

Project Report

Grounds for Collaboration: A Model for Improving Coffee Sustainability Initiatives

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Abstract: Smallholder coffee producers are the foundation of the specialty coffee industry and are currently facing a set of challenges that threaten the sustainability of the industry. Movement towards a more sustainable specialty coffee sector requires strong collaboration between interdisciplinary researchers and industry stakeholders to develop research projects and interventions that address critical social, economic, and environmental threats to the industry. To improve upon past sector initiatives it is essential that cross-sector collaboration better incorporate and center coffee farmers' voices, which have often been absent from top-down interventions. This article describes one such collaboration, which investigated agronomic and market system needs of the Guatemalan smallholder coffee sector. We conducted participatory interviews with 33 coffee producers and 22 non-producer key informants, and used mixed-methods analysis of the interview data to better understand the key challenges facing smallholder coffee producers in Guatemala. The following factors emerged: pests and diseases, climate change, price, labor, nutrient management, market access, yield, nurseries and transplants, and technical assistance. Cross-sector, interdisciplinary collaborations that directly address these areas would directly improve the long-term sustainability of the coffee industry by reducing pressures currently limiting specialty coffee production. This research framework can also serve as a model for others interested in conducting interdisciplinary, cross-sector research.

Keywords: specialty coffee; interdisciplinary research; participatory; cross-sector



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1. Introduction

Partnerships among actors in the coffee industry can catalyze change and create shared investment in research and industry initiatives. The research presented in this paper is an interdisciplinary collaboration between academic researchers and private sector stakeholders that examines the sustainability needs of the coffee industry from the perspective of coffee producers and those working to support coffee production and marketing in Guatemala. Our research needs-assessment findings document critical agronomic and market system challenges facing Guatemalan coffee production using qualitative data collection methods and mixed-methods analysis. We hope that the needs assessment findings can be used for future research and development interventions in Guatemala. Additionally, the methodology used is one model for interdisciplinary and cross-sector efforts seeking to address the longevity of the coffee industry in Guatemala as well as in other coffee producing and consuming countries. The strategies used in the needs assessment ensure coffee producers are consulted as stakeholders, revising the common top-down approach to sustainability interventions.

1.1. Vulnerabilities of Specialty Coffee Production

Coffee producers face a host of social, economic, and environmental challenges that threaten their livelihoods and the long-term supply of coffee, especially high-quality,

washed arabica (*Coffea arabica*) coffees [1]. Researchers have documented how these challenges have resulted in critical vulnerabilities for producers' livelihoods and a limited ability for the majority of smallholders to adapt to these conditions [2–4]. Washed arabica producers struggle to differentiate their product for consistent price premiums, making them vulnerable to commodity price shocks and volatility [5]. Global price fluctuations are felt most directly by smallholder producers of higher quality arabica, whose socioeconomic well-being, including access to education, food security, and other basic needs, is often negatively impacted by low, volatile coffee prices [1]. The threat of climate change to the viability of current and future coffee production compounds the risks to smallholder livelihoods [6]. The global supply of coffee, especially high-quality arabica coffee, is projected to decrease in volume by 50% by 2050 as cultivation becomes less viable in parts of Brazil, India, and Central America [7].

1.2. Industry Efforts to Address Specialty Coffee Production Vulnerabilities

1.2.1. Sustainability Standards

The modern specialty coffee industry has been a leader in developing initiatives and standards to respond to social, economic, and environmental challenges facing producers [1]. Coffee buyers, roasters, and retailers contributed to the early and widespread adoption of foundational sustainability certifications like Fairtrade for fair trade and Organic coffee [8]. Market demand for certifications that addressed social, economic, and environmental challenges in coffee producing communities led to the development of a variety of voluntary sustainability standards (VSS) by the private sector [9]. In response to consumer demand, the VSS trend expanded from third-party certifiers to private coffee corporations, such as Starbucks and Nespresso, that developed their own standards (CAFE and 4AAA respectively) [9]. Many of these sustainability standards have been top-down, designed with the economic and marketing goals of the certifier rather than the coffee producer in mind [10,11].

1.2.2. Third Wave Coffee Movement

Standards are only one of the structural changes within the coffee industry aimed at addressing sustainability goals. The Third Wave coffee movement, which began in the late 20th century, emphasized shortening coffee value chains and connecting coffee producers directly to retailers and consumers [12]. Third Wave coffee has many definitions, but broadly includes using an artisanal approach to delivering higher-quality coffee to consumers through direct trade and product differentiation, and employing specialized roasting and brewing methods [13,14]. Third Wave coffee traders have promoted the idea that direct trade provides higher-quality coffee for consumers, while offering price premiums to producers by eliminating additional actors in the value chain [13]. Other models include relationship coffee, where intermediaries in the value chain, such as green coffee importers, exporters, or buyers, create longer-term buying relationships with producers, incorporating traceability and sustainability alongside the pursuit of high-quality coffee [15]. The impact of direct trade and relationship coffee models are less studied than VSS, but recent studies of impact for producers and consumer preferences are available [16–18].

1.3. Academic Research on Addressing Specialty Coffee Production Vulnerabilities

Academic research has followed the trajectory of coffee sustainability standards and shifting consumer preferences [19,20]. Studies of the increasing number of standards and evolving trade models have revealed some key limitations and unintended consequences. For example, limited demand for certified coffee, such as Fairtrade, Organic, Rainforest Alliance, etc., has resulted in lower returns to producers who are able to sell less than half of their certified coffee for the market price premium [21]. The low return on the volume of sale of certified coffee is compounded by the fact that the increased availability of certified coffee has decreased price premiums [21]. In the context of relationship coffee trade models, benefits have been observed to accrue to a small number of well-connected

and well-resourced individuals, rather than a broad set of producers [22]. The limited impact of decades of business-led solutions to address threats to the sustainable and ethical supply of coffee requires a new model to address the increasing pressures of persistent and emerging challenges.

1.4. Academic and Industry Collaborations on Specialty Coffee Production Vulnerabilities

The academic study of the social, economic, and environmental factors related to the viability of coffee production has often been decoupled from private sector sustainability efforts. One way to improve upon past initiatives and their evaluations is to further integrate research in industry initiatives designed to address challenges to sustainable specialty coffee production. Models of academic and industry collaborations have emerged in the past decade. Coffee's first Checkoff Program, launched by World Coffee Research at Texas A&M University in 2013, is an early example of an initiative supporting collaborative, scientific research with industry trade [23]. This partnership demonstrates the importance of further integrating research and private sector initiatives to address sustainability challenges.

1.5. Research Motivation and Article Overview

In order to improve upon past efforts to address the sustainable production of specialty coffee, researchers and industry actors should develop more robust partnerships. It is critical that new initiatives include those directly involved in production, including producers and other stakeholders in coffee-producing countries. While published research evaluating sustainability challenges is well documented, there is limited published research on an interdisciplinary and cross-sector approach to research and sustainability initiatives, particularly those that elicit farmer perspectives directly. The objectives of the research presented in this paper are twofold: to provide a production-centric assessment of key research and development needs in the coffee industry, and to provide a model for future collaborations between academia and industry seeking to address critical challenges in the coffee industry.

