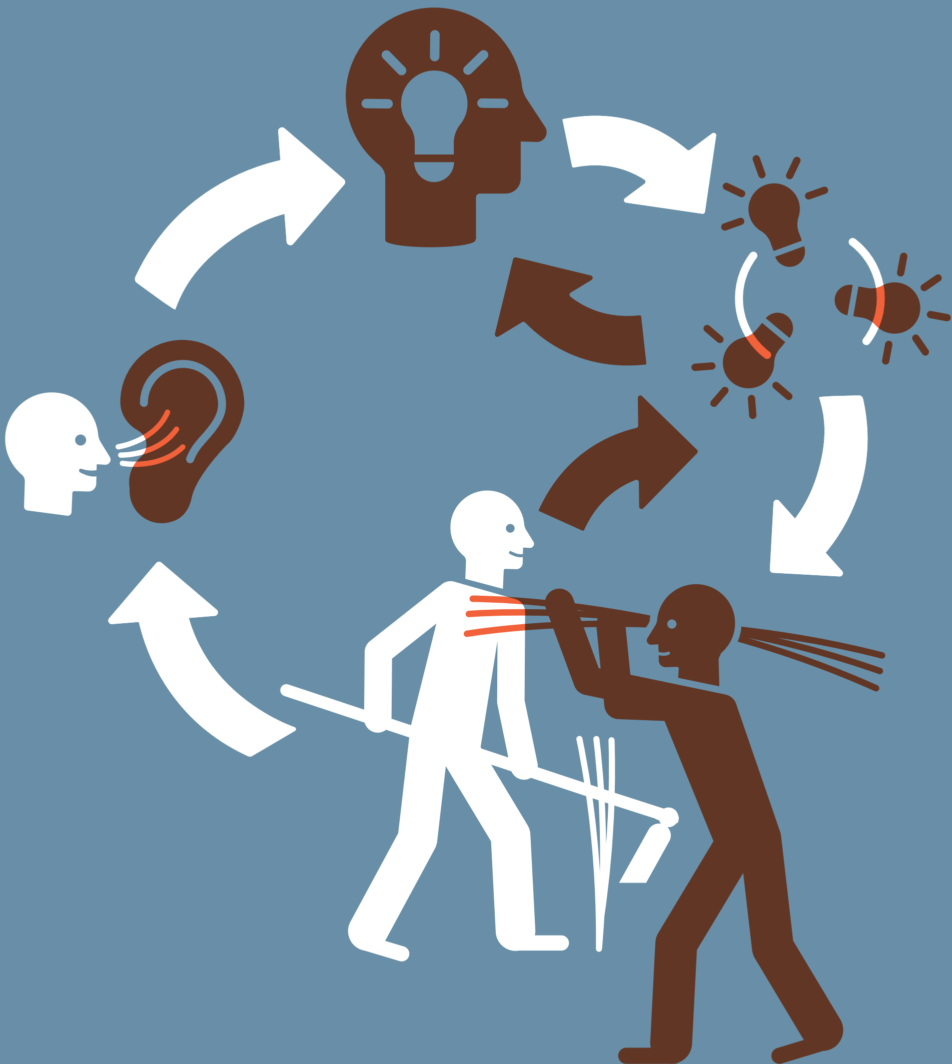
Disentangling the experiential learning process of Ugandan coffee farmers

The role of innovation platform governance mechanisms, farmer role identities, and farm family resources



Robert Ochago

Propositions

1. Family support does not help a Ugandan coffee farmer to experiment with innovative practices.
   (this thesis)
2. A Ugandan coffee farmer knowing how to solve farming problems does not guarantee that these will be solved.
   (this thesis)
3. The fragmentation of scientific disciplines is only a solution to context-specific problems.
4. Research for rural development is more focused on research than on rural development.
5. Systems thinking promotes effectiveness rather than efficiency in solving development problems.
6. Rural community members' reliance on government handouts has rendered them impoverished.
7. Rural community members are well equiped to solve their own problems.

Propositions belonging to the thesis, entitled
Disentangling the experiential learning process of Ugandan coffee farmers: The role of Innovation platform governance mechanisms, farmer role identities, and farm family resources

Robert Ochago

Wageningen, 07th June 2023

DISENTANGLING THE EXPERIENTIAL LEARNING PROCESS OF UGANDAN COFFEE FARMERS

The role of innovation platform governance mechanisms, farmer role identities, and farm family resources

Robert Ochago

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This research was conducted under the auspices of the Wageningen School of Social Sciences (WASS)

DISENTANGLING THE EXPERIENTIAL LEARNING PROCESS OF UGANDAN COFFEE FARMERS

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Robert Ochago

Thesis
submitted in fulfillment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus,
Prof. Dr A.P.J Mol,
in presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on Wednesday 07 June 2023
at 01:30 p.m. in the Omnia Auditorium.

Robert Ochago

Disentangling the experiential learning process of Ugandan coffee farmers: The role of innovation platform governance mechanisms, farmer role identities, and farm family resources

306 pages

PhD thesis, Wageningen University, Wageningen, The Netherlands (2023)

With references, with summary in English

ISBN: 978-94-6447-610-1

DOI: https://doi.org/10.18174/588908

To my wife, Kyomugisha Prossy (Psalms 128:3; Proverbs 31:10-31), and our lovely children Emunot E. Ochago, Eminat M. Ochago, Eyalama S. Ochago, and Esiana J.Ochago (Psalms 127:3-5)

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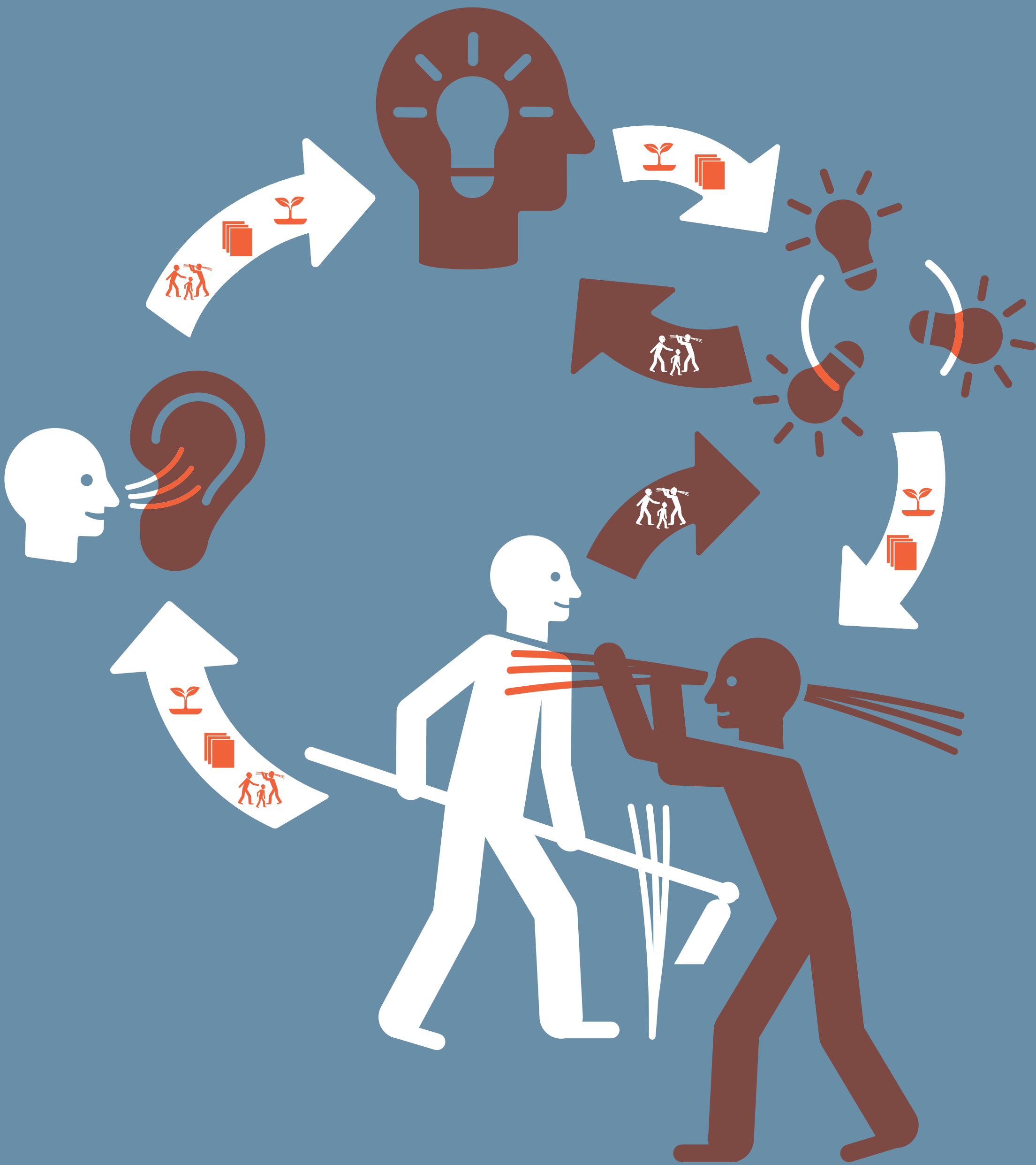
List of Acronyms

ACIAR	Australian Centre for International Agricultural Research
BCU	Bugisu Cooperative Union
BUACE	Bukusu Area Cooperative Enterprise
CBOS	Community-Based Organizations
CDO	Community Development Office
DFI	Development Finance Institutions
DLG	The District Local Government
EL	Experiential Learning
FAO	Food and Agricultural Organization
FFSs	Farmer Field Schools
FGDs	Focus group discussion
FI	Follow up interviews
FMR	Farm Family Resources
FRI	Farmer Role Identities
GTZ	German Technical Cooperation
HPHCP	Harvesting, postharvest handling, and coffee processing
ICRAF	World Agroforestry Centre
IP	Innovation platform
IPGM	Innovation Platform Governance Mechanisms
KADLACC	Kapchorwa District Landcare Chapter
KII	Key informant interview
MFI	Monetary Financial Institution
MUK	Makerere University
NAADS	National Agricultural Advisory Services
NARO	National Agricultural Research Organization
NUCAFE	National Union of Coffee agribusinesses and farm Enterprises
OWC	Operation Wealth Creation
SACCO	Saving and Credit Cooperative
UCA	Uganda Cooperative Alliance
UCDA	Uganda Coffee Development Authority
VIP4FS	Value chain innovation platforms for food security
VSLAs	Village Savings and Loans Associations
WFP	World Food Program
UWA	Uganda Wildlife Authority



1

General Introduction

CHAPTER ONE: General Introduction

1.1. Smallholder farmers' experiential learning process

Agriculture accounts for 80% of global food production, employment, and income worth $2.2 trillion (Bosc et al. 2013; Graeub et al. 2016). Coffee is the most important source of income in over 50 low-income countries in terms of revenues for agricultural enterprises (Kuma et al. 2019). The export earnings of the top five coffee producers in Africa are Ethiopia (1.4 billion USD), Uganda (494 million USD), Côte d'Ivoire (22 million USD), Tanzania (17.3 million USD), and Kenya (16.6 million USD). Despite Uganda's potential as Africa's second-largest Arabica coffee exporter after Ethiopia, its coffee exports are low when compared to African counterparts such as Ethiopia (ICO 2020b). This is mostly due to the sector's reliance on smallholder farmers, who confront several obstacles along the farming process, including production, harvest, postharvest handling, and marketing. Drought in most coffee-growing regions, for example, resulted in shorter peak harvest seasons and lower production in central and eastern Uganda (ICO 2020b). The other challenge is insect pests and diseases (Liebig et al. 2016b; ICO 2019), which cause up to 57 percent coffee yield loss (Cerda et al. 2017). Additionally, insect pests and diseases lower the quality of coffee (Velmourougane, Bhat, and Gopinandhan 2010; Pimenta, Angélico, and Chalfoun 2018; Walker et al. 2019) leading to low and fluctuating coffee market prices (Abrar, Solomon, and Ali 2014; Kidist, Zerihun, and Biniam 2019).

