers grow both Arabica and Robusta varieties, reflecting farmers' diversification strategies to reduce market risks and their responsiveness to diverse market demands. Geographically, the survey sample mainly comes from the three main coffee-producing areas of Chiang Rai (42.6%), Chiang Mai (29.4%) and Lamphun (28.0%), which has good regional coverage and helps to show the differences in market access and sustainable practices in different regions. In terms of education level, 45.8% of the farmers have completed secondary education, and another 27.4% have a higher education background, indicating that the interviewed group has a certain knowledge base, which provides good conditions for them to adopt sustainable agricultural practices and understand certification standards.

The effect of demographic variables on the core variables of the study was tested using ANOVA.

In this study, the relationship between the demographic characteristics of smallholder farmers and the core research variables was examined using one-way analysis of variance (ANOVA), covering four aspects: sustainable agricultural practices, certification, membership of cooperatives and market access. The results of the analysis show that the impact of different demographic variables on these core variables varies.

**Table 1: ANOVA**

Variable	Sustainable agricultural practices	Certification	Cooperative Members	Market access
Farm size	Not significant (p=.553)	Not significant (p=.740)	Not significant (p=.219)	Not significant (p=.165)
Age	Not significant	Closer to significant (p=.066)	Not significant	Significantly (p=.003)
Type of coffee grown	Not significant	Not significant	Not significant	Significantly (p=.016)
Geographical Location	Significantly (p=.016)	Closer to significant	Closer to significant	Significantly (p=.006)
Education level	Not significant	Not significant	Not significant	Not significant

First, with regard to farm size, the statistical results show that it has no significant impact on any of the four core variables ( $p > 0.05$  for all). This indicates that, in the sample from northern Thailand, there is no significant difference in the adoption of sustainable agricultural practices, participation in certification, membership of cooperatives and market access levels, regardless of the size of the farm owned by the farmer. Farm size is not a key factor in determining whether farmers participate in institutional mechanisms or enter high-end markets.

In contrast, age showed a significant effect on market access and was also close to significant for the certification variable. This suggests that younger farmers may have a greater advantage in terms of market integration, possibly benefiting from stronger learning abilities, digital adaptability, or enthusiasm for participating in emerging cooperative models and certification programs. This result suggests that when promoting sustainable agriculture and certification programs, special attention should be paid to the barriers to participation of middle-aged and older groups.

The coffee variety cultivation strategy also significantly affects market access. The data shows that farmers who grow a mixture of Arabica and Robusta varieties are more prominent in entering high-quality markets, possibly because their products are more diverse and flexible, and can better meet the needs of different markets.

Geographical location showed an influence in multiple dimensions. In particular, the adoption of sustainable agricultural practices showed significant differences between regions, while the influence of certification and membership in cooperatives was close to significant, and the influence on market access was the most significant. This indicates an imbalance in institutional resources, the degree of cooperative development, the promotion of certification, and the degree of market connectivity in each region. For example, Chiang Mai had a higher penetration rate of certification, while Chiang Rai showed stronger market activity.

Finally, education level did not show a significant influence among all core variables. This

effect may be neutralized by cooperative support, community outreach activities, or project training, making educational background no longer a key determinant of participation.

In summary, age and geographical location are important variables affecting smallholder participation in the system and market access, while farm size and education level have no significant impact in the current context. The research results suggest that future sustainable agriculture and market access policies should focus on regional development imbalances and generational participation differences, and strengthen institutional support for marginalized groups.

**Table 2:** Correlation Analysis

Variable Combination	Pearson's r	Sig.
SAP ↔ Certification	0.968	p < .01
SAP ↔ Co-op Member	0.946	p < .01
SAP ↔ Market Access	0.733	p < .01
Certification ↔ Market Access	0.738	p < .01
Certification ↔ Co-op Member	0.929	p < .01
Co-op Member ↔ Market Access	0.736	p < .01

The above results indicate that there is a high positive correlation between sustainable agricultural practice, certification and cooperative membership, which all show significant positive associations with market access.