In Section 2 of this paper, we provide information about the context of our research as it relates to coffee production in Guatemala and the specialty coffee sector and describe our methodological framework and approach for data collection and analysis. In Section 3, we present the results of our research, describing the key agronomic and market system challenges facing smallholder coffee producers in Guatemala. We discuss the significance of well documented and emerging challenges in the Guatemalan smallholder coffee production context in Section 4. We also consider the implications of these challenges for the specialty coffee industry and propose recommendations for future research to address these sustainability challenges. We conclude in Section 5 with reflections on the importance of conducting research and development interventions in the specialty coffee sector that are interdisciplinary in nature, include partners from across the industry, and center farmer voices whenever possible.

2. Methods

2.1. Research Context

2.1.1. Guatemalan Coffee Production as Context

Coffee has been cultivated in Guatemala since the mid-1800s and grew to become a major export crop later that century [24]. Until the late twentieth century, much of the coffee grown in Guatemala was produced on relatively large fincas, or plantation-style tracts of land, that relied on forced indigenous labor for on-farm maintenance and harvest [25]. After the end of the International Coffee Agreement (ICA) quota system in 1989 and the subsequent drop in global market prices, many finca landowners began growing other crops on land previously under coffee production, and finca laborers began producing coffee themselves [25].

Today there are around 125,000 coffee producers in Guatemala, and approximately 97% of those producers are smallholder coffee farmers [26,27]. Smallholder coffee producers

in Guatemala are defined by the US Department of Agriculture's Foreign Agricultural Service as having 1.7 to 2 hectares of land [27]. Many Guatemalan smallholder producers aim to produce high-quality, specialty coffee. High altitudes and diverse microclimates in Guatemala position the country to take advantage of the higher-value, specialty coffee markets [28]. However, economic and environmental hardships have created a challenging production situation for many smallholder Guatemalan coffee farmers. The international coffee price collapse that occurred between 1999 and 2003 cut Guatemalan coffee exports almost in half ([25], p. 165). From 2008 to 2013, the coffee leaf rust (CLR) epidemic swept through Central America, causing yield and quality losses on upwards of 70% of coffee farms in Guatemala [29]. Another major dip in coffee prices occurred in 2018, when the global price of coffee dropped below \$1.00/lb and coffee farmers were once again forced to make challenging decisions about the viability of their coffee agribusinesses [30].

2.1.2. Guatemalan Coffee Production as Context

Our research focused on specialty coffee production. However, the majority of the coffee producers and non-producer key informants interviewed for this research work with a combination of specialty and commodity coffee. Although much of the information discussed in this paper focuses on specialty coffee, many of the research findings apply to small-scale commodity coffee production as well.

We will use the following parameters and definitions for specialty coffee. According to the existing Cup of Excellence criteria [31] administered by the Alliance for Coffee Excellence (ACE) and the Specialty Coffee Association (SCA) cupping scoring metrics, specialty coffee must have distinct qualities most often identified by geographic location and must score exceptionally in grading and cupping metrics developed by ACE and SCA. Specialty coffee' can be roughly defined as scoring 80 or above on a 100-point scale that sets benchmarks for "objective quality" markers [12]. Although this definition describes broad parameters for the industry-standard definition of specialty coffee, it is important to note that throughout the coffee industry, coffee buyers define specialty coffee by their own metrics.

Some coffee farmers produce high-quality or specialty coffee as a strategy to increase their income. Premiums are paid for specialty coffee production both through certifications as well as through trade models such as relationship and direct trade coffee. Throughout the results and discussion presented below, we consider the opportunities and limits presented by the specialty coffee market for Guatemalan coffee producers.

2.2. Research Framework

The research framework for this project has three pillars: interdisciplinary design, cross-sector collaboration, and participatory research principles. Interdisciplinary research is one way to address complex research questions, especially at the intersection of biophysical and social science, where questions of agronomic production and human decision-making inform persistent challenges and potential solutions [32]. One researcher for this work has a background in social science research methods and international economic development and the other researcher has extensive training in agronomic sciences. Our respective backgrounds allowed us to develop and evaluate research questions and responses with distinct lenses through the shared analysis and writing process. Drawing on existing interdisciplinary research models, we integrated our respective disciplinary training into a shared set of research priorities, questions, vocabulary, and tools [33,34]. In order to gain a holistic understanding of issues facing the coffee industry, we used qualitative data collection methods and a mixed method analysis process to achieve the research objectives.

Collaboration with stakeholders across the coffee value chain was essential to grounding the research, ensuring it was responsive to industry needs. In order to develop partnerships and incorporate first-hand knowledge of the agronomic needs facing Guatemalan coffee industry stakeholders, we spent six months identifying potential collaborators, meeting with firm representatives and finalizing a partnership structure. Ultimately, we

partnered with two firms: Disagro, an agro-input company headquartered in Guatemala, and Caravela Coffee, a green coffee importer/exporter with operations in Guatemala. Both firms provide technical assistance directly to coffee producers and were interested in collaborating with us.

Research collaboration with the private sector requires additional flexibility compared to interdisciplinary collaboration across university departments or research partnerships between institutions. Cross-sector partners must develop an understanding of the unique constraints and incentives of each sector, and successful partnerships must co-develop timelines and modes of communication that work for all involved. For example, academic research is often framed around the academic calendar year, which may not align with off-season opportunities for farm site visits, etc. Research costs should be discussed early, and can be a shared investment from both parties.

The project team sought to incorporate principles and methods of participatory research. Participatory research methods have multiplied across disciplines over time, but are rooted in participatory action research [35]. Throughout our discussion, participatory research will refer to the broad set of methods and principles that seek to solicit the insight and expertise of all community stakeholders to inform research questions, design, analysis, and application. Our methodology was built on the six research principles of participatory action research and agroecology as outlined by Méndez et al. [36]: shared interest in research, belief in collective power, commitment to participation, humility, trust, and accountability and communication. As such, partner organizations offered input on research objectives and survey tools and provided feedback throughout the data collection process. Farmers were also consulted as participants—not subjects—in the research. They led farm transect walks, developed annual calendars and identified not only their own current practices, but innovations and solutions they saw as opportunities to address the agronomic and market system challenges they experienced first-hand.

2.3. Research Questions

Within the research framework outlined above, our research question was: what are the primary challenges facing the sustainability of smallholder, specialty coffee production in Guatemala, according to farmers and other value chain stakeholders? The goal of the research was to identify the most pressing issues and needs faced by producers and actors across the coffee value chain using open-ended inquiry. The research needs assessment findings would then be disseminated and used to inform further research.

We broke down this larger question into two topics: agronomic and market systems challenges. The key agronomic questions focused on annual management practices, decision-making, the availability of technical assistance, and on-farm innovation and experimentation. To learn about farmers' experience with specialty coffee markets, we asked questions about processing, sales of coffee, and marketing channels. Additional data were collected about farm size, scale of production, and ownership. Semi-structured interview guides and questions developed for this research are available in Appendix A.