This background implies that farmers continuously face challenges in agriculture in general, and in coffee farming in particular, hence need to continuosuly learn through these challenges. Experiential learning (EL) is an approach to learning that requires overcoming challenges (Percy 2005; Pincus et al. 2018). Farmers learn to overcome challenges by reflecting on previous challenges, discussing practical ideas with others, and working together to solve challenges (Laforge and McLachlan 2018; Oreszczyn, Lane, and Carr 2010; Milestad et al. 2010; Lubell, Niles, and Hoffman 2014; Okumah et al. 2021), a process that may not always develop naturally and smoothly (Manolis et al. 2013). Addressing challenges may enhance farmers' attention, information, and knowledge, but it may also elicit negative feelings such as anxiety, fear, self-doubt, and distrust, which may impede experience-based knowledge development (Vince 2010). To date, research has not given light on how farmers learn effectively from their challenges. Accordingly, I sought to ascertain the process of farmers' knowledge development because of performing activities when confronted with challenges. Moreover, farming challenges are complex and demand multiple solutions. Complex farming challenges [1] have several dimensions, that are rooted in interactions across diverse organizational and social settings, and involve a variety of actors (Schut et al. 2015). Actors (e.g., researchers, donors, policymakers, and practitioners) have embraced the value chain approach as a means of improving farmer learning to tackle their challenges (Collins, Dent, and Bonney 2016; Kaplinsky, Terheggen, and Tijaja 2011; Ponte et al. 2014; Horton et al. 2017; Maru et al. 2018; Bisseleua et al. 2018). The most prevalent operationalization of coffee value chains in low-income nations is through innovation platforms (IPs) (Pali and Swaans 2013; Camacho-Villa et al. 2016; Kilelu, Klerkx, and Leeuwis 2014; Brown et al. 2021; Sako et al. 2021). IPs can take many forms, but in the context of this thesis, IP is defined as structured interfaces among farmers where they can learn how to address their farming challenges by tapping into the capacities of diverse actors (e.g. processors, traders, transporters, input suppliers, traders, policymakers, extension agents, and researchers) (Homann-Kee Tui et al. 2013; Homann-Kee Tui et al. 2015; Birachi et al. 2013; Hermans et al. 2017; Schut et al. 2018; Lukurugu et al. 2021). International research and development (R&D) organizations such as CGIAR organizations are at the forefront of designing and applying IP approaches (Dabire et al. 2017; Schut et al. 2017). IPs facilitate farmer learning through the following activities: (1) identifying challenges and potential solutions; (2) testing and refining solutions; and (3) creating capacity to execute solutions (Probst et al. 2019; Sanyang et al. 2014). However, this assistance is not always successful (Faysse 2006; Warner 2005), because assisting farmers to address specific challenges necessitates a thorough understanding of how farmers develop knowledge from performing activities when faced with challenging situations (Gorman 2019; Pant 2012). Though there is a large body of literature on the operation and impact of innovation platforms on farmer learning in a variety of contexts (Audouin et al. 2021; Kelly, Bennett, and Starasts 2017; van Rooyen et al. 2017), less research has focused on how IPs assist farmers to learn to solve their challenges (Schut et al. 2019; Probst et al. 2019). Focus is placed on knowledge of crop and livestock production and value addition, as well as information on inputs, credit, and markets (as learning outcomes for farmers in IPs) (Brouwer et al. 2019; Mulema and Mazur 2016; Akpo et al. 2021) rather than on the entire learning process, i.e. the

[1] Farming challenges and value chain challenges are used interchangeably

connection between challenges and knowledge via learning activities. Therefore, another objective of this thesis is to investigate how innovation platforms enable farmers' learning.

1.2. Drivers of farmers' experiential learning process

The role of IP in assisting farmers in learning to address their challenges has been researched in a variety of settings (Audouin et al. 2021; Kelly, Bennett, and Starasts 2017; van Rooyen et al. 2017; Akpo et al. 2021). In India, for example, IP-supported horizontal linkages (farmer societies) were established to assist farmers in learning how to address challenges such as chickpea seed shortages (Sah et al. 2021). All these studies attribute such learning to the governance mechanisms put in place by the individual IPs. Apart from describing learning as a challenge-solution relationship, these studies do an excellent job of documenting the IP governance mechanisms accountable for farmer learning. However, these studies do not always link governance mechanisms to specific learning outcomes or, more importantly, the learning process. This reinforces the ongoing call for research on IP governance (Kilelu, Klerkx, and Leeuwis 2013; Cullen et al. 2014). Considering this, I decided to investigate the effect of IP governance mechanisms on farmers' EL processes.

1.2.1. IP governance mechanisms as a driver of farmers experiential learning process

I zoom in on IP governance mechanisms to better understand the effect of IP mechanisms on the transformation of coffee farmers' challenges into experiential knowledge. Simply launching or activating a platform will not result in farmers understanding how to solve their problems; care must be taken to consider how the platform governs relationships inside the IP (Ochago et al. 2021; Hinnou et al. 2018). In line with value chain literature, governance is defined as a stakeholder/actor's ability to influence or regulate the conduct of other stakeholders on the platform (Miningou et al. 2021). Such a stakeholder establishes the parameters within which other stakeholders will function, as well as the methods through which these parameters are communicated and regulated, and how activities are coordinated (Gereffi 1994). This influence can extend to the design of relationships between IP actors, such as who takes part in learning activities, by IP management (Eidt, Pant, and Hickey 2020; Rossi, Bui, and Marsden 2019). In this thesis, governance is defined as mechanisms, such as set guidelines, that actors use to determine or regulate the activities in the value chain (IP). It is essential to govern relationships within IPs because they are made up of multiple stakeholders with diverse requirements, interests, and ambitions, all of whom are likely to interact, resulting in tensions and conflicts (Hinnou et al. 2018; Kilelu, Klerkx, and Leeuwis 2013, 2017). Indeed, IPs are renowned for transforming into battlegrounds, since solutions for some members may result in new challenges for others (Leeuwis 2000). Thus, IP governance mechanisms are appropriate tools for correcting power imbalances that influence the dynamics of interactions among IP actors (Eidt, Pant, and Hickey 2020; Rossi, Bui, and Marsden 2019). Previous research in agricultural development policy, research, and practice reveals that IP governance mechanisms facilitate multi-stakeholder interaction and farmer learning to address challenges (Kilelu, Klerkx, and Leeuwis 2013; Cullen et al. 2014). Farmers' learning to address challenges is governed indirectly by IPs through controlling their learning activities and resulting knowledge. IPs, for example, establish and enforce the rules governing who can be a member (Birachi et al. 2013; Audouin et al. 2021), who does what within the IP (Cadilhon 2013; Tenywa et al. 2011), and who participates in IP learning activities (Fatunbi et al. 2016b; Cadilhon 2013). IPs indirectly govern members' learning activities by imposing the following: First, establish a space for farmers to reflect—collaboratively identify and prioritize challenges, root causes, and solutions. Yet, no single study exists that defines how such governance mechanisms impact their learning to solve their challenges (Schut et al. 2019; Mikwamba et al. 2021; Hinnou et al. 2018). Therefore, a third objective of this research is to investigate how IP governance mechanisms influence the process of farmers' knowledge development because of performing activities when confronted with challenges.

What is more, while there is literature on IP functioning and impact (Lema et al. 2021; Schut et al. 2019), it mostly focuses on knowledge as a learning outcome (Akpo et al. 2021; Mulema and Mazur 2016). This is troublesome because one of the learning outcomes is learning new roles (Ochago et al. 2021). Likewise, learning in the IP is role driven. Farmers who are also input suppliers and traders, for example, learn about agrochemicals to sell to other farmers and cost-benefit analyses (Homann-Kee Tui et al. 2015). While it is true that learning in the IP context is role-based, less effort has been taken to investigate this, which is why I decided to examine the effect of farmer role identity on their EL process.

1.2.2. Role identity as drivers of farmers' experiential learning process

Existing agricultural development literature undeniably stresses role-based learning among farmers. To put it another way, farmers' role identity, or how they see their role in farming society, as well as the meanings and expectations that come with those roles and their performance (Burke and Stets 2009), may influence farmer learning positively (McGuire et al. 2015). For example, farmers who are also input suppliers and traders learn about agrochemicals, as well as cost-benefit analysis (Homann-Kee Tui et al. 2015). Farmers' identities influence their learning by prompting the learning activities in which they participate, such as training, meetings, seminars, exchange trips, and demonstrations (Yirzagla et al. 2021), which leads to increasing challenges knowledge (Ochago et al. 2021). While existing literature links farmer identities and learning, the focus is on the social and biophysical environment (McGuire, Morton, and Cast 2013; McGuire et al. 2015; Sulemana and James 2014; Burke and Running 2019), and on the farmers' knowledge of their social and biophysical environment (McGuire, Morton, and Cast 2013; McGuire et al. 2015). However, this is only one aspect of the experiential learning process. In summing up, farmers' learning processes (learning to solve their challenges) are impacted by their role identities; yet no one study exists that specifies how farmer role identities influence their acquisition of knowledge to solve their challenges. Hence, the fourth objective of this thesis is to determine how the farmer's EL process is influenced by their role identity.

Then, from the existing IP literature, family members serve as a critical resource for farmer learning (Ochago et al. 2021). Family members offer necessary resources for the farmers to learn how to solve their challenges in the IP setting, but this has not been systematically studied. Building on these I study the effect of farm family resources on farmers' EL process.