**Table 3:** Model Summary

Model	R	R Square	Adjusted R	Std. Error of the Estimate
1	.733a	.537	.536	5.71153

a. Predictors: (Constant), Sustainable Agricultural Practices

**Table 4:** Anova

Model	Source	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18840.781	1	18840.781	577.556	.000b
	Residual	16245.531	498	32.622		
	Total	35086.312	499			

a. Dependent Variable: Market Access

b. Predictors: (Constant), Sustainable Agricultural Practices

**Table 5:** Coefficients

Model	Predictor	B	Std. Error	Beta	t	Sig.
1	(Constant)	9.960	1.434		6.945	.000
	Sustainable Agricultural Practices	.803	.033	.733	24.032	.000

Note. <sup>a</sup> Dependent Variable: Market Access

The results of the linear regression analysis show that sustainable agricultural practices have a

significant positive impact on market access. First, from the Model Summary, the R value of the regression model is 0.733, indicating a strong correlation between sustainable agricultural practices and market access. In addition, the  $R^2$  value is 0.537, indicating that sustainable agricultural practices can explain 53.7% of the variation in market access. This shows that this variable has a strong explanatory power in predicting market access, while the remaining 46.3% may be affected by other factors. The adjusted  $R^2$  (Adjusted R Square) is 0.536, which is not much different from  $R^2$ , indicating the robustness of the model. The Std. Error of the Estimate is 5.71153, indicating that the regression model has a small prediction error.

In the results of the analysis of variance (ANOVA), the F value of the regression equation is 577.556, and Sig. = 0.000, indicating that the entire model is statistically significant. This shows that the regression relationship between sustainable agricultural practices and market access is not accidental, but meaningful.

The regression coefficients (Coefficients) further reveal the specific impact of sustainable agricultural practices on market access. The intercept  $B = 9.960$ ,  $t = 6.945$ ,  $P = 0.000$  shows that there is a certain base level of market access even when sustainable agricultural practices are zero. The regression coefficient  $B = 0.803$ ,  $t = 24.032$ ,  $P = 0.000$  for sustainable agricultural practices shows that the impact of sustainable agricultural practices on market access is highly statistically significant. The standardized regression coefficient (Beta) is 0.733, indicating that for every one standard unit increase in sustainable agricultural practices, market access will increase by 0.733 standard units. This further supports the positive contribution of sustainable agricultural practices to market access.

The results support Hypothesis 1: the adoption of sustainable agricultural practices has a positive and significant impact on the market access of smallholder coffee farmers.

**Table 6:** Intermediary Analysis

Path	B	$\beta$	$R^2$	p
SAP → Certification	1.0344	0.9684	0.9378	< .001
Certification → Market Access	0.3144	0.2871	0.5502	< .001
Total effect (including mediation)	0.4881	0.4457		-

The results of the mediating analysis show that certification partially mediates the relationship between sustainable agricultural practices (SAPs) and market access. The analysis assessed the relationships between variables through path A (sustainable agricultural practices → certification), path B (certification → market access), and the complete mediating model.

The results support Hypothesis 2: Certification partially mediates the relationship between SAPs and market access.

**Table 7: Regulatory Effect Analysis**

Model	Predictor	B	Std. Error	Beta	t	Sig.
1	(Constant)	43.874	.253		173.281	.000
	Z Certification	.757	.031	.738	24.425	.000
2	(Constant)	43.873	.248		176.674	.000
	Z Certification	.409	.082	.398	4.964	.000
	Z Cooperative Members	.445	.098	.366	4.554	.000
3	(Constant)	44.032	.288		152.855	.000
	Z Certification	.416	.083	.406	5.039	.000
	Z Cooperative Members	.421	.100	.346	4.206	.000
	Interaction terms X and Mo	-.003	.003	-.035	1.095	.274

a. Dependent Variable: Market Access

To test whether membership in a cooperative plays a moderating role between certification and market access, this study uses hierarchical regression analysis to construct a model. In the first step, only the certification variable is included in the model, and the results show that certification has a significant positive impact on market access ( $B = 0.757$ ,  $\beta = 0.738$ ,  $p < .001$ ), indicating that certified farmers are generally able to access high-value markets more effectively.

In the second step of the model, the variable of membership in a cooperative was further introduced to examine its independent main effect. The results showed that both variables, certification ( $B = 0.409$ ) and membership in a cooperative ( $B = 0.445$ ), had a significant impact on market access, indicating that both certification and membership in a cooperative significantly improved the market access of smallholder farmers.