2.4. Data Collection and Analysis

Using the research framework outlined above, we collected qualitative interview data through field site visits and key informant interviews. We used a combination of needs assessment methodologies drawn from qualitative interview methods in sociology [37,38], rapid rural appraisal [39], and community-based participatory research [40,41]. We determined semi-structured interviews would be an effective way of capturing information about agronomic and market system challenges [42].

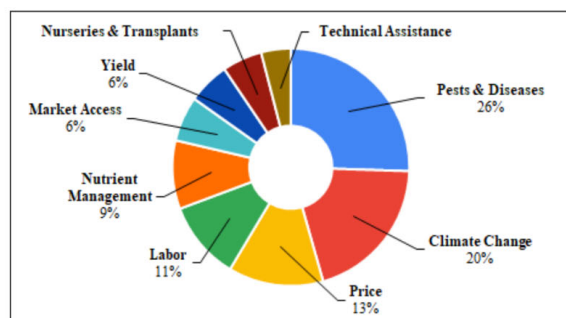
The process of developing a field interview tool for data collection took about six months, from development to field testing. First, interview topics and questions were developed over three months, using the research questions as an organizing principle. We reviewed similar surveys on coffee production to inform the types of questions that could be included [43–46]. Integrating feedback across stakeholders took about a month

and a half. Once complete, the field guide was tested and refined in the field during the first week of interviews. Topics in the final field guide included the history and farm background, annual management practices, decision-making, technical assistance, innovation and experimentation, processing, and markets/marketing.

Interviews were conducted over a three-month period in five departments: Sacatepéquez, Chiquimula, San Marcos, Huehuetenango, and Chimaltenango (Figure 1). Interviewees for the project were identified using purposeful and snowball sampling methods [47]. These qualitative methods sought to identify participants with a sufficient depth of experience with the research questions to maximize the efficiency of interviews during our field work [47]. We worked with partner organizations to identify a purposeful sampling of producers in their networks who had experience with specialty coffee production and selected smallholder producers whenever possible. This sampling method was designed to provide a deep knowledgebase for the interviews and select farmers who could represent the typical case of smallholder specialty coffee producers in Guatemala [47]. Partner organizations used these criteria to identify participating producers and coordinated travel to each farm. We primarily identified non-producer key informants through a snowball method, beginning with researcher contacts and interviewee recommendations; non-producer key informants also included staff from Disagro and Caravela Coffee. Interviewee selection across both key informant groups sought to explore typical cases of smallholder specialty coffee production in Guatemala, rather than providing a representative or generalizable sample [47]. The research collaboration prioritized cross-sector collaboration and participatory research design within a qualitative research framework instead of a quantitative sampling method. Semi-structured interviews were primarily conducted in Spanish, with some interviews conducted in English. The field notes from each interview were summarized, translated into English, and prepared for data analysis at the conclusion of field work.

Key Challenges Facing Guatemalan Coffee Production

Top 9 Key Challenges across departments



(a)

Map of Guatemala



(b)

Key Informant Types

(c)



Producer Key Informants:

Interview respondents directly involved in producing coffee, including farm owners, farm managers, and coffee cooperative members



Non-Producer Key Informants:

Interview respondents who play essential roles in the coffee industry, but are not coffee producers; these include coffee buyers, NGOs, agro-input dealers, technical assistance providers, national coffee associations, and national federations

Key Differences

(d)



Nurseries and Transplants:

Producers most commonly discussed plant quality from commercial nurseries
Non-producers most commonly discussed on-farm seedling production challenges
Non-producers in San Marcos discussed nurseries and transplants significantly more than any other respondents



Technical Assistance:

Technical assistance was mentioned as a top challenge by non-producers, but not producer key informants

Figure 1. Key challenges facing Guatemalan coffee production. (a) Frequency counts of challenges determined from coding of the interview data revealed that pests and diseases, climate change, price,

and labor were the top four challenges mentioned by interviewee respondents. (b) Map of Guatemala with Chimaltenango, Chiquimula, Huehuetenango, San Marcos, and Sacatepéquez, where research was conducted, indicated by dark gray shading. (c) Key differences in responses relating to nurseries and transplants and technical assistance were identified through mixed-methods analysis and highlight distinct perspectives across key informant types. (d) Definitions used to differentiate ‘producer key informants’ and ‘non-producer key informants’ in this study.

Data analysis took three months, culminating in a final report for stakeholders. A mixed-methods analysis framework was used, where qualitative data were coded and subsequently quantified using frequency counts to identify major themes within the dataset and focus qualitative analysis on those key themes [48]. Survey data were compiled and imported into MaxQDA, the selected qualitative data analysis software (QDAS), for the analysis. The research team collaboratively developed a codebook, met regularly to address questions about code definitions and their application, and revised the codebook as needed [34]. We again applied an interdisciplinary lens to the coding process, using descriptive codes [49] to capture agronomic and market data in order to demarcate the information needed for interdisciplinary analysis. We equally divided coding duties and performed two intercoder agreements during the coding process to validate the codebook application between coders. Once the full dataset was coded, frequency counts were generated using MaxQDA to assess most frequently cited challenges. Analysis was informed by the interpretivist tradition [50], allowing researchers to bring the background of their own discipline to bear on the qualitative interpretation of data.

3. Results

3.1. Summary

The following findings are drawn from the analysis of semi-structured interviews with 33 coffee farmers, five cooperatives, one focus group meeting with women cooperative members, and 22 non-producer key informants (Table 1). The non-producer key informants interviewed for the needs assessment included buyers, input providers and a technical assistance provider; some individuals were interviewed multiple times in different departments during site visits. The distribution of interviewees across the five departments is summarized in Table 1 with totals for each department and informant type bolded. As summarized in Section 2.3, interviewee selection for producer key informants used purposeful sampling in collaboration with private sector collaborators and snowball sampling for non-producer key informants. Given the preeminence of Huehuetenango as a location for high-quality, specialty coffee production, both collaborators work with producers and industry stakeholders in that department. This resulted in a higher total number of interviewees in that department compared to other departments. In line with the conceptual framework for this research, particularly our participatory and cross-sector research framework, all interviews were included in the data analysis. Details regarding the standardization of frequency counts across and within departments are provided below.

Throughout the presentation of results, the frequency with which a topic was mentioned in the interview data is expressed as a percentage in parentheses after the topic. Percentages are used to describe the number of times a particular challenge was discussed relative to other issues mentioned by interviewees. The summary data statistics convey the frequency of mentions by producer and non-producer interviewees across all nine major challenges. Percentages were calculated at the summary level based on the total number of mentions in the coded dataset. In contrast, percentages within the Sections 3.2 and 3.3 refer to the total number of mentions across the four or five major challenges within their respective category, either Agronomic or Market System. In the Sections 3.2 and 3.3, data are further disaggregated by interviewee type to highlight any differences between producers and non-producers.