1.2.3. Family resources as drivers of farmers' experiential learning process

Recent research reveals that farmers' EL processes, among other things, rely on resources (e.g. information, labor, emotional support, coffee production inputs, links to training avenues, and supporting actors through family members) obtained through family interactions Ochago et al. (2021). Family interactions boosted farmers' experiential knowledge, according to studies (Hoang, Dufhues, and Buchenrieder 2016; Fisher 2013; Sutherland and Burton 2011; Hoang, Castella, and Novosad 2006; Pratiwi and Suzuki 2017; Danielsen et al. 2020) through availing resources which in turn assist farmers in engaging in learning activities. As per Danielsen et al. (2020), farmers learned about pest and disease management via their spouses, friends, and neighbors. Other research, contends that family interactions generate homogeneous and redundant knowledge within the family (Fisher 2013), hence impeding the acquisition of new knowledge outside the family (Smith, Anderson, and Moore 2012; MacGillivray 2018). Nonetheless, a growing body of research has found a positive relationship between family resources and farmer learning, i.e., the relationship between farming challenges and the level of knowledge gained through learning activities (EL). However, it's still unclear how family resources affect the experiential learning process. Hence, the fifth objective is to determine how the farmer's EL process is influenced by the resources available through family ties.

Overall, the purpose of this Ph.D. thesis is to 1) explain coffee farmers' experiential learning process, and 2) determine the effect of innovation platform governance mechanisms, farmer role identities, and farm family resources in their experiential learning process using the Ugandan coffee Innovation platforms as the empirical context.

1.3. Theory and hypothesis development

Kolb's EL theory is widely employed in contemporary research to better explain the process through which people learn to deal with challenges (Morris 2020). According to Kolb's model, experiential learning is a cyclical and context-dependent process in which experiences are transformed into experiential knowledge (Kolb 2015; Kolb and Kolb 2009). This model suggests that knowledge is constructed through the tension of four stages, each of which responds to contextual demands (Kolb and Kolb 2009); it depicts and idealizes a learning cycle in which learners engage in experiencing, reflective observation, abstract conceptualization, and active experimentation (Kolb and Kolb 2005). To start experiences (expected and unexpected events) are the product of active experimentation (Matsuo and Nagata 2020). The second step is reflection, which entails going over and analyzing expected and unexpected events. The third stage is abstract conceptualization. At this stage, learners extract lessons and develop conclusions based on their reflective analysis by identifying the causes and solutions to challenges (Miller and Maellaro 2016) and offering alternate methods of action (Korthagen 2005) and remedial action plans (Gibbs 1988). The fourth stage is active experimentation. The solutions, alternative methods of action, or remedial action plans derived from 'abstract conceptualization' are applied at this step.

1.3.1. Farmers' experiential learning process

1.3.1.1.Challenges (Experiences)

Kolb (1984) asserts that to learn, learners must have actual experiences. Existing research on experiential learning characterizes experiences as challenges (Manolis et al. 2013; Miettinen 2000; Morris 2020; Matsuo and Nagata 2020; Ochago et al. 2021). The EL process entails resolving one-of-a-kind, context-specific, and ill-structured challenges (Blair 2016; Asfeldt and Beames 2017). The value chain challenges that smallholder coffee farmers confront are emphasized in this study. First, pests and diseases in the coffee production process(Liebig et al. 2016b; Cerda et al. 2017). Second, poor quality and quantity at harvesting and postharvest handling (Hameed et al. 2018). Thirdly, the coffee market's low and fluctuating pricing (Abrar, Solomon, and Ali 2014; Kidist, Zerihun, and Biniam 2019). Although these challenges are well-known, there is little research in the agricultural value chains and learning literature on how challenges initiate farmers' EL (Schut et al. 2019; Probst et al. 2019).

1.3.1.2.Reflection observation

Reflective observation, according to Di Stefano, Pisano, and Staats (2015b); Beard and Wilson (2013) requires seeing, hearing, and discussing the experience—what happened, how it happened, and why it happened. Schön (1987)'s reflection theory divides reflection into two parts: reflection in action (Cajiao and Burke 2016) and reflection on action (Ajjawi and Boud 2018). Decisions made during practice, or "how teachers think on their feet," are referred to as "reflection in action" p. 12 (Farrell 2012). Reflection-in-action is almost totally concerned with the process of challenge-solving. Reflection-in-action comprises solving challenges using observational analysis, listening, and/or touch or 'feel.' Reflection on action, on the other hand, takes place after the activity has been completed (Schön 1987). In other words, reflection-on-action refers to the act of looking back to assess what occurred (Ajjawi and Boud 2018). In a nutshell, the reflection process comprises identifying challenges, discovering root causes, and assessing feasible solutions (Miller and Maellaro 2016). As the theory of reflection is understood at this point, farmers' reflection on their challenges has not been investigated outside of a classroom setting.

1.3.1.3.Experiential knowledge

According to Johanson and Vahlne (1977), experiential knowledge is information learned solely from personal experience. Experiential knowledge is formed when a farmer produces, discovers, and captures solutions to challenges (Newman and Conrad 2000; Andreeva and Kianto 2011). Experiential knowledge refers to a farmer's ability to align information with his or her own or other farmers' skills and knowledge and apply it to problem-solving activities. Farmers that work with coffee IPs, for example, learn about new agricultural techniques like optimum plant spacing, line planting, composting, fertilizer application, insect and disease spraying, and selective picking of red ripe cherries (Chichaybelu et al. 2021; Ochago et al. 2021). Moreover, farmers learn about value chain actors (such as fellow farmers, processors, traders, etc.) and farming methods through their IPs (Ochago et al. 2021). Based on prior research, this study employs two interconnected factors to describe farmers' experience knowledge: knowing new value chain actors and farming methods. Farmers' level of experiential knowledge (knowing new value chain actors and farming practices) increased when they considered their present knowledge and interactions with other value chain actors (Ochago et al. 2021).

1.3.1.4.Active experimentation

Furthermore, farmers experiment to determine whether they can address their challenges by applying what they already know (Leitgeb et al. 2014; Meynard, Dedieu, and Bos 2012a). They experiment with new seed varieties, and alternative production processes, and look for new ways to promote their products through their social networks as a solution to their challenges (Skaalsveen, Ingram, and Urquhart 2020; Ochago et al. 2021). As a result, active experimentation occurs when a farmer applies his or her current knowledge to address challenges and interacts with other value chain actors to improve their ability to solve challenges. Farmers' active experimenting was described in the literature in two ways. First, farmers, act promptly in response to challenges by engaging in active experimentation increasing their level of challenges solving knowledge (Kayes, Kayes, and Kolb 2005; Ochago et al. 2021). Second, other farmers address their challenges by experimenting with the knowledge they have obtained. For example, Ochago et al. (2021) found that farmers experimented with alternative pest and disease control measures after realizing that the root of the high disease and pest infestation is due to fake agrochemicals. They collectively purchased certified agrochemicals in bulk from reputable dealers within their farming communities.

As a summary, Figure 1 depicts the hypothesized potential mediation relationships guided by Kolb's theory of experiential learning. Challenges are related to experiential knowledge through reflection and active experimentation in the first model, and experiential knowledge is linked to challenges through active experimentation in the second.

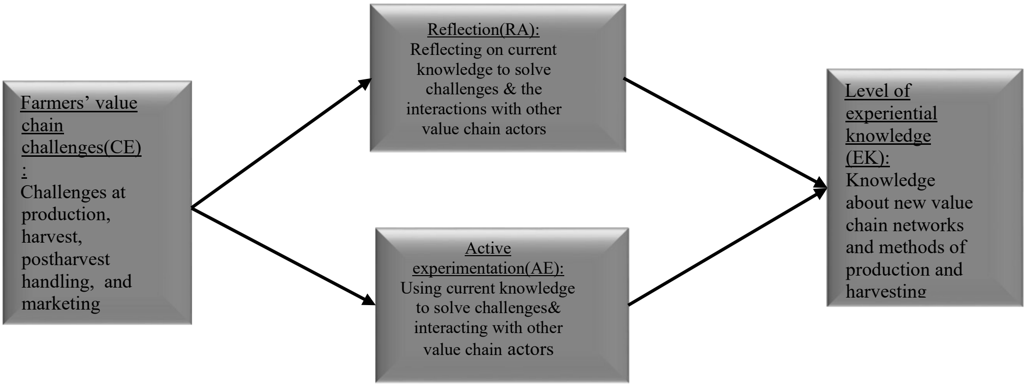


Figure 1: A mediation model 1-the mediating effects of reflection and active experimentation

1.3.2. The effect of the context- IP governance mechanisms, farmers' role identities, and family resources on smallholder farmers' experiential learning process

1.3.2.1. The effect of IP governance mechanisms on their experiential learning process

There is strong evidence that the value chain (Akpo et al. 2021) and challenges- and solution-oriented innovation platforms (Audouin et al. 2021; Toillier et al. 2021) govern the process by which farmers acquire knowledge while striving to address their challenges (Fatunbi et al. 2016b; Cadilhon 2013). Whereas research has been conducted on the subject, the question of how IPs govern farmers' learning to solve challenges remains unanswered (Schut et al. 2019). There is no straightforward solution to this topic in present studies on IP governance and farmer learning to tackle their challenges. Rather than determining the impact of IP governance mechanisms on farmer learning, existing IP research focuses on ensuring good governance and increasing the participation of key actors in Innovation Platforms (Sako et al. 2021; Audouin et al. 2021; Davies et al. 2018; Lamers et al. 2017; Schut et al. 2017; Lukurugu et al. 2021; Miningou et al. 2021).

Although evidence is limited, qualitative studies suggest that when faced with coffee value chain challenges, the process by which farmers reflect on their current knowledge and interact with other value chain actors is moderated by IP members' commitment, trust, involvement, and access to IP resources. As said by Ochago et al. (2021), coffee IP farmers' commitment and trust, involvement, and access to IP resources aided them in reflecting on their current knowledge and interactions with other value chain actors when confronted with coffee value chain challenges. Similarly, Sako et al. (2021) reported that farmer commitment and involvement in Innovation Platform activities assisted them in reflecting on their existing knowledge. Besides that, Akpo et al. (2021); Audouin et al. (2021) found that trust fostered by IPs among farmers and other value chain actors encourages reflection on the farming information shared. Moreover, IP members rely heavily on IP-mobilized resources (Schut et al. 2019; Kusters et al. 2018; Sah et al. 2021) such as funds, stakeholders, seeds, and research technologies to support their learning activities, which may include reflection. Following on from the preceding, access to IP resources may influence their ability to reflect on their challenges.

Reflection on IP-related learning results in experiential knowledge. Farmers' experiential knowledge is enhanced when they reflected on their current knowledge whilst also participating in activities like field demonstrations and interacting with other value chain actors (Ochago et al. 2021). Trust in the information shared fostered commitment and involvement in IP-level activities, resulting in increased knowledge. The moderating effect of IP governance mechanisms on farmers' knowledge acquisition via reflection was not statistically examined in their study, but it is suggested. Because there is no extensive research to explain this relationship, I used studies such as (Akpo et al. 2021; Hounkonnou et al. 2018) and supported by the first steps in this research (Ochago et al. 2021) to test the moderating effect of IP members' commitment, trust, involvement, and access to IP resources on the relationship between their reflection, and the level of experiential knowledge.