However, when the interaction term “certification  $\times$  cooperative membership” was introduced in the third step of the model to test the moderating effect, the results showed that the interaction term was not significant ( $B = -0.003$ ,  $p = .274$ ). This indicates that cooperative membership does not significantly enhance or weaken the effect of certification on market access. In other words, cooperative membership does not constitute a moderating variable for the effect of certification in the context of this study.

The results do not support Hypothesis 3, that is, membership in a cooperative does not significantly moderate the effect of certification on market access. This may mean that although cooperatives support farmers in other ways, their role in promoting the market benefits of certification is still limited or they fail to show a moderating effect due to problems such as governance capacity and market dysfunction.

## Discussion

The empirical results of this study support two key theoretical propositions. First, behavioral sustainable practices (Behavioral SAP) can be translated into economic capital, that is, farmers' continued adoption of ecologically friendly technologies and management practices in agricultural operations not only helps to improve the robustness of agroecosystems, but also provides a basis for opening up access to high-value markets. This finding echoes Grabs et al.'s (2016) hypothesis that “ecological performance drives market performance” and responds to the theoretical trend in sustainability research that emphasizes the economicization of ecological behavior (Jena & Grote, 2022).

Second, certification systems play a key intermediary role in connecting sustainable production with market access. The study found that certification not only provides consumers and buyers with credible sustainability signals, but also provides a standardized market access mechanism for smallholder farmers. This mechanism is consistent with institutional theory's view that “normative paths” promote market integration (North, 1990), and reinforces the current widespread practice of using certification as an “institutional threshold” in global value chains. As international markets continue to increase their demand for ethical sourcing and environmental compliance, the importance of certification systems will further increase (Subervie & Lemeilleur, 2020).

However, despite the significant intermediary effect of certification, its actual effectiveness depends on two key preconditions. First, certification must be based on high-quality and sustainable agricultural practices in order to fulfil its labeling function. Second, the market premium and buyer trust brought about by certification need to be realized through effective organizational support and market channels. In this study, although certification does enhance the indirect effect of sustainable agricultural practices on market access, certification itself is not a panacea (Méndez et al., 2010). Therefore, certification should be regarded more as an “empowerment tool” than an “access threshold”. Its institutional design should focus on capacity building, compliance support and continuous incentives for farmers.

It is worth noting that this study was unable to confirm the significant moderating effect of cooperative membership on the relationship between certification and market access. Although cooperatives showed a certain positive effect in the main effect model, their ability to enhance the market effect of certification is limited. This finding suggests that the organizational performance of cooperatives cannot be measured only by the number of members or registration qualifications, but should also focus on the quality of governance, market integration capabilities and the efficiency of technical support (Lemeilleur, Subervie, & Presoto, 2020). If cooperatives lack transparent governance, effective training systems, and market-oriented capabilities, it will be difficult to realize the transformation of institutional benefits, even if their members participate in certification programs.

In summary, this study empirically confirms the path relationship of “sustainable agricultural

practices → certification → market access,” and further points out that the marginal gains of cooperatives in this process have not been fully released. This suggests that promoting the economic capacity of smallholder farmers not only starts from the technical level of agriculture, but also requires simultaneous strengthening of the coordination of institutional support structures and the integration of market functions. Future policies and development interventions should pay more attention to the collaborative design of multi-dimensional mechanisms, and promote the integration of behavioral transformation (such as the adoption of SAP) and institutional construction (such as certification and cooperative organization) to achieve truly sustainable market participation.

### **Conclusion**

This study systematically investigates the mechanisms through which sustainable agricultural practices (SAP), certification, and membership in cooperatives influence smallholder farmers' market access using an empirical quantitative approach. The study constructs an analytical framework that integrates institutional theory, the resource-based view (RBV), and market access theory to gain an in-depth understanding of how institutional interventions shape smallholder farmers' market opportunities through the behavioral path and organizational support. Through a combination of hierarchical regression analysis and mediating/moderating model testing, this study has made important theoretical and practical discoveries.