Table 1. Number of interviews by department and interviewee type.

		Department					
Type of Interviewee		Chimaltenango	Chiquimula	Huehuetenango	Sacatepéquez	San Marcos	Total
PRODUCER	Farmer	2	7	14	6	4	33
	Cooperative	0	1	2	1	1	5
	Focus Group	0	1	0	0	0	1
NON-	Buyer	0	4	6	1	2	13
	Input Provider	0	0	4	3	0	7
	Technical Assistance Provider	0	0	1	0	0	1
	Other	0	0	1	0	0	1
TOTAL		2	13	28	11	7	61

The assessment identified nine major agronomic and market system challenges, in the following order: pests/diseases (25.5%), climate change (20.1%), price (13.0%), labor (10.7%), nutrient management (9.3%), market access (6.1%), yield (5.7%), nurseries and transplants (5.4%), and technical assistance (4.0%). Definitions for each term are provided below. It should be noted that interviews did not ask farmers which challenge they would rank as the most severe, but instead the findings reflect the topics mentioned most frequently across all interviews. Figure 1 provides a comparison of the top challenges based on the frequency of mentions.

3.2. Agronomic Challenges

‘Agronomic challenges’ are defined in this needs assessment as the on-farm production factors limiting coffee producers’ ability to maximize quality and yields. Across all five departments surveyed, four factors were consistently cited as major agronomic challenges by producer and non-producer key informants. Those challenges were pests and diseases (39.4%), climate change (34.5%), nutrient management (16.6%), and yield (9.5%). Each challenge will be described further in the subsequent sections, and an expanded analysis of the results can be found in the Section 4 of the paper.

Unless otherwise indicated, the numbers and percentages reported describe data from farmer and cooperative interviews. Because coffee production differs across departments in Guatemala, farmers experience production challenges differently depending on where their farms are located. As such, the following sections describe the differences in the frequency with which each agronomic factor was discussed at the departmental level.

3.2.1. Pests and Diseases

‘Pests and diseases’ was identified in the interview data whenever an interviewee referenced a pest and/or disease as an agronomic challenge for coffee farmers. The descriptions included the general terms ‘pest’, ‘insect’, and ‘disease’, as well as the mention of specific pests and diseases. The diseases mentioned by interviewees included anthracnose (*Colletotrichum kahawae*), coffee leaf rust (*Hemileia vastatrix*), ojo de gallo (*Mycena citricolor*), and phoma (*Phoma costaricensis*). Interviewees discussed the following insects: aphids (*Toxoptera aurantii*), coffee berry borer (*Hypothenemus hampei*), leaf miner (*Perileucoptera coffeella*), and mites (*Oligonychus coffeae*). Interviewees also described nematodes as significant pests in some cases. CLR was most commonly cited followed by coffee berry borer.

Across all departments surveyed, the agronomic challenge most commonly reported by producers was pests and diseases (39.4%). In Chiquimula (45.1%), Sacatepéquez (71.8%), and San Marcos (39.3%) this was also the most commonly mentioned challenge. In Huehuetenango (30.8%) it was the second most commonly discussed challenge; in Chimaltenango (20.7%) it tied with yield as the second most commonly mentioned challenge among pro-

ducer respondents. Among non-producer respondents, pests and diseases was also the first or second most commonly mentioned challenge on country-wide and departmental levels.

Within pests and diseases in almost all cases, CLR was the most commonly cited disease issue, and the interview data provided nuanced insights into producer perspectives on managing it. Despite the history of devastation from the recent CLR epidemic, farmers seemed confident in their ability to manage rust on their farms. Farmers shared they have “learned to get along with” CLR on their farms now. However, farmers expressed concern that a new strain of CLR or a similarly destructive pest or pathogen would emerge and cause comparable destruction to that incurred in the 2011–2013 epidemic.

3.2.2. Climate Change

The code for ‘climate change’ refers to any mention of climate change or an effect of climate change as an agronomic challenge for the coffee industry. Interview respondents either used the term ‘climate change’ explicitly or described generational changes in weather patterns from earlier in their lives or their family members’ lives when referring to climatic changes over time.

Across the five departments surveyed, climate change was the second most commonly discussed agronomic challenge (34.5%). In Chimaltenango (44.8%) and Huehuetenango (41.5%), it was the most commonly mentioned agronomic challenge. In Chiquimula it was the second most commonly discussed challenge (33.6%). In Sacatepéquez, climate change was the third most commonly discussed agronomic challenge (12.8%); in San Marcos (17.9%), it tied with yields as the second most commonly mentioned agronomic challenge. It is unclear why producers in Sacatepéquez and San Marcos cited climate change at a lower rate than producers in other departments.

Climate change was frequently mentioned in conjunction with other challenges, with key informants sharing how particular climate change effects compounded other challenges they were facing. Across departments surveyed, the most commonly mentioned climate change factors causing production challenges for farmers were related to rainfall (69.0%). Farmers described both reduced and unpredictable rainfall patterns as major issues leading to fertilizer volatilization and runoff, reductions in fruit set, and decreased harvest synchronicity. Several cooperative members indicated that scarce rainfall had negatively impacted the quality of their coffee, elaborating that the reduced rainfall has led to poor fruit development on their farms. Reduced coffee quality ultimately lowers price premiums coffee producers receive for their coffee, reducing the viability of coffee production as an income stream for smallholder farmers. Producers also referenced changes in temperature due to climate change, noting both changes in rainfall and temperature were contributing to increased pest and disease incidence and decreased yields. The interconnected nature of climate change and other challenges will be discussed in more detail in the Section 4.1 of this paper.

3.2.3. Nutrient Management

In the context of this research, the term ‘nutrient management’ is used to describe application or manipulation of nutrients in a coffee production system. Nutrient sources observed or reported on coffee farms in this study included synthetic fertilizers, organic fertilizers, and applications of composted or raw plant or animal wastes such as coffee cherry pulp, livestock manure, and vermicompost. The code ‘nutrient management’ described challenges such as managing fertilization to improve coffee quality, limitations to nutrient management due to rainfall patterns and input costs and other issues related to plant nutrient management. It was the third most common agronomic challenge across the five departments surveyed (16.6%) and in Chimaltenango (13.8%), Chiquimula (15.9%), and Huehuetenango (16.4%). In Sacatepéquez (15.4%) and San Marcos (25%), it was the second most commonly discussed challenge. Non-producers mentioned nutrient management at a lower frequency across all five departments surveyed (9.0%) and in Huehuetenango

(3.7%). It was the only agronomic challenge discussed by non-producer respondents in San Marcos and was not discussed at all in Sacatepéquez or Chimaltenango.