Regarding IP governance and farmer experimentation, IPs assist farmers in a variety of ways. For example, the Burkina Faso Groundnut IP fostered trust by facilitating interactions between farmers and extension service personnel, resulting in the establishment of field demonstrations on groundnut production and improved varieties as a solution to low productivity caused by limited access to improved legume varieties (Miningou et al. 2021). Similarly, IPs boosted farmer commitment and trust by forming farmer seed producer groups. Concurrently, the platform farmers leveraged extension agents' existing knowledge via field demonstrations (Monyo et al., 2021). According to other studies, IPs support farmer experimentation by mobilizing resources such as information, money, stakeholders, seeds, and research tools (Kusters et al. 2018; Sako et al. 2021).

Then, using current farming challenges-solving knowledge, IP farmers engage in a variety of experimentation activities to improve their challenges-solving abilities. For instance, Ochago et al. (2021), found that IPs helped farmers experiment with alternate pest and disease control strategies as a solution to high disease and pest infestation. When farmers recognized that fraudulent agrochemicals were the core cause of the pest and disease challenge, they jointly (through their IP) purchased certified agrochemicals in bulk from trustworthy suppliers in their farming communities. The IP acts as a facilitator in this arrangement, fostering interpersonal trust among IP members through the open sharing of information and evidence-based information (Hounkonnou et al. 2018). IPs improved farmer commitment, involvement, and access to resources such as seeds and research technologies in other arrangements (Sako et al. 2021; Iorlamen et al. 2021). According to the evidence discussed above, IP governance appears to moderate the relationship between farmer experimentation and challenge-solving.

1.3.2.2. The effect of coffee IP-farmers' role identities on their experiential learning process

Role identity theory is concerned with the many perceptions and actions associated with a role. Roles are social positions that have behavioral and action expectations attached to them (Stryker 2008; Ashforth and Dukerich 2001; Burke and Stets 2009; Dukerich 2001). Roles can be deeply embedded in "who I am" (i.e., one's identity) or situational, reflecting a set of goals and behaviors inspired by a specific circumstance (Ashforth, Harrison, and Corley 2008). Simply said, roles influence how people see how they should act (Stets and Burke 2000). Here as result, when people take on a role, they frequently think or act differently than when they take on a different role.

I focused on the meanings people assign to themselves as occupants of positions in farming society to better understand farmer role identities. Several farmer role identities and their social construction have been documented (Burton et al. 2020; Burton and Wilson 2006; Kaplan and Garner 2017; Kaplan, Neuber, and Garner 2019), but not in the context of rural agricultural value chains. Instead, agricultural value chain literature identifies the following roles in terms of role composition: producers, processors, traders, transporters, and input providers (Ochago et al. 2021; Fatunbi et al. 2016b). This literature does not capture farmer role identities along the value chain in a systematic way. On this basis, I answer this and other calls (Burton and Wilson 2006; McGuire et al. 2015) by gathering data on farmer role identities and their importance to the experiential learning process.

According to Ashforth, Harrison, and Corley (2008), role identity encompasses both competence (e.g., experience, skills, abilities, and traits) as well as motivation (e.g., values and goals). The influence of role identity on role-related learning cannot be avoided. For example, role identity influences challenge-solving knowledge (Cardon et al. 2009). Unfortunately, no study has been conducted that links individual identities to specific learning activities, let alone research that focuses specifically on farmer knowledge. Farmers' identities influence their learning by prompting the learning activities in which they participate, such as training, meetings, seminars, exchange trips, and demonstrations (Yirzagla et al. 2021). These findings provide an initial indication of farmers' role identity influencing the process by which farmers generate knowledge to address challenges by participating in a variety of collective learning activities—the experiential learning process.

Increased knowledge is the result of role-based learning activities (Ochago et al. 2021). When faced with pests and diseases, farmers learn about pest and disease control strategies such as organic pesticide production and application, as well as inorganic pesticide spraying on plants (Tahir et al. 2020; Iorlamen et al. 2021; Chichaybelu et al. 2021; Schut et al. 2019). Farmers who are also input suppliers and traders learn about agrochemicals to sell to other farmers, as well as cost-benefit analysis (Homann-Kee Tui et al. 2015). Because of the above, this section employs 'role identity' as a moderator in a mediation process that relates challenges to experiential knowledge via active experimentation.

1.3.2.3. The effect of farmers' farm family resources on their experiential learning process

A family is a social construct composed of grandparents, parents, siblings, spouses, and, eventually, children and grandkids (Pylyser, Buysse, and Loeys 2018; Finch 2007). Interactions among family members help farmers overcome challenges by sharing resources such as information, knowledge, labor, emotional support, coffee production inputs, links to training avenues, and supportive actors. Ochago et al. (2021) found that when farmers confronted challenges in their farming activities, they used their family resources to execute two key learning activities: reflection and experimenting. Farmers got to know about alternative pest and disease management methods as well as value chain actors when they reflected on advice from family members and used such advice to try out various pest and disease management methods such as pruning, mulching, and so on. As shown in this study, farmers' family resources enable them to reflect on and experiment with their existing coffee value chain knowledge, as well as interact with other value chain actors to increase their experiential knowledge. Even though this study reveals that family resources influence the relationship between farmers' methods of transforming experience and their experiential knowledge in coffee value chain contexts, no individual farmer's family resource relates to experiential knowledge.

In conclusion, Figure 2 shows the dual stage moderated mediation models. I anticipate that IP governance mechanisms, farmer role identity, and farm resources moderate the relationship between farmers' value chain challenges and reflection, as well as the relationship between their reflection and level of experiential knowledge. The interaction between farmers' value chain challenges and their experimenting with various challenges-solving methods, as well as the relationship between their experimentation and their level of experiential, is moderated by farmers' access to family resources. The IP governance mechanisms and farmer role identity then moderated the interplay between farmers' experiential knowledge and their experimentation with various challenges-solving strategies, as well as the relationship between their experimentation and their challenges-solving abilities.

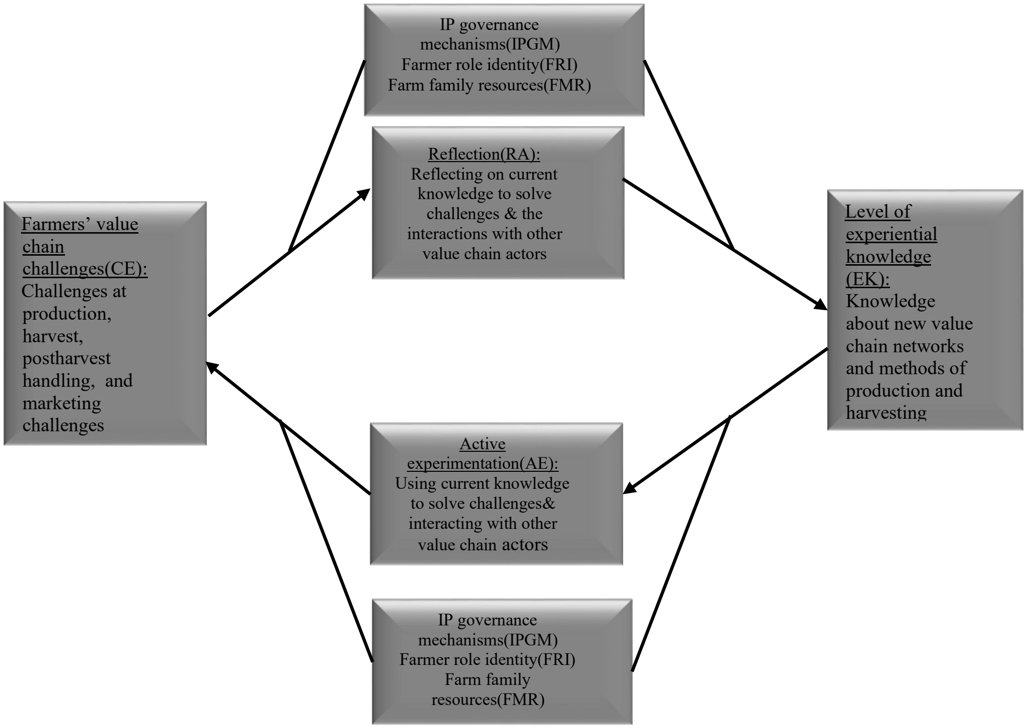


Figure 2: A dual-stage moderation mediation model - The moderated effect of IP governance mechanisms, farmer role identity, and farmer farm family resources on their experiential learning process

1.4. Research gaps and research questions

1.4.1. Research gaps

In brief, my thesis seeks to address the following research gaps. EL is an approach to learning that requires overcoming challenges (Pincus et al. 2018). Through reflecting on previous challenges, and discussing practical ideas with others farmers learn to address their challenges (Okumah et al. 2021), a process that may not always develop naturally and smoothly (Manolis et al. 2013). Addressing challenges may enhance farmers' attention, information, and knowledge, but it may also elicit negative feelings such as anxiety, fear, self-doubt, and distrust, which may impede experience-based knowledge development (Vince 2010). To date, research has not given light on how farmers learn from challenging experiences. Moreover, value chain-based IPs are popularly employed by R&D organizations to help farmers to identify and address specific challenges and solutions from production to acquiring a marketable product (Magala, Najjingo Mangheni, and Miiro 2019; Probst et al. 2019). However, this assistance is not always successful (Faysse 2006; Warner 2005), because assisting farmers to address specific challenges necessitates a thorough understanding of how farmers develop knowledge from performing activities when faced with challenging situations (Gorman 2019; Leitgeb et al. 2014). Hence the question of how innovation platforms (IPs) enable farmers in gaining knowledge to make sense of and address production, harvesting, postharvest handling, and market challenges is unanswered.

Understanding the role of IPs in enabling farmers to gain knowledge to make sense of and address challenges in IP governance is a critical aspect to study. This is because IPs govern farmers learning to address challenges (Kilelu, Klerkx, and Leeuwis 2013; Cullen et al. 2014). IPs, for example, establish and enforce the rules governing who participates in IP learning activities (Fatunbi et al. 2016b; Cadilhon 2013) by imposing the following: First, establish a space for farmers to reflect—collaboratively identify and prioritize challenges, and root causes, and solutions. Following that, IPs help farmers generate knowledge through sponsoring training, exchanging visits, seeing and learning (observation), and experimenting (Vellema et al. 2013). IPs facilitate farmer experimentation by mobilizing resources such as funding, stakeholders, land, meeting venues, seeds, transportation, and research technologies (Schut 2017; Kusters et al. 2018; Akpo et al. 2021). This research I quote reveals that the IP's governance mechanisms have an influence on farmers' learning processes (learning to solve their challenges); yet, no single study exists that defines how such governance mechanisms impact their learning to solve their challenges (Schut et al. 2019; Mikwamba et al. 2021; Hinnou et al. 2018).

Furthermore, farmer learning is role-based. Indeed, farmers may identify as productivists (Burton and Wilson 2006), and ‘good farmers’ (Riley 2016; Burton et al. 2020), which influences their learning. Farmers who are also input suppliers and traders learn about agrochemicals to sell to other farmers and cost-benefit analysis (Homann-Kee Tui et al. 2015). This research clearly shows that farmers' learning processes (learning to solve their challenges) are influenced by their role identities; yet no one study exists that specifies how farmer role identities influence their acquisition of knowledge to address their challenges (farmer experiential learning process).