First, the results clearly show that sustainable agricultural practices have a significant positive impact on market access. The regression analysis shows that sustainable agricultural practices are not only a key factor in improving the ecological performance of farms, but also one of the strongest predictors of farmers' access to high-value markets (standardized regression coefficient  $\beta = 0.733$ , model explanatory power  $R^2 = 0.536$ ). This result emphasizes the logical path that “sustainable behavior itself is a market resource,” suggesting that policymakers should also pay attention to the positive externalities of improving the economic capacity of farmers when promoting environmentally friendly agriculture.

Second, the study further found that certification partially mediates the relationship between sustainable agricultural practices and market access. Certification mechanisms not only provide an institutional standard framework, but also enhance the recognizability and market credibility of agricultural products as a “market signaling mechanism.” The significance of the mediating effect indicates that certification can effectively transform sustainability practices into a systematic path to market access, and promote farmers' access to more stable trading relationships, higher bargaining power and potential price premiums. However, this mediating path is only partially mediated, which means that even without certification, sustainable agricultural practices themselves can also enhance market participation through quality improvement and reputation accumulation.

Third, although cooperative membership was a positive variable in descriptive statistics and the

main effect model, its moderating effect in the relationship between certification and market access was not significant. The results of the interaction term analysis show that cooperative status did not significantly enhance the impact of certification on market access (interaction term  $p = .274$ ), that is, cooperatives failed to amplify the marginal effect of certification in the institutional role chain. This result may reflect the fact that cooperative organizations have not yet fully played their due role in terms of market functions, certification support, or governance effectiveness. It suggests that future research needs to explore in greater depth the heterogeneous performance of cooperatives in different institutional contexts.

In addition, the analysis of control variables shows that farm size and education level have a limited impact on the core variables, indicating that institutional participation and market performance are more affected by external organizational resources and the policy environment than by individual-level capital accumulation. However, age and geographical location show significant differences in market access. Young farmers are more motivated to adopt sustainable agricultural practices, but are relatively weak in terms of certification participation and market links. Geographical location significantly affects the market opportunities and institutional resources available to farmers, reflecting the uneven development of policy implementation and cooperative organizations in different regions. This finding emphasizes the need for differentiated policy interventions, and a strategy of “tailored measures” and “local conditions” should be implemented in resource allocation and institutional support.

In summary, this study empirically verifies the logical chain of “sustainable agricultural practices → certification → market access” and points out that the organizational effectiveness of cooperatives has not been fully reflected in the certification and market paths. The study not only fills the gap in the systematic exploration of the interaction mechanism of multiple variables in the existing literature, but also provides a clear empirical basis and direction for intervention for policymakers, development organizations and certification bodies in promoting the development of sustainable smallholder farmers.

## References

- Akenroye, T. O., Kumar, M., Dora, M., & Ihua, U. B. (2022). Evaluating the barriers to adopting sustainable agriculture practices in smallholder coffee farming: Implications for global value chains. *In Africa and Sustainable Global Value Chains*. Springer.  
<https://researchonline.ljmu.ac.uk/id/eprint/15193/3/>
- Akenroye, T. O., Kumar, S., Dora, M., & Ihua, B. (2022). Cooperative structures and agri-value chain sustainability. *Journal of Agribusiness Management*, 45(3), 122–138.
- Arifin, B., Reed, M., Rosanti, N., & Ismono, H. (2022). Partnership for sustainable coffee certification: Linking up smallholder farmers to global coffee market. *Sustainability Science and Resources*, 1(1), 1–15. PDF Access