3.2.4. Yield

The term ‘yield’ was identified in the data when interviewees referenced challenges with or changes in yield. Producers referenced yield at various points in the production process including on-farm production, harvest, and processing. Yield was the fourth most commonly discussed agronomic challenge across the departments surveyed (9.51%), although it was not mentioned as a challenge by farmers and cooperatives in Sacatepéquez. In Chimaltenango (20.69%), yield was the second most commonly discussed challenge. In San Marcos (17.85%), yield and climate change were discussed equally. In Chiquimula (5.31%) and Huehuetenango (11.32%) it was the fourth most commonly discussed challenge. Yield was also the third or fourth most commonly mentioned agronomic challenge among non-producer key informants in San Marcos, Sacatepéquez, Huehuetenango, and Chiquimula; it was not mentioned at all in Chimaltenango. Frequently, challenges relating to yield were connected to climate change, as with one producer who mentioned that reduced rainfall the previous year had led to a 20% reduction in coffee yields on his farm.

3.3. Market System Challenges

For this research needs assessment, ‘market system challenges’ were defined as any aspect of agribusiness management for coffee producers impacting farm operation and sale of coffee. The top four market system challenges reported by farmers and cooperatives were price (36.6%), labor (30.2%), nurseries and transplants (18.3%), and market access (14.9%). Similarly, the top market system challenges reported by non-producers were price (31.1%), labor (26.2%), market access (22.9%), and technical assistance (19.7%). Each challenge will be discussed in greater detail below. The rankings and review of findings will be reported by interviewee type below due to the slight variation in topics ranked between the two types of interviewees. Given the geographic spread of producers and because levels of infrastructure and market access vary by department, market system challenges have also been reported at the departmental level. Note that no non-producer key informants were interviewed in Chimaltenango so the analysis of responses for non-producer interview data only covers four departments: Chiquimula, Huehuetenango, Sacatepéquez, and San Marcos. Chimaltenango had the smallest number of interviews across departments with only two producer key informant interviews, which may explain why some challenges are not mentioned as frequently or at all in the department.

3.3.1. Price

‘Price’ as a market system challenge included interview data referencing the challenge of prevailing price or nature of prices for coffee. Prices may vary in unit or end buyer, but are all captured under this definition. References to price may also include price relative to other producers or producing countries. Among coffee producers, price was the most frequently referenced challenge in Chimaltenango (40.0%), Chiquimula (48.8%), and San Marcos (35.7%). In Huehuetenango (34.7%) price was among the top two major market system challenges cited. In Sacatepéquez (12.5%), it was cited far less frequently. Non-producer key informants generally ranked price lower than farmers, but it was still consistently high across the four departments where market system challenges were reported by non-producer key informants. In Chiquimula (27.3%), price was ranked second by non-producer key informants but was mentioned with the same frequency as technical assistance. In Huehuetenango (36.0%), Sacatepéquez (25.0%), and San Marcos (33.3%), it was also ranked second by non-producer key informants.

Given the global coffee price crisis that began in the fall of 2018 and its potentially significant impact on small and medium producers in Guatemala, price was one area of focus within the market systems challenges questions in the survey tool. Farmers’ responses provided greater clarity on how they adapt to low prices, which have short-, medium-,

and long-term ramifications for coffee supply. Producers cited cost-cutting measures they are making to compensate for lower prices. Often, this involved reducing labor and input costs, which can negatively impact quality and yield. Additionally, producers described a lack of access to finance as a limiting factor in their ability to cope with the price crisis.

Price was mentioned as a challenge at a much lower rate in Sacatepéquez than in any other department. The city of Antigua, which has a long history of coffee production, strong name recognition in consuming countries, and a market with consistent demand for its coffee, is located in Sacatepéquez. The name recognition and market relevance of Antigua is so profound that several interviewees discussed the practice of coffee produced elsewhere in Guatemala being sold as “Antigua” coffee. As a result, it is likely that coffee producers in this region enjoyed a buffer to the effects of the price crisis relative to their counterparts in other departments.

3.3.2. Labor

‘Labor’ includes mentions of the labor requirements for coffee production as a major challenge for the industry. Additional references to labor refer to times when the interviewee identified wages or living conditions for laborers as a problem in the coffee industry. Labor also includes references to migration specifically. In Huehuetenango (40.2%) and Sacatepéquez (43.8%), labor was the most frequently cited challenge, and in Chimaltenango (19.5%) it was second. It was cited much less frequently in San Marcos (7.1%). In contrast, non-producer key informants mentioned labor with a higher degree of variation across departments. In Huehuetenango (48.0%), it was again the market system challenge most frequently identified by non-producer key informants. In Sacatepéquez (18.8%), it ranked similarly to technical assistance. In Chiquimula, it was the lowest ranked (9.1%), and it was not mentioned as a challenge at all in San Marcos by non-producer key informants. It is not known why labor was mentioned at a much lower rate in San Marcos than in other departments. Across both interviewee types, labor ranked significantly higher in Huehuetenango than it did in any other department. Interviewees discussed labor migration as a major production challenge in the area in part because many farms are unable to pay laborers at the same rates offered in other coffee producing regions or countries.

Labor shortages were a common challenge mentioned by farmers, and reducing labor costs was a primary way farmers adapted to lower coffee prices. Labor availability and labor costs were described as limitations to entering the specialty coffee market as many agronomic management tasks associated with high-quality coffee production require substantial labor. One non-producer key informant shared an example of how labor migration patterns are directly impacting the coffee industry as he has observed increasing herbicide use due to the decreased amount of labor available for weeding. In addition, producers faced difficult tradeoffs in attracting and retaining qualified laborers, given the investment of training and maintaining consistent laborers.

3.3.3. Nurseries and Transplants

The challenge of ‘nurseries and transplants’ in the interview data described the lack of reliable plant nurseries and transplant material as a challenge to the coffee industry. Although nursery production of transplants is related to agricultural production, the interview data primarily characterized the transplant and nursery operations part of operational planning. Nurseries and transplants was one of the top four market system challenges cited by coffee producers and cooperatives, but not by non-producer key informants. It is unclear why that was the case. In San Marcos (32.1%) nursery and transplant challenges were the highest cited challenge among producer key informants. In Sacatepéquez (18.8%), Chimaltenango (8.0%), Huehuetenango (21.7%), and Chiquimula (7.3%), the challenge was mentioned less frequently.

Limited access to healthy seedlings from nurseries for farm renovation and poor transplant management were major issues mentioned in relation to nurseries and transplants. Material from commercial and on-farm nurseries alike often resulted in weak transplants.

The poor timing and management of transplanting also led to negative on-farm outcomes. Several producers also mentioned nurseries had sold them plants they claimed were one variety but later turned out to be another. Many also reported they preferred to produce their own transplants rather than purchase them from a nursery because of the transplant quality issues. While farmers often identified the lack of clear genetic selection and presence of diseases as challenges when purchasing from other nurseries, technical assistance providers often identified on-farm nursery challenges. The perspectives of producers and non-producer stakeholders suggest there is an opportunity to support the development of quality nurseries in Guatemala.