Finally, farmers' EL processes, among other things, rely on resources obtained through family interactions (e.g., information, labor, emotional support, coffee production inputs, links to training avenues, and supporting actors through family members) (Ochago et al. 2021). According to studies (Danielsen et al. 2020; Pratiwi and Suzuki 2017), family interactions increased farmers' experiential knowledge by providing resources that help farmers engage in learning activities. According to other studies, family interactions generate homogeneous and redundant knowledge within the family (Fisher 2013), inhibiting the acquisition of new knowledge outside the family (Smith, Anderson, and Moore 2012; MacGillivray 2018). There is no agreement on whether family resources help farmers learn to address their challenges, hence it is unclear how family resources affect the experiential learning process.

1.4.2. Research questions

This Ph.D. thesis aims to 1) explain coffee farmers' experiential learning process in Innovation platforms, and 2) determine the effect of innovation platform governance mechanisms, farmer role identities, and farm family resources in their experiential learning process. Using Ugandan coffee Innovation platforms as the empirical backdrop for this study, I attempted to contextualize farmers' experiential processes. Following a mixed-methods sequential-embedded approach, the research questions inform each other in the overall description of the thesis setup.

Research question 1 (chapter two): How are the challenges of coffee farmers transformed into experiential knowledge? To answer this question, I explored the process by which coffee farmers' knowledge development results from learning activities when confronted with challenges.

Second research question (chapter three): What effects do IP governance mechanisms have on the process of farmers' knowledge development because of performing activities when confronted with challenges? In this study, I argue that indirect relationships between farmers' value chain challenges and experiential knowledge generated through learning activities may be conditional on-IP governance mechanisms.

Third research question (chapter four): What are the implications of farmers' role identities on the process of their experiential knowledge development because of performing activities when confronted with challenges?

Fourth research question (chapter five): What are the effects of farmers' farm family resources on their experiential knowledge development process because of performing activities when faced with challenges?

1.5.Research context, data, and methods

1.5.1. Description of study context

The research was carried out in the districts of Kapchorwa, Manafwa, and Namisindwa in Uganda's Eastern region's Sebei and Bugisu subregions (Figure 3). The district of Kapchorwa is divided into seven sub-counties, Namisindwa has seven sub-counties, while Manafwa has 10. Kapchorwa, Manafwa, and Namisindwa have population estimates of 113,500, 157,900, and 220,000 people, respectively, according to the Uganda Bureau of Statistics (UBOS 2017).

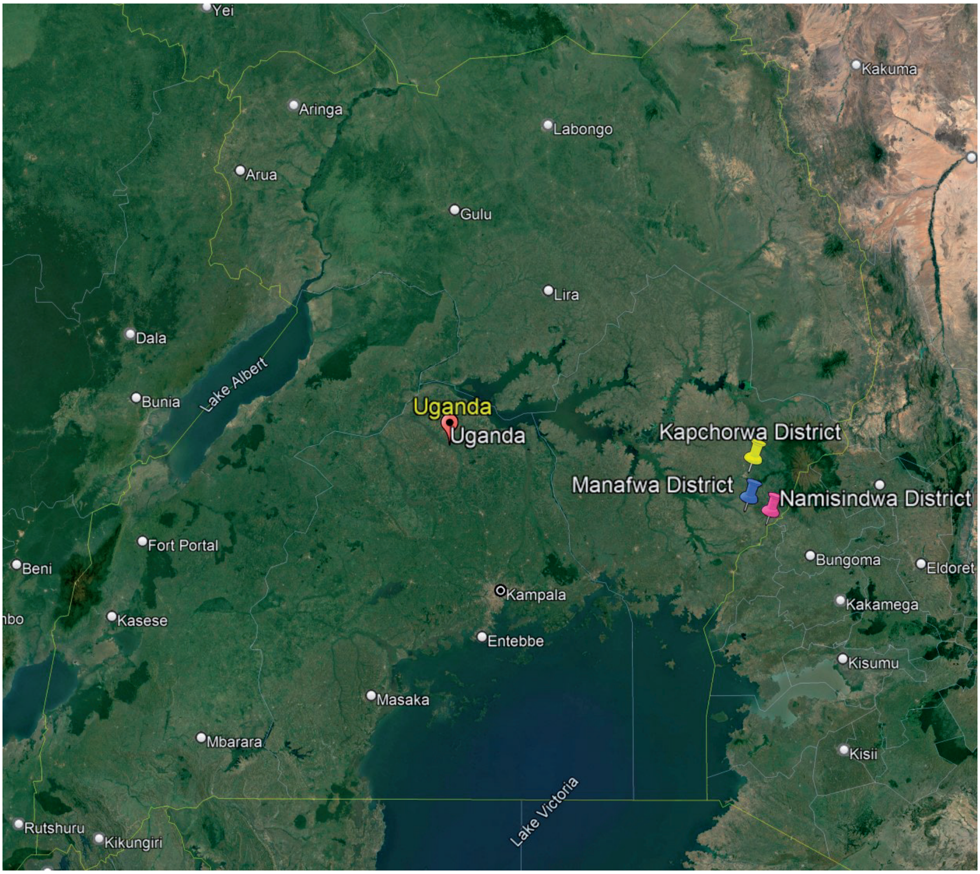


Figure 3: Map of Uganda showing the study sites

Agriculture is the area's principal economic activity, which is divided into three zones: highland, midland, and lowland. These topographical zones determine the types of farming operations that farmers engage in, as well as the crops that are farmed. The highlands and midlands are dominated by coffee and bananas, while the plains are dominated by maize and bananas. Coffee is grown by smallholder farmers[2] on plots of less than one acre, which are frequently intercropped with bananas (Jassogne, Lderach, and Van Asten 2013). Coffee yields in Kapchorwa range from 1556 kg/ha to 1776 kg/ha in Manafwa and Namisindwa. When maintained appropriately, the average yields for Arabica coffee in both districts are less than

[2] Smallholders are farmers who own small pieces of land and rely almost completely on family labor to raise subsistence crops and one or two cash crops. They are defined by their restricted resource endowment. Because of smallholder farmer's restricted resource endowment, the terms "family farm" and "smallholder farm" are frequently interchanged. See (Kostov, Davidova, and Bailey 2019; Garner and de la O Campos 2014; Lowder, Skoet, and Raney 2016).

the national average of 2000kg/ha. The high prevalence of insect pests and diseases is principally responsible for the low output potential (Judith Oduol 2017). This is an example of a complex coffee-growing challenge that necessitates several solutions. A range of stakeholders is involved in complex farming challenges, which have multiple dimensions and are founded on relationships across varied social environments (Schut et al. 2015). Therefore, a wide range of stakeholders has embraced the coffee value chain approach as a solution to farmers' challenges (Kaplinsky, Terheggen, and Tijaja 2011; Collins, Dent, and Bonney 2016; Ponte et al. 2014; Horton et al. 2017; Maru et al. 2018; Bisseleua et al. 2018). The most common method of operationalizing coffee value chains in low-income countries is through innovation platforms (IPs) (Pali and Swaans 2013; Camacho-Villa et al. 2016; Kilelu, Klerkx, and Leeuwis 2014).

So, coffee IP farmers in Uganda's primary coffee-growing districts of Kapchorwa, Manafwa, and Namisindwa were researched to contribute to ongoing discussions about, IP governance farmers' role identity, access to farm family resources, and farmer learning. Farmers interact in IPs, which are dynamic learning environments that aid farmers in their efforts to innovate. Simultaneously, there is a great deal of variation among IPs in Uganda, both in terms of supporting services and organizational structure and membership.

1.5.2. Research design

The case study research approach was used in the study, and both quantitative and qualitative data were collected. The research was divided into two stages. Following sequentially embedded mixed methods, phase one extensive interviews with farmers inspired the formulation of a phase two questionnaire (Creswell and Clark 2017; Harrison, Reilly, and Creswell 2020). The first phase of the study was exploratory and focused on the qualitative aspects of the study, while the second phase concentrated on the quantitative aspects. The qualitative phase involved a sequence of three sub-steps i.e., key informant interviews (KIIs), focus group discussions (FGDs), and follow-up interviews (FI) using interview checklists I generated based on existing literature (Appendices 1 & 2). Qualitative techniques yielded data on the aspects highlighted in table 1. In phase two, I examined the effect of IP governance mechanisms, role identities, and farmers' family resources on the experiential learning process of smallholder coffee IP farmers (Appendix 3). Table 1 summarizes the research design by demonstrating the logical relationships between the research components, which include research dimensions/chapters/research questions, data required and collection methods, and data analysis procedures.

Table 1: Research design

Phases		Data source	Checklist type	Data collected	Specific data collected and the study dimension or chapter/research question	Analysis procedure
Phase one	Step 1	Research Assistant under the VIP4FS project	KII Tool-Appendix 1a	Qualitative	Experiential learning (RQ 1/Chapter 2) -Farmers' challenges IPs seek to address -Farmers' challenges solving learning activities of the IPs -Farmers learning (challenges-learning activities-knowledge) situation before IP formation, after and five years from now IP governance mechanisms (RQ 4/Chapter 5) -IPs key attributes, Attributes of an active IP	Content analysis
		Follow-up interviews with the district focal persons working with IPs	KII Tool-Appendix 1b	Qualitative	Experiential learning (RQ 1/Chapter 2) -Individuals and organizations helping farmers address their value chain challenges in IPs and learning support offered to farmers -Individuals and organizations that hindered farmers to address their value chain challenges and how, -Remedies to negative relationships between farmers and individuals/organizations	
		Innovation platform facilitators	KII Tool Appendix 1c	Qualitative	The experiential learning process (RQ 1/Chapter 2) Experiences i.e., challenges at production, harvesting, postharvest handling and coffee processing, and marketing Learning activities (reflection and active experimentation) production, harvesting, postharvest handling and coffee processing, and marketing -Individuals and organizations involved in farmers' learning activities and the support accorded Learning outcomes-value chain experiential knowledge acquired i.e., production, harvesting, postharvest handling and coffee processing, and marketing	

					<u>Farmer identities (RQ 4/Chapter 4)</u> -How farmers in IPs define themselves -Identities changes and through which process -What do farmers like about the new roles -Individuals and organizations that helped develop new farmer role identities and how	
					<u>IP governance mechanisms (RQ 2/Chapter 3)</u> -How IPs are organized i.e., goals, membership criteria, values, resource pooling, and coordination tasks	
	Step 2	Farmers at the FGD level	FGD checklist -Appendix 2	Qualitative	<u>Experiential learning process</u>	
	Step 3	Follow-up interviews at individual farmers' level	FI checklist-Appendix 2	Qualitative	<u>Experiential learning process</u>	
Phase two		Farmers	Survey questionnaire-Appendix 3	Quantitative	<u>Farmer experiential learning process</u> 1. Farmers' challenges at production, harvesting, postharvest handling and coffee processing, and marketing -Challenges to the knowledge transformation process -Reflection i.e., current knowledge the farmer reflects on and other value chain actors the farmer interacts with -Active experimentation i.e., use their existing coffee value chain challenges solving knowledge and value chain actors the farmer interacts with -Experiential knowledge i.e., value chain actors the farmer got to know, and farming methods 2. Farmers' access to IP governance mechanisms, role identities, and family resources as moderators for the experiential learning process	PLS-SEM

1.5.3. Target population and sampling procedures

1.5.3.1. Target population

Farmers in coffee Innovation Platforms are the target population (Figure 4). IPs represent dynamic learning environments that support the adoption of innovations and where farmers interact. At the same time, there is a lot of heterogeneity among IPs in Uganda, in supporting services as well as in structure and membership. This is more advantageous since it gives a more level playing field for evaluating farmer learning than selecting individual farm households. Finally, due to their horizontal and vertical connections, the innovation platforms are currently the most popular farmer grouping.