- Bacon, C. M., Méndez, V. E., Gómez, M. E. F., Stuart, D., & Flores, S. R. D. (2008). Are sustainable coffee certifications enough to secure farmer livelihoods? The Millennium Development Goals and Nicaragua's Fair-Trade cooperatives. *Globalizations*, 5(2), 259–274.  
<https://doi.org/10.1080/14747730802057688>
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
- Beuchelt, T. D., & Zeller, M. (2013). The role of cooperative business models for the success of smallholder coffee certification in Nicaragua: A comparison of conventional, organic and Organic-Fairtrade certified cooperatives. *Renewable Agriculture and Food Systems*, 28(3), 195–211. <https://doi.org/10.1017/S174217051200021X>
- Borrella, I., Mataix, C., & Carrasco-Gallego, R. (2015). Smallholder farmers in the speciality coffee industry: Opportunities, constraints and the businesses that are making it possible. *IDS Bulletin*, 46(3), 29–44. <https://doi.org/10.1111/1759-5436.12142>
- Byrareddy, V. M., Deb, U. K., Wani, S. P., & Whitbread, A. (2019). Enhancing market participation of smallholder coffee producers through improved institutional arrangements in Asia. *Agricultural Systems*, 173, 319–329. <https://doi.org/10.1016/j.agsy.2019.03.010>
- Chiputwa, B., Spielman, D. J., & Qaim, M. (2015). Food standards, certification, and poverty among coffee farmers in Uganda. *World Development*, 66, 400–412.  
<https://doi.org/10.1016/j.worlddev.2014.09.006>
- Dietz, T., Estrella Chong, A., & Grabs, J. (2020). Environmental certification of coffee farms: Beneficial for biodiversity? *Ecological Economics*, 169, 106546.  
<https://doi.org/10.1016/j.ecolecon.2019.106546>
- Gashema, B. (2021). The impact of cooperative membership on agricultural performance: Evidence from Rwanda. *Agricultural Systems*, 188, 103027. <https://doi.org/10.1016/j.agsy.2020.103027>
- Gashema, B. (2021). The role of farmer cooperatives in sustainable market access: Evidence from coffee sectors in East Africa. *Sustainability*, 13(4), 1944. <https://doi.org/10.3390/su13041944>
- Grabs, J., & Kilian, B. (2016). Towards a more sustainable coffee sector: Supporting farmers through certification and beyond. In J. Grabs et al. (Eds.), *Sustainability in Global Coffee Production* (pp. 89–110). Springer.
- Grabs, J., Kilian, B., & Hernández, R. (2016). Understanding coffee certification adoption: A value chain perspective. *Sustainable Production and Consumption*, 7, 33–45.  
<https://doi.org/10.1016/j.spc.2016.02.002>
- Hajjar, R., Newton, P., Adshead, D., & Bogaerts, M. (2019). Scaling up sustainability standards: Strategy and paths forward. *Environmental Research Letters*, 14(12), 125006.  
<https://doi.org/10.1088/1748-9326/ab5f28>

- Hernandez-Aguilera, J. N., Gómez, M. I., & Jones, A. D. (2018). Sustainability in coffee agroecosystems: A livelihoods perspective. *Agricultural Economics*, 49(5), 613–624. <https://doi.org/10.1111/agec.12447>
- International Coffee Organization (ICO). (2023). *Coffee Market Report*. Retrieved from <https://www.ico.org>
- Jena, P. R., & Grote, U. (2022). Fairtrade certification and livelihood impacts on small-scale coffee producers in Ethiopia. *Agricultural Economics*, 53(3), 412–427. <https://doi.org/10.1111/agec.12701>
- Jena, P. R., & Grote, U. (2022). Impact of coffee certification on smallholder livelihood and environmental sustainability: Evidence from Ethiopia. *Agricultural Economics*, 53(2), 232–244. <https://doi.org/10.1111/agec.12661>
- Jena, P. R., & Grote, U. (2022). Sustainability certification and livelihood outcomes in coffee farming: Evidence from Ethiopia. *Food Policy*, 107, 102202. <https://doi.org/10.1016/j.foodpol.2022.102202>
- Jena, P. R., & Grote, U. (2022). The impact of coffee certification on small-scale producers' livelihoods: A case study from the Jimma Zone, Ethiopia. *Agricultural Economics*, 43(4), 429–440. <https://doi.org/10.1111/j.1574-0862.2012.00594.x>
- Lee, S., Chang, S. J., & Sun, M. (2019). Market access constraints and smallholder farmers: The role of financial risk in agribusiness. *Journal of Development Studies*, 55(11), 2341–2359.
- Lemeilleur, S., Subervie, J., & Presoto, A. (2020). Coffee farmers' motivations to comply with sustainability standards: A field experiment in Brazil. *Journal of Agribusiness in Developing and Emerging Economies*, 10(3), 353–372. <https://doi.org/10.1108/JADEE-04-2019-0051>
- Lemeilleur, S., Subervie, J., & Presoto, A. (2020). Fair trade and cooperative governance: Evidence from Côte d'Ivoire. *World Development*, 130, 104917. <https://doi.org/10.1016/j.worlddev.2020.104917>
- Maguire-Rajpaul, V., & Rajpaul, A. (2020). The economic and environmental benefits of organic coffee farming: Evidence from Latin America. *Journal of Sustainable Agriculture*, 15(2), 113–126.
- Méndez, V. E., Bacon, C. M., Olson, M., Petchers, S., Herrador, D., Carranza, C., ... Mendoza, A. (2010). Effects of Fair Trade and organic certifications on small-scale coffee farmer households in Central America and Mexico. *Renewable Agriculture and Food Systems*, 25(3), 236–251. <https://doi.org/10.1017/S1742170510000268>
- Nguyen, L., & Drakou, E. G. (2021). Measuring the adoption of sustainable agriculture practices among smallholders: Evidence from Southeast Asia. *Sustainability*, 13(12), 6845. <https://doi.org/10.3390/su13126845>
- Njeru, J., Garnett, T., & Girkin, C. (2024). Ethical consumerism and sustainable agriculture in Africa: The potential of coffee certification. *Journal of Agricultural Sustainability*, 18(1), 44–61.