3.3.4. Market Access

In the interview data, ‘market access’ refers to challenges such as producers’ access to exporters or buyers, or vice versa, as well as broader market dynamics. The definition includes physical access and proximity to markets and the social networks required to sell to buyers. Unlike the other top market system challenges, market access was not mentioned in all five departments where farmers and cooperatives were interviewed. Market access was the second most commonly cited market system challenge by producers in Chiquimula (24.3%). In Chimaltenango (24.0%), Sacatepéquez (25.0%), and San Marcos (25.0%) it was the third most commonly cited. In Huehuetenango (3.3%), it was least commonly cited. Within the four departments where market system challenges were reported by non-producer key informants, Sacatepéquez (37.5%) and Chiquimula (36.4%) cited market access as a challenge most frequently, while in Huehuetenango (12.0%) and San Marcos (11.1%) it ranked lower. Market access was cited significantly less across both respondent groups in Huehuetenango than it was in any other department. Coffee produced in Huehuetenango has a global reputation for quality and is highly sought after by many coffee buyers. This consistent market likely makes market access a lower priority challenge in Huehuetenango than it is in many other regions of Guatemalan coffee production.

3.3.5. Technical Assistance

‘Technical assistance’ in the dataset described or identified the limitations of technical assistance providers and/or providing bodies as a challenge. Technical assistance was only ranked as one of the top four challenges by non-producer key informants, not coffee producers. It is not known why this was the case. Technical assistance had some variance across departments. It was the primary challenge in San Marcos (55.6%), while in Huehuetenango (4.0%) it was the least frequently cited of the top four market system challenges. In Chiquimula (27.3%), technical assistance was tied with three codes as the second most referenced challenge with value chain transparency and price. In Sacatepéquez (18.8%) it was equally ranked with labor.

4. Discussion

4.1. Interconnected Challenges

One major finding across interview data was a description of interconnected challenges by interviewees. In Figure 2, the three primary challenges of climate change, low coffee prices, and labor shortages create secondary challenges such as poor management practices, low farm profitability, and limitations to growers’ capacity to adapt to constrained growing conditions. The primary and secondary factors interact to reinforce a cycle of low coffee quality and yields. Combined, they create the perfect storm for smallholder coffee producers, and for specialty coffee buyers and consumers. The compounding issues result in less viable and increasingly unstable incomes for smallholder coffee farmers. This phenomenon can contribute to possible trends in farm abandonment and lower coffee production, ultimately leading to reduced availability of quality coffee. The complexity and interrelated nature of low coffee prices, climate change, and labor shortages require that the solutions developed to address these challenges consider the larger context of and relationships within the coffee agroecosystem.

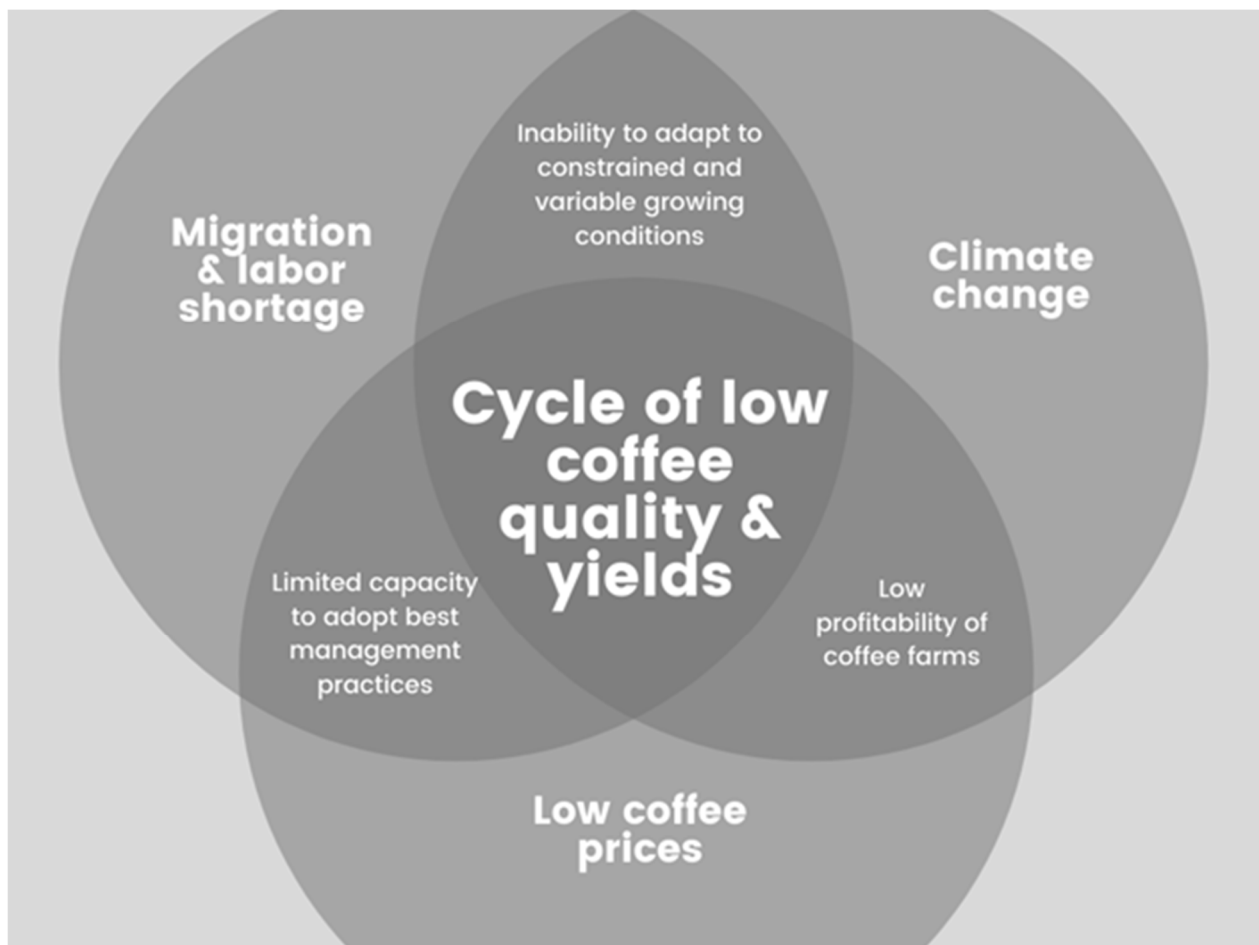


Figure 2. Impact of compounding and interrelated challenges facing the specialty coffee sector.

4.2. Implications for Specialty Coffee

The interrelated challenges of low prices, climate change, and labor shortages have specific implications for specialty coffee production in Guatemala. Specialty coffee was mentioned frequently as an alternative and means to achieving higher prices by producer and non-producer key informants. The low coffee prices and agronomic challenges facing producers limit capacity to invest in and implement practices that allow them to reliably produce specialty coffee in Guatemala. As such, it is important for technical assistance providers, buyers, and other value chain actors to understand the opportunity and limitations specialty coffee price premiums have for different producer situations.