1.5.3.2. Sampling

1.5.3.2.1. Qualitative data

Starting with the districts and working my way up to the target respondents, I used a multi-stage sampling approach. The sampling process involved six steps. First, using a purposive non-random sampling technique, I chose three districts for their robust coffee supply chains (over 100,000 tons per year) and continuing capacity-building initiatives using an innovation platforms strategy. Although snowball sampling has the potential to favor one group over another, it is often employed in qualitative agricultural research to target farmer participants who may be difficult to reach or who are knowledgeable. Second, in each district, I purposefully selected six to ten sub-counties for interviews. Through a snowballing technique, the third step of sampling involved locating relevant key informants to determine farmers' experiential learning process and other relevant IP aspects that shape farmers' EL. The starting point was at the VIP4FS coordination regional office-Makerere University and thereafter to the coordination offices/points at the district level. The research assistants at Makerere University's Value chain Innovation platforms for food security (VIP4FS) project coordination office provided me with a list of 450 coffee IP farmers, which I later validated with the district IP coordination team (IP facilitators/coordinators/chairpersons) during a one-day meeting. This continued until the appropriateness of the collected data was attained (O'reilly and Parker 2013; Fusch and Ness 2015).

With the help of key informants, in the fourth step, I generated the lists of IP facilitators/coordinators/ chairpersons for each district to capture the study's overall aspects. After learning about the study's goals, together with each district IP coordination team (the IP facilitators/coordinators), we developed a list of potential FGD participants during a one-day meeting. From each IP, four people were chosen purposively. Three IPs were selected per district totaling 12 participants for a district-level focus group discussion through a snowballing technique. I used the remaining IP members from the preceding list of members for FGDs to pick participants for individual interviews. In the fifth step, I used the snowballing technique to select participants for individual follow-up interviews with the help of key informants. As a result, 48 IP members were chosen to further triangulate the FGDs. I chose 6 key informants, 43 FGD participants, and 48 IP members at the end of this process (Figure 4).

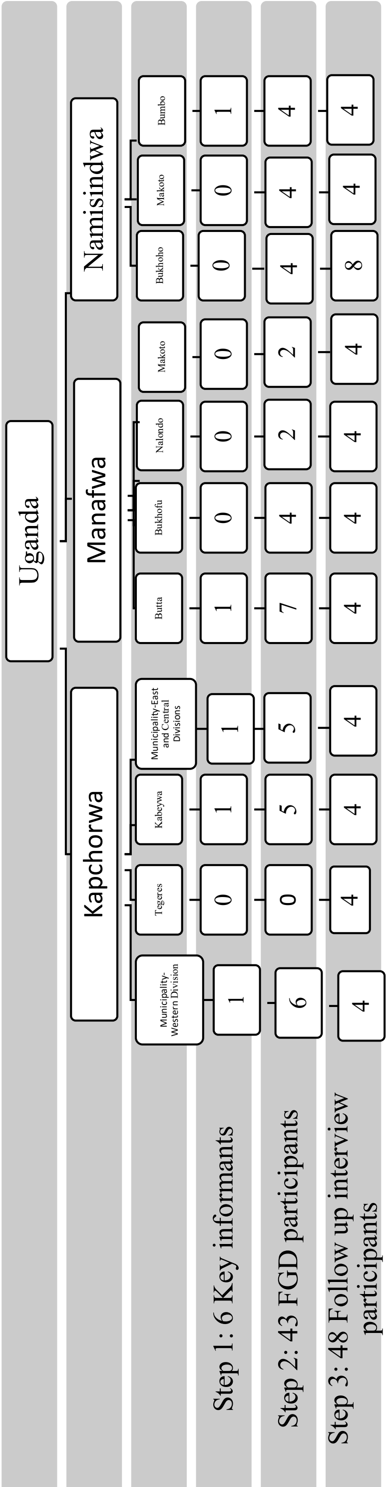


Figure 4 Respondents interviewed during the qualitative phase

1.5.3.2.2. Quantitative data (Survey)

As the sixth step, I used the sample framework (a list of 450 coffee farmers) to select a random sample for the survey (quantitative data collection). I used a stratified random selection approach to choose survey participants from a list of 450 (the sample framework). Then I sorted the names and used Excel's RAND function to choose every second name on the sheet. A total of 214 people (Table 2) were chosen to participate in the survey.

Table 2: Respondents interviewed in phase two (survey)

District	Sub County	Quantitative (Survey)
Kapchorwa	Municipality-Western Division	8
	Tegeres	1
	Kabeywa	12
	Municipality-East and Central Divisions	12
	Chema	24
	Kapteret	6
	Chebonet	5
	Kapchesombe	3
	Sipi	3
Manafwa	Butta	24
	Bukhofu	17
	Khabutoola	18
	Luwa Town Board-Mukoto	8
	Bukhofu-Bukusu	4
Namisindwa	Bukhoho	16
	Bumbo	43
	Namweru	1
	Bunamulingi	7
	Mukhuyu	2
3 Districts	**19 Sub Counties**	**214**

1.5.4. Data collection tools

1.5.4.1. Qualitative data collection tools

Three types of data-collecting checklists were used: key informant interview, focus group, and individual follow-up interview checklists (Appendices 1, 2 & 3). Based on existing literature, I created three checklists in sequential order: the key informant interview checklist informed the FGD, which in turn informed the individual follow-up interview checklist. Following checklist development, a group of specialists (my Wur supervisors) verified all checklists for content validity. The individual checklist was also pre-tested for applicability. Four respondents have interviewed face to face at a central location: Municipality-Central Division, Kapchorwa district. The pre-test assisted in gauging the interview duration, question clarity, and a shared understanding of interviewing code words in the local languages. As a result, the checklist for real data collection was refined.

1.5.4.2. Quantitative data collection tool

The survey questionnaire (Appendix 3) was created by me using current literature (Appendix 10). The first section (A) gathered socio-demographic information, whereas the second section (B, C1, 2 & 3) consisted of statements on which respondents were asked to express their views on a 5-point Likert scale. Likert scale items were used to investigate all study components. Respondents can express their actual feelings using Likert-type scales. Factors such as reliability determine the number of response categories on a scale (Bendig 1954; Dawes 2008; Preston and Colman 2000; Krosnick 2018). Leung (2011) found no differences in reliability, mean, or standard deviation for 4, 5, 6, and 1-point Likert-type scales. Finally, Leung (2011) discovered that, unlike 6 and 11-point scales, 4 and 5-point scales did not follow a normal distribution. In this study, I found a five-point Likert scale appears to be suitable for both the research attributes and the responders' group. Therefore, the responses were graded on a five-point scale. Appendix 8 contains the items for the variables that were constructed using the existing literature. Following questionnaire development, the questionnaire was assessed for content validity by a team of specialists (my Wur supervisors). Pretesting with a comparable group who did not participate in the study was used to assess the applicability of the structured interview instrument. Face-to-face interviews were conducted with 22 respondents (twenty by research assistants and two by me) in two central locations: Tegeres Sub County, Kapchorwa district, and Butta Sub County, Manafwa district. The pre-test helped to ensure interview time, question clarity, and a common understanding of the interviewing code words in the local languages. The completed questionnaires were used by the main author to create data templates and analysis of emerging results. The preliminary data analysis resulted in the refinement of the survey questionnaire for the actual data collection.

1.5.5. Data collection procedure

1.5.5.1.Qualitative data collection procedures

The interview, the most widely used data collection method due to its nature allows participants to determine the degree of information given and maintain the level of privacy (Holstein and Gubrium 2016; Silverman 2013; Bryman 2016). Interviews allow the collection of more complete and spontaneous answers through the interaction between the interviewer and the interviewee, avoiding incorrect interpretation of the questions by the interviewee (Minichiello et al., 2008). In this phase, I employed semi-structured interviews (Appendices 1 to 2). Semi-structure interviews are widely used in social studies (Bryman 2016) because they are easy to follow up, involved collective efforts of both the interviewer and the participant as well as allow participants to determine the degree of information given and level of privacy maintained (Holstein and Gubrium 2016; Silverman 2013). I collected data in three sub-phases/steps throughout phase 1 of data collection (Table 1).

1.5.5.1.1. Key informant interviews

As the first step of phase 1, primary data were gathered through semi-structured interviews. Using checklists (appendix 1), key informants were interviewed individually in their homes or offices for 1.5 hours on average to capture the overall aspects of the study (Table 1). A voice recorder was used to capture the interview/discussion and the recordings were later played to get a deeper analysis of the information gathered. The interviews with the key informants led to emerging conceptual categories of farmers' challenges that trigger learning activities, learning activities themselves besides several potential learning outcomes. It also provided background information about the IP features (Appendix 7). Also, based on the key informant interviews (KIIs), lists of IP facilitators/coordinators/chairpersons were crafted.

1.5.5.1.2. Focus group discussions level

As the second step of phase 1, FGDs aimed to gain in-depth insights that emanated from the key informant interviews. Data on farmers' experiential learning as well as the factors influencing their experiential learning were captured (Table 1). Each focus group discussion took place in a meeting room with respondents seated in a semi-circular fashion, writing supplies such as flip chart papers and different colored marker pens, and audio recording equipment were used. Audio-recording the discussion and later playing allowed a deeper analysis of the conversations. With my support, each FGD was facilitated in a central location by two trained research assistants: a moderator and a note-taker. These started with a brief about the exercise to ensure participants are aware of the information to be collected, the approach, and what the collected information will be used for. Ground rules such as only one person should speak at a time; there is no right or wrong answer; one doesn’t have to agree with what another person says, all views are important, and one should feel free to share his or her individual experience during discussion guided the discussions. Participants were asked to speak freely about their responses in their native tongues (Kuksabin, and Lugisu). I acted as an observer and took independent notes on the discussion. During the discussion, the most dominating participants/speakers were men, model/contact farmers, traders, processors, opinion leaders, or those with leadership roles. These were educated, financially stable, or have well-managed coffee fields, well informed, and networked. To achieve consensus, a hand vote with at least half the participants won. Data was collected and analyzed from 43 FGD participants at the end of this process (Figure 4).