- Ortiz-Miranda, D. (2015). Governance in agricultural cooperatives: A new institutional economics approach. *Journal of Co-operative Studies*, 48(2), 5–13.
- Schader, C., Ssebunya, B. R., Baumgart, L., & Landert, J. (2019). Sustainability performance of certified and non-certified smallholder coffee farms in Uganda. *Ecological Economics*, 165, 106384. <https://doi.org/10.1016/j.ecolecon.2019.106384>
- Schader, C., Ssebunya, B., Baumgart, L., & Landert, J. (2019). Does fair trade improve farmer livelihoods and empower women? *Sustainability*, 11(6), 1673. <https://doi.org/10.3390/su11061673>
- Schoonhoven-Speijer, M., & Ruben, R. (2015). Value chain development and the poor: Promises and pitfalls. *The European Journal of Development Research*, 27(4), 546–561. <https://doi.org/10.1057/ejdr.2014.37>
- Scott, W. R. (2001). *Institutions and organizations* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Snider, A. G., Sibelet, N., & Faure, G. (2017). Collective action and certification: The role of producer organizations in facilitating sustainable agriculture among smallholders. *Journal of Rural Studies*, 54, 373–382. <https://doi.org/10.1016/j.jrurstud.2017.06.019>
- Snider, A., Kraus, E., Sibelet, N., Bosselmann, A. S., & Faure, G. (2016). Influence of voluntary coffee certifications on cooperatives' advisory services and agricultural practices of smallholder farmers in Costa Rica. *The Journal of Agricultural Education and Extension*, 22(5), 435–453. <https://doi.org/10.1080/1389224X.2016.1227418>
- Subervie, J., & Lemeilleur, S. (2020). Assessing the certification of coffee producers: Does Fair Trade certification improve farmers' livelihoods? *Ecological Economics*, 176, 106708. <https://doi.org/10.1016/j.ecolecon.2020.106708>
- Subervie, J., & Lemeilleur, S. (2020). Coffee farmers' incentives to comply with sustainability standards: A case study in Brazil. *Journal of Agribusiness in Developing and Emerging Economies*, 10(1), 1–18. <https://doi.org/10.1108/JADEE-04-2019-0051>
- Subervie, J., & Lemeilleur, S. (2020). Voluntary sustainability standards: The effects of fair trade on coffee farmers in Costa Rica. *Ecological Economics*, 165, 106389. <https://doi.org/10.1016/j.ecolecon.2019.106389>
- Thailand Coffee Association. (2023). *Coffee Industry in Thailand*. Retrieved from <https://www.thailandcoffee.org>
- Van Rijsbergen, B. J., Elbers, W., Ruben, R., & Njuguna, S. N. (2016). The ambivalent impact of coffee certification on farmers' welfare: A matched panel approach for cooperatives in Central Kenya. *World Development*, 77, 277–292. <https://doi.org/10.1016/j.worlddev.2015.08.021>