4.2.1. Agronomic Constraints on Improving Coffee Quality

When describing agronomic and market system challenges, key informants often cited the desire to improve coffee quality as a motivating factor for farm management decisions. Producer and non-producer key informants discussed the importance of monitoring and, when possible, manipulating the following agronomic factors when focusing on the production of high-quality coffee: elevation, climate conditions, variety selection, nutrient management, pest and disease treatment, shade management, maturity at harvest, postharvest processing and drying, and green coffee storage. Some producers shared that while they were aware that specific production and post-harvest factors were important, they lacked knowledge about how to manage them to maximize the quality of their coffee.

Although research institutions conduct research relating to best management practices for coffee production, the results of this research often do not reach farmers at all or in a

way that is convincing or actionable for them. Increased access to agronomic production information coupled with training emphasizing experimentation and adaptation can assist farmers in applying best practices on their own farms. Based on interview responses, some of the agricultural practices technical assistance providers should focus on sharing include intercropping, mulch management, pruning, shade management, variety selection, and nutrient management.

4.2.2. Improved Technical Assistance for Specialty Coffee

Technical assistance providers are often trusted sources of information about a wide range of agronomic and market system topics. In this study, technical assistance coverage was highly dependent on the department and farm location of producers, resulting in scenarios of limited to no coverage and some duplicative coverage. In the interview data, Anacafé was the only technical assistance provider cited by interviewees in all five departments. When discussing Anacafé, key informants named several services provided, including on-farm visits, cooperative development programs, input subsidy programs, quality assessment services, and gatekeeping role as the export licensing entity. Although their reach was significant, key informants discussed the limits of their programming due to funding and the number and geographic spread of producers across Guatemala. Across non-producer key informant interviews, there was consensus that there are an insufficient number of technical assistance providers, regardless of their source, organization or funding. Confronting the persistent and emerging challenges to Guatemalan coffee production requires an increased investment in technical assistance provision from both the private and public sectors through direct and intentional coordination among public and private providers as well as expansion through information and communications technology (ICT) in order to reach more coffee producers in an effective and comprehensive manner.

4.2.3. Market Access for Specialty Coffee

Common market system challenges discussed in relation to coffee quality included market access and price. Farmers demonstrated consistent understanding of quality assessment methodologies and the impact quality analysis has on price premiums paid for specialty coffee. Quality and access to markets are deeply interconnected and were often referenced together. Farmers discussed the tradeoff between investing in higher quality at a cost to their operations without the certainty of a higher market price or a guaranteed buyer of higher-quality coffee.

In order to increase the availability and volume of quality, specialty coffee, producers require more information about key market requirements that often act as a barrier to entry for producers interested in the price premiums available for quality coffee. During interviews with cooperatives in San Marcos and Huehuetenango, producers noted that different markets require different specifications and having a clear understanding of relative humidity and bean sizes was important to meeting different buyer needs. Buyers, either through intermediaries, technical assistance providers or direct relationships with their coffee producers, should provide farmers with additional information about their buying practices and requirements to increase value chain transparency. Farmers need to better understand the requirements and norms of sale of buyers, without fearing repercussions for reporting issues encountered during production, harvest, and processing. Providing constructive feedback for producers around issues of quality is a critical step in improving coffee quality for both producers and buyers.

4.3. Applications for Further Research

Successful interdisciplinary and cross-sector collaborations require four critical components: academic collaboration, outreach across sectors, targeted engagement with producers, and a focus on determining essential research inputs and outputs. We see a need for such collaborations to address the complex and critical issues facing the coffee industry. Interdisciplinary, cross-sector partnerships provide the opportunity to pool and leverage

funds, bringing together resources across sectors to accomplish greater impact and avoid duplication. Such partnerships provide significant opportunity to draw on unique skills and experiences across sectors that can ground the research and ensure it is relevant and beneficial for all stakeholders. The methods described earlier in this paper provide a framework for effective collaboration.

It is essential in the planning and partnership process to determine what involvement and voice farmers will have in the research project [51–53]. Consulting with farmers early to assess their ability and interest in participating at different stages of research ensures their voices are heard and their time is respected. It is important not only to treat farmers as contributors of data and expertise, but to also involve them in co-generating research questions and conducting analysis when feasible.

Research needs assessments are only one way of ensuring the research is responsive and applicable, but it is an important one. Where research or stakeholder timelines do not permit a new on-the-ground assessment, other tools such as rapid appraisals or desk research to identify past assessments can also be critical investments to the research framework and outcome.

Lastly, cross-sector collaboration requires that participants identify the best formats for disseminating information. Trade publications, field-ready summary tools, and other formats should be considered in addition to traditional outlets for publishing research findings for all stakeholders. In sum, while research collaboration takes additional time, planning, and flexibility, the potential impact of cross-sector partnerships is worth the investment.

5. Conclusions

This research needs assessment contributes a clear understanding of major agronomic and market challenges facing smallholder coffee producers in Guatemala. The participatory interviews, conducted with 33 coffee producers and 22 non-producer key informants, identified the key challenges facing the sector as: pests and diseases, climate change, price, labor, nutrient management, market access, yield, nurseries and transplants, and technical assistance. The results outlined in this paper provide a roadmap for future research and interventions to address sustainability challenges in the sector. This research framework can also serve as a model for others interested in conducting interdisciplinary, cross-sector research.

In the year following this research needs assessment, the emergence of a novel coronavirus, SARSCoV-2, dramatically highlighted how crises facing the coffee industry threaten the sustainability of the industry. The challenges of travel and mobility affect coffee harvest labor and retail customers alike. Access to capital has shrunk for actors accustomed to financing options and continues to be nonexistent for many producers. Uncertainty surrounding retail sales and access to transport has resulted in broken contracts from both buyers and producers. The global pandemic provides a critical lens on business as usual and offers the opportunity to see how deeply interconnected stakeholders are in the industry.

A continued, concerted shift away from one-size-fits-all solutions toward collaborative, interdisciplinary interventions that center farmers in their design and execution is a key to the continued success and longevity of the coffee industry. Left unaddressed, issues such as pests and diseases, climate change, prices, and labor will continue to negatively impact the sustainability of the coffee industry as a whole. New initiatives and research have already begun on the challenges facing the industry in the face of SARSCoV-2 [54,55]. As before, there continues to be a need to prioritize collaboration and ensure all voices and perspectives are heard. This study provides a framework as well as concrete recommendations for contributions from private and public sector actors at all levels of the value chain to develop such solutions. We hope the analysis has made clear the interconnected nature of the challenges facing the specialty coffee sector and the need to foster collaboration in research and industry initiatives to ensure specialty coffee can weather the crises we face and build a more equitable, shared vision for the industry's future.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Institutional Review Board of 1440661-1.

Informed Consent Statement: All subjects gave their informed consent for inclusion before they participated in the study.

Data Availability Statement: Due to the sensitive nature of the questions asked in this study, survey respondents were assured raw data would be reported in the aggregate and remain confidential. Data not available/the data that has been used are confidential.

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Appendix A

Semi-structured interview guides used for field interviews, including: (1) individual producer interview guide, (2) producer focus group discussion guide, and (3) non-producer key informant interview guide.