1.5.5.1.3. Follow-up interviews at the individual level

Finally, in the third step of phase 1, topic areas from FGD were replicated at the individual coffee farmer level. Each research assistant conducted a face-to-face interview with a respondent at their home during this round of data collecting. The interview place was chosen by the respondent who alerted the field guide who in turn led the research team to the venue. Each interview lasted about 2 hours. Interview results were written down in notebooks and audio recorded. Data was collected and analyzed from 48 IP members at the end of this process (Figure 4). Through back-and-forth between data analysis and data collection (Gioia, Corley, and Hamilton 2013), I was able to determine the number of interviews using the saturation logic (Yin 2018).

1.5.5.2.Quantitative data collection procedures

In phase two, a total of 214 respondents (Table 2) were interviewed by research assistants for an average of 1 hour and 15 minutes each using a standardized survey questionnaire that was content validated. Like phase 1(qualitative interviews) I only interviewed during the first and midway of the interviews for each district as a quality measure and to formalize how I would later analyze this data. I held two separate training for the 16 research assistants (one for kuksabin speakers and the other for lugisu), interviewed respondents alongside my research assistants, and conducted a preliminary analysis of the data which led to refining the survey tool for the actual data collection. Appendix 11 contains the items for the variables that were generated using existing literature.

1.5.6. Data analysis

1.5.6.1.Qualitative data analysis

All interviews were fully transcribed, and I coded them using Atlas ti 8, a qualitative data analysis program. Because this research is only loosely influenced by previous literature, I applied the Gioia technique (Gioia, Corley, and Hamilton 2013). The coding was influenced by data iterations, established literature, and continuing fieldwork. In three coding rounds, I constructed codes from words and concepts often cited by participants during interviews. The initial stage of open coding required sifting through the data sentence by sentence and transcript to assign meaning to text chunks such as phrases, sentences, words, and entire paragraphs (Corbin and Strauss 2014). First-order codes describing the farmers' EL, roles, and farm family resources were created using words and concepts often expressed by participants during interviews. Then, second-level codes were created by merging first-order codes based on their similarities in terms of meanings and themes (see appendices 4a to b). Finally, code groups established the overall theoretical dimensions (see appendices 4a to b). Patterns within and between cases were considered during data analysis (Miles, Huberman, and Saldana 2019).

1.5.6.2.Survey data analysis

To analyze quantitative data, I used IBM SPSS version 23. Before beginning the data analysis, I checked missing values and revised negatively worded items and codes in the SPSS data display section for preliminary completeness or data omissions. I converted the data set to CSV file format after data editing, which is compatible with the statistical software SmartPLS 3. PLS-SEM is a nonparametric variance-based approach commonly used for studying complicated interrelationships between observable and latent variables in a variety of fields, including agriculture and psychology (Willaby et al. 2015). PLS-SEM provides advantages when working with complex models, non-normal data, and small samples (see Hair et al., 2019 for more information), and it is especially well suited to models with higher-order components (Hair Jr et al. 2017). The PLS-SEM algorithm allows the computation of measurement and structural model relationships. In short, the algorithm computes partial regression links in the measurement and structural models using distinct ordinary least squares regressions, as the name implies. Hair Jr et al. (2022) state that the evaluation of the PLS-SEM results is done in two consecutive steps: The structural model is evaluated once the measurement model has been evaluated. The measurement model is interested in the relationship between a latent variable and its indicators. The measurement model includes the evaluation of the reflective constructs in terms of internal consistency reliability, indicator reliability, convergent validity, and discriminant validity. A structural model, on the other hand, defines the relationship between the constructions in a model. The structural model is evaluated by estimating the explained variance (R^2) and the out-of-sample predictive relevance (Stone-Geisser-Q^2). The Stone-Geisser-Q^2 is calculated using the blindfolding procedure with omission of 10. Because PLS-SEM is a non-parametric estimate approach, a re-sample bootstrapping procedure is required to allow for hypothesis testing.

Before testing the hypothesis, I first run algorithms to validate measurement reliability and validity before looking at structural model links. The measurement model displays outer loadings, Cronbach alpha value, composite reliability, and average variance. The structural model displays coefficients, P-values, confidence intervals, and the estimation of the explained variance (R^2) (Hair, Risher, et al. 2019; Hair Jr et al. 2022). I bootstrapped all stages using a 5,000-resampling approach to generate 95 percent confidence intervals for significance testing. I used the standard error and covariance matrix estimator with heteroscedasticity. All product-defining aspects were mean-centered, including IP governance mechanisms, farmer role identities, farm family resources, challenges, reflection, and active experimentation.

1.5.7. Validity and reliability

1.5.7.1. Qualitative data

The robustness of the questionnaire, namely whether it will provide consistent results at different times and under varied settings, such as with different samples or with different interviewers, is referred to as reliability. I was open-minded and conscious of the inescapable subjectivity when outlining the research methodologies. In addition, I kept meticulous records of the data collection procedure and made certain that interviews were conducted with many participants to allow for cross-case comparison. Still, when I categorized the data on my own, I solicited comments on preliminary findings from colleagues and supervisors.

The ability of an instrument to measure what it is designed to measure is characterized as validity (Blumberg et al., 2014; Creswell, 2014). To ensure the quality and credibility of the research, essential concepts such as experiential process were extracted from Kolb's experiential learning cycle, as well as other known agricultural and context-specific literature. First, for construct validity, I used the triangulation method—the utilization of numerous sources of information. The current thesis has concentrated on data triangulation and theory triangulation. I ensured data triangulation by using a variety of sources, whereas theory triangulation was achieved by adapting and applying experiential learning, identity, and IP theories in the rural farm context and from various perspectives, such as disentangling the components of the EL process and texting the relationships between farmers' family resources, role identities, and IP governance mechanisms, and farmers' EL process. Moreover, I did a thorough review of the literature, including books and papers, to lay the groundwork for the collection of empirical evidence (see section 1.3).

Second, before being pre-tested (Bryman & Bell, 2015) for suitability (clarity and logical flow of the questions and duration of the interview) on a comparable population in an area that did not participate in the study, all tools I created were approved for content validity by a panel of experts (wur supervisors).

Third, I analyzed the data using a variety of sources (opinion leaders, extension agents, Innovation platform leaders, coffee farmers, traders, wash station leaders, and so on), multiple methods (KIIs, FGDs, FIs), a team of researchers (Wur supervisors/experts, myself, research assistants, VIP4FS project contact persons).

Finally, I ensured the quality of the data by thoroughly training competent research assistants in local dialects. Every day after the data collection operation, I held team debriefs to exchange lessons and challenges to guarantee that the interview checklists were consistently interpreted. Furthermore, to improve question comprehension, technical jargon was avoided, and simple language was used throughout the interviews. Furthermore, interview data were transcribed and cross-checked by members of the research team (myself, research assistants, and field contacts/guides) to guarantee consistency and transparency. For later analysis, all interviews were both manually (through notebooks and/or flip charts) and electronically recorded.

1.5.7.2.Quantitative data

Before analyzing structural model linkages, I conducted PLS-SEM procedures to ensure measurement reliability and validity. Hair, Risher, et al. (2019) have well-documented methodologies for assessing loadings, Cronbach's alpha, composite reliability, ρA, the average variance extracted (AVE), and discriminant analysis for reflective components. All Cronbach's coefficients and rho_A (ρA) values were more than 0.7, suggesting internal consistency and reliability, as seen in chapters 3, 4, and 5 (Hair Jr et al. 2017). Most of the loadings in Appendix 8 were good and highly significant ($p<0.01$). Whereas some indicator loadings were less than 0.7, they were kept since the composite reliabilities of the structures are above the acceptable criteria of 0.7 (Hair, Ringle, and Sarstedt 2011). This outcome demonstrated that the indication was accurate (Hair Jr et al. 2017). Furthermore, all AVE values were more than 0.5, indicating high convergent validity. The bootstrapping approach with 5,000 samples, the no sign changes option, the bias-corrected and accelerated (BCa) bootstrap confidence interval, and two-tailed testing at the 0.05 level were used to assess discriminant validity (Aguirre-Urreta and Rönkkö 2018; Cheah et al. 2019). Tables 6 (chapter 3), 9 chapter 4 & 15 (chapter 5) show that the heterotrait-monotrait (HTMT) values were less than the 0.85 conservative criterion (Henseler, Ringle, and Sarstedt 2015). These data demonstrated discriminant validity (Hair Jr et al. 2017).

1.5.7.3.Ethical considerations

Because the current study featured coffee farmers expressing their personal experiences (Kvale & Brinkmann, 2009), I considered ethical issues. Before conducting the interviews, the following factors were carefully considered (Bryman & Bell, 2013). While I did not write a formal letter, I enlisted the help of familiar faces, such as VIP4FS project staff and other community members, in obtaining respondents' permission for interviews to be conducted, recorded, and responses to be validated by them, and for the data to be used for the current research and related publications. This was the case since I have extensive experience with the research site, where I met certain contacts and respondents as early as 2012 during data gathering for my master's degree.

1.6.Thesis outline/structure

The structure of the thesis is described below (figure 5). Chapter 1 provides a general introduction. Chapters 2, 3, 4, and 5 go into the research themes of the study. Chapter 6 deals with the discussion and wraps things up.

The second chapter examines qualitatively how coffee farmers' experiences were transformed into experiential knowledge. This question demonstrates that farmers' knowledge to address their challenges is a result of engaging in activities that result in challenges. Moreover, building on the notion that IPs mean to provide a safe environment for actors to experiment and explore solutions to their shared challenges, this chapter also determines how IP processes influence the process of farmers' knowledge development because of performing activities when confronted with challenges. Through linking Kolb's theory of experiential learning and the IP theory(systems thinking), this chapter uses an inductive approach, drawing on Gioia, Corley, and Hamilton (2013) to understand how farmers learn from experiences. Hence, this chapter advances experiential theory in the context of agriculture by proposing a model for how IPs can expedite farmers' experiential learning processes based on challenges encountered.

Chapter three analyses the moderating effect of the IP governance mechanism on farmers' experience of knowledge transformation. The survey design was based on qualitative data. In the setting of rural coffee value chains, this chapter connects Kolb's theory of experiential learning and IP theory to farmers' experiential learning processes.

The fourth chapter expands on the qualitative findings of chapter two by examining the impact of farmer role identification on farmers' challenges (experiences) with the knowledge transformation process. By linking Kolb's theory of experiential learning and the identity theory, I used a combination of qualitative and quantitative methodologies This chapter demonstrates that farmers have many identities, that the coffee farmer identity acts as a springboard to new identities, and that identity-building is a social learning activity by integrating the farmer identity and experiential learning theories.

Chapter five examines the moderating role of farm family resources on farmers' transformation of challenges into experiential knowledge. In this chapter, I applied quantitative approaches by connecting Kolb's theory of experiential learning and the social network theory. The chapter demonstrates how the availability of family resource support can potentially increase experiential learning by integrating the family embeddedness perspective—a nuanced lens of the social embeddedness perspective (Granovetter 1985; Granovetter 1973) that focuses on embeddedness within the specific context of family ties and experiential learning theorization—into the chapter.