1. Individual Producer Interview Guide

History/Farm Background

- Can you tell us about the history of your farm?
- Age of trees
- Size of farm
- Varieties of coffee planted
- Transplant process
- Altitude
- Yield

Annual Management

- Can you tell us about your annual management plan on your farm?
- Soil analysis
- Source
- Interpretation of results
- Shade trees
- Coverage
- Species
- Pruning/replacements
- Nutrient Management
- Number and frequency of fertilization events
- Type of
- How did you decide on the type of fertilizer you use?
- Rust
- Other diseases
- Types of products used

- Insects and pests
- Pruning practices
- Harvest
- Timing
- Amount of labor required
- Cost of labor

Decision-Making

- Can you tell us how your fertilizer management strategy has changed in the past 3–5 years?
- What information did you obtain that made you make those adjustments?
- What makes (a source of nutrient management) information reliable enough for you to make a change on your farm?
- Given the drop in coffee prices, have you had to adjust your nutrient management schedule?
- What information about managing your farm was passed down to you from your father or grandfather?
- What production practices do you use that are different from those of your neighbors or other coop members? Why is that?
- What management questions or aspects of your coffee operation would you like to better understand or improve?

Technical Assistance

- What is the main source of technical assistance for your farm?
- How often do you receive visits?
- How often do you attend trainings?
- Other sources (neighbors, internet research, local distributor shops, etc.)
- Other types of capacity building
 - o Financial
 - o Costs
- If you are a finca, do you provide technical assistance to small farms?
 - o Content
 - o Goals
 - o Purchasing model

Innovation and experimentation

- What is a new practice that you have recently tried on your farm?
 - o How do you identify new practices you would like to try on your farm?
 - o How do you decide to implement them?
- Size of experimentation plots
- What new innovations or technologies would you like to try next?
- Diversification
 - o What crops/products/services?

Processing

- What form of coffee (fruit, parchment, etc.) do you sell to buyers?
- What processing methods do you use?
- If you don't process your coffee, who does?
- Are you interested in roasting or tasting/cupping your coffee?
 - o Has anyone cupped your coffee?

Markets/Marketing

- What are the main markets for your coffee?
 - o Ideal number of markets/buyers for your farm
 - o Types of processing used

- o If you export, how does your coffee reach international markets?
- Are you a part of a cooperative or association?
 - o What are the benefits you have from
- Certifications

Closing

- Do you have any questions for us?

2. Producer Focus Group Discussion Guide

Seasonal Calendar Questions

- What month does your harvest conclude?
- During the next month, what maintenance tasks do you begin on your farm?
- Follow line of questioning for month by month management calendar
- Can you please explain the farming activities you carry out for your coffee crop (including purchase of inputs, production, postharvest, marketing)?
- Where did you learn how to perform these tasks and who provides information on how to best manage your farm?
- Alternatively (depending on the situation): Why do you do X (activity) at X timing?

Winter

- What are the main tasks you perform on your coffee farm in the winter?
- What are the challenges you face when implementing these tasks?
- Do you grow other crops in the winter season?
- What other problems occur?

Summer

- What are the main tasks you perform on your coffee farm in the summer?
- What are the challenges you face when implementing these tasks?
- Do you grow other crops in the summer season?
- Can you describe your harvest process month by month?
- Can you describe how you market or sell your coffee each year?
- For example, last harvest who and when did you sell your crop?
- What other problems occur?

3. Non-producer Key Informant Interview Guide

Questions for all stakeholders

- What is needed to support the long-term sustainability of Guatemala's coffee sector?
- What are the current challenges that coffee farmers in Guatemala face? Which (of the answers you provided) is the most significant?
- What are the strengths of the Guatemalan coffee sector?
- In your experience, where do farmers get most of their information about best management practices in coffee production?
- Does your organization provide training to coffee farmers?
- If so, what type of training?
- If so, how often do you offer training?
- What are the most common coffee varieties you see produced by smallholder coffee farmers?
- What are the most common coffee varieties you see produced by medium-sized coffee farmers?
- What are the current trends or gaps in research and programming from your perspective?
- Do you think it is important for farmers to learn more about the quality of their coffee? Why or why not?

- Would you see a regular meeting of stakeholders in the sector as useful? Who should chair or lead this effort?

Questions for technical assistance providers

- What municipalities do you work in with coffee farmers?
- Are there challenges you see as unique to specific regions of production in Guatemala?
- What is the (average) farmgate price of coffee in Guatemala (conventional vs. specialty)?
- If farmers needed to prioritize 1–3 improved practices, which do you believe would have the biggest impact on their ability to increase yields and quality?
- Is there a written form of this information and would you be willing/able to share it with us?
- How do you develop extension/cultivation materials for farmers?
- How are technical assistance providers trained on this information? Are they trained beyond their formal education once hired?
- Do you have any data or anecdotal evidence on how responsive are farmers to these recommendations and what conditions allow them to adopt changes or not?
- What % of them implement recommendations/what % of recommendations are implemented?
- What typography of producer tends to implement?
- What are perceived barriers to adoption of these practices?

Questions for Public Sector/Quasi-Public Sector Stakeholders

- What public resources do you need to expand your support to the coffee sector?
- What is the biggest constraint to expanding your support to the coffee sector?
- Human capacity/staff
- Financial support
- Have you had success collaborating with the private sector? What made those partnerships successful or challenging?
- Have you had success collaborating with the development sector? What made those partnerships successful or challenging?
- How do you disseminate your knowledge, research findings, and technical information to farmers?

Questions for NGOs and Development Actors

- What role are NGOs and development actors currently serving in the coffee sector of Guatemala?
- How do you disseminate your knowledge, research findings, and technical information to farmers?
- Have you had success collaborating with the private sector? What made those partnerships successful or challenging?
- Have you had success collaborating with the public sector? What made those partnerships successful or challenging?
- How do you coordinate with other NGOs and development actors?

Questions for Supply Chain Actors

- Who do you primarily buy coffee from or sell coffee to?
- What processing do you do to the coffee before sale?
- Approximately how much coffee did you buy in the last 12 months?
- Approximately how much coffee did you sell in the last 12 months? To whom (what category of VC actor) did you sell it?
- What are the top three qualities of a good coffee supplier?
- What is the average length of the relationship between you and your supplier?
- Would you pay more for higher quality coffee (yes or no)?

- o If no, why?
- Would you pay more for coffee that had already been sorted into grades (yes or no)?
 - o If no, why?
- Would you pay more for single variety /origin coffee (yes or no)?
 - o If no, why?
- Would you pay more for certified organic /fair trade coffee (yes or no)?
 - o If no, why?
- Would you change suppliers if farmers could provide higher volumes of coffee (i.e., through a cooperative)? (Yes or no)
 - o If no, why?
- What are some of the challenges you face in maintaining your business? Rank top 3 (1 = most important and commonly faced challenges, 3 = least important challenge)
- Are women involved at any time in your coffee business? (Indicate all that apply)

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