Chapter six gives a general discussion, conclusion, and recommendation. This chapter expands on the primary findings by synthesizing them, exploring their theoretical, practical, and policy implications, and suggesting future research. As a result, section 6.1 concentrates on the main findings and discussions of the primary study questions. Section 6.2 adds to the literature on smallholder coffee farmers' experiential learning process and the impact of their social setting from the perspectives of theory, practice, and policy. Section 6.3 identifies future research areas.

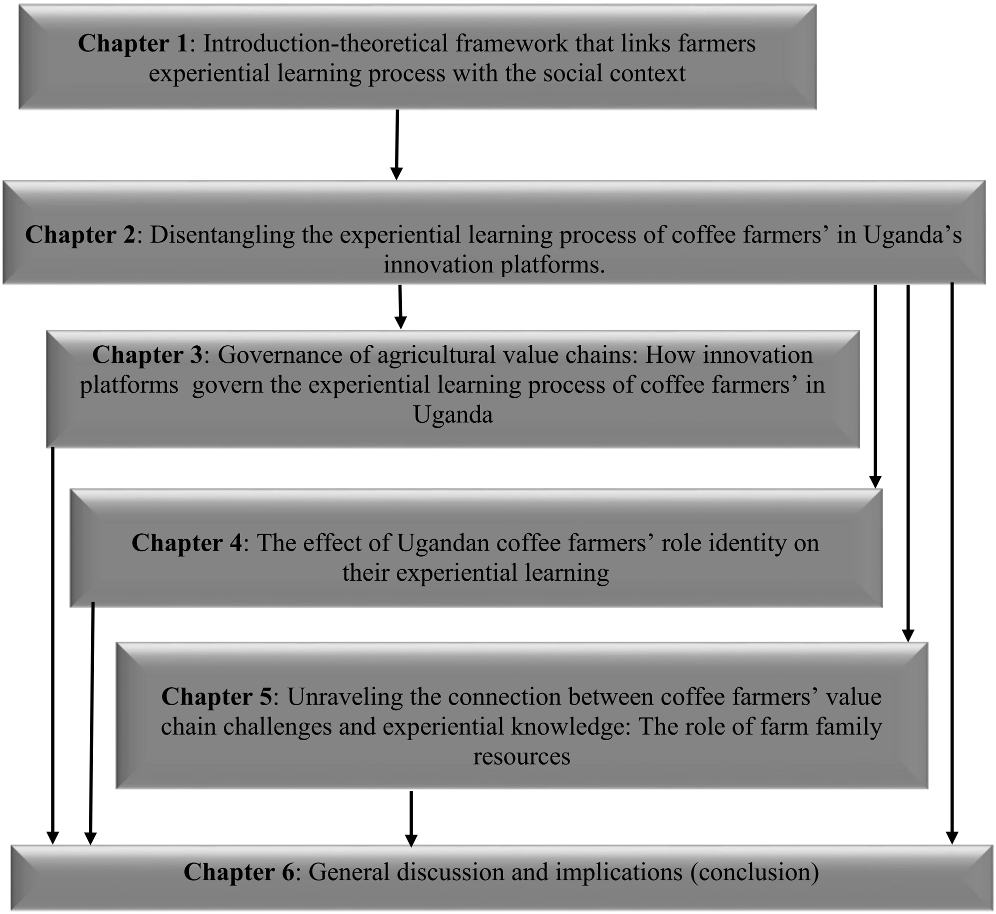
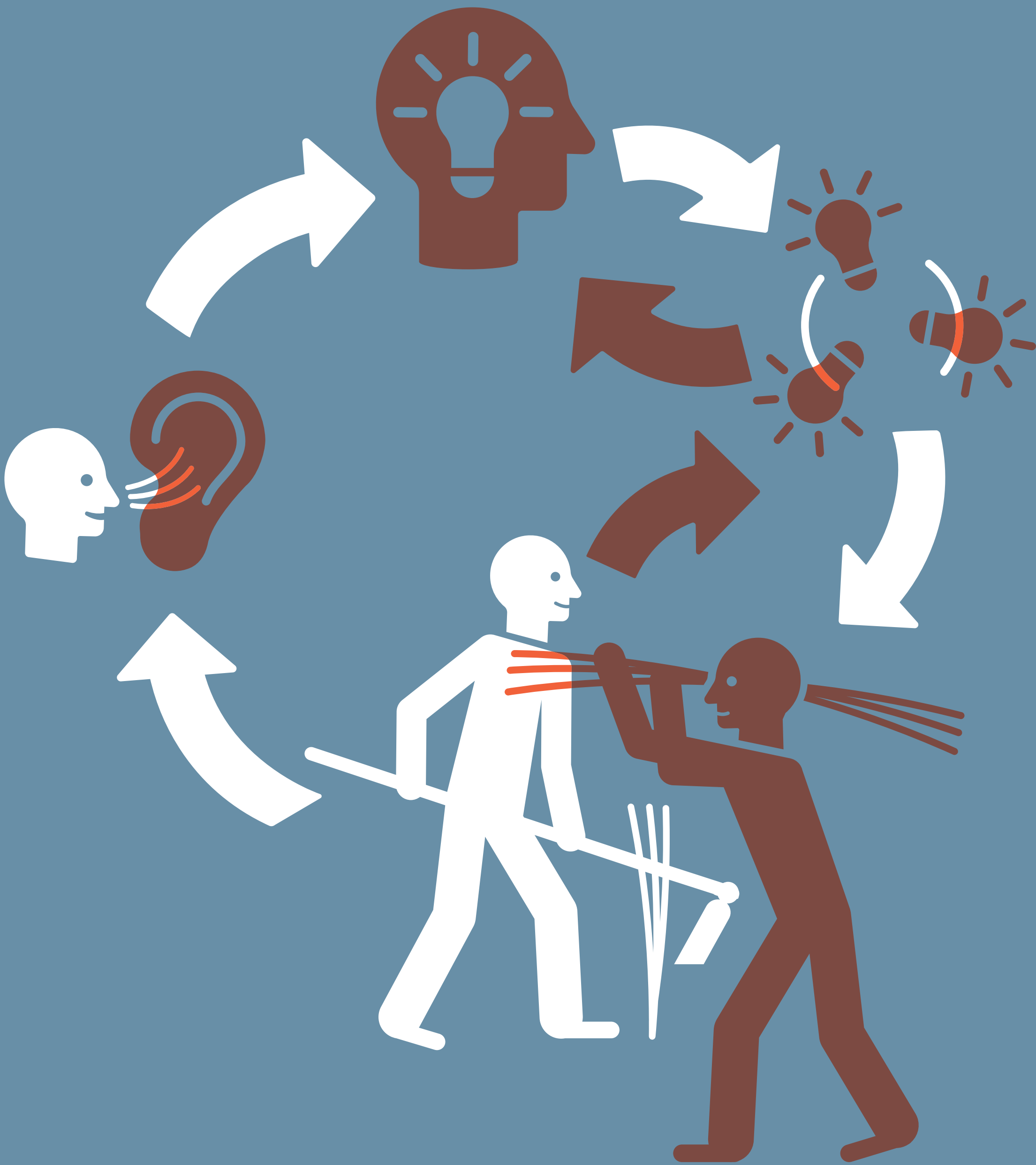


Figure 5: Ph.D. outline/structure



2

Disentangling the experiential learning process of coffee farmers in Uganda’s innovation platforms

Abstract

Purpose: While new rich learning opportunities emerged through the introduction of Innovation Platforms (IPs) in agricultural value chains, the extent to which IPs enhance farmer experiential learning is still unclear.

Design/methodology/approach: This paper brings clarity to the above question by interviewing 91 coffee IP farmers. Data were analyzed through content analysis to generate overarching themes for farmers' experiences, learning activities, and outcomes.

Findings: Results reveal that participation in IP learning activities generates farmers' knowledge to cope with coffee value chain challenges. Specifically, farmers' making meaning of challenges and generating new solutions represents an iteration between individual critical reflection and experimentation of value chain activities. The IPs facilitated multi-directional knowledge flows among farmers by mobilizing necessary resources.

Practical implications: As many Sub-Saharan Africa (SSA) governments cannot provide sufficient extension support, farmers increasingly rely on IPs whose processes stimulate members' learning commitment and endeavors. Nevertheless, Governments can use these findings to tailor the design and implementation of IPs to farmers' experiential learning processes.

Theoretical implications: The study contributes to experiential theory in the context of agriculture by advancing a model on how IPs can accelerate farmers' experiential learning processes based on the challenges experienced.

Originality/value: This article extends knowledge of experiential learning in the IP context.

Keywords: Agriculture; coffee value chains; social networks; multi-stakeholder platforms; extension approaches; problem-based learning

This chapter is based on: Robert Ochago, Domenico Dentoni, Thomas Lans & Jacques Trienekens (2021): Disentangling the experiential learning process of coffee farmers in Uganda's innovation platforms, The Journal of Agricultural Education and Extension, https://doi.org/10.1080/1389224X.2021.1977664

CHAPTER TWO: Disentangling the experiential learning process of coffee farmers in Uganda's innovation platforms

2.1. Introduction

The coffee value chains in Sub-Saharan Africa (SSA) largely depend on smallholder farmers, who face numerous challenges such as high pests and disease incidences. Mainly attributed to farmers' limited coffee protection knowledge and practice arising from structural problems such as weak extension support, several extension approaches have been employed to address farmers' challenges with minimal success (Amankwah et al. 2015). Participatory approaches to extension, for instance, have failed to recognize the importance of multi-stakeholders involvement in new knowledge introduction and utilization (Akpo et al. 2015). Consequently, innovation platforms (IPs) emerged (Pali and Swaans 2013) under different names and heterogeneous forms (Camacho-Villa et al. 2016; Kilelu, Klerkx, and Leeuwis 2014). Unlike other commonly used extension approaches to knowledge sharing among actors in the Agricultural Knowledge and Innovation System (AKIS), such as innovation networks, innovation partnerships, and multi-actor innovation, IPs are structured physical interfaces among farmers where they tap into the capacities of diverse stakeholders to learn how to diagnose their context-specific problems (Homann-Kee Tui et al. 2013). For example, low yields due to a lack of productivity-enhancing technical knowledge and skills; (2) poor produce quality due to poor postharvest handling practices; and limited access to markets due to a lack of information (Kelly, Bennett, and Starasts 2017; van Rooyen et al. 2017). Cost-effective IPs rely on farmer-to-farmer (Davis, Franzel, and Spielman 2019; Simpson et al. 2015; Akpo et al. 2020) and social learning methods (Vasilaky and Leonard 2018; Takahashi, Muraoka, and Otsuka 2020) where farmers learn among themselves (Mahiya 2021). Each stakeholder contributes to the platforms their previous experiences, knowledge, and other resources (Mahiya 2021). Hence, IPs are ideal tools for addressing complex value chain challenges in a holistic manner (Flor et al. 2016). IPs may comprise farmers, processors, traders, transporters, input suppliers, output handlers, policymakers, extension agents, researchers, and non-governmental organizations (NGOs) depending on the problem they are addressing (Fatunbi et al. 2016b). The composition of the IP changes after a specific challenge has been addressed or as members take on a new challenge (Davies et al. 2018), when new stakeholders are added to address the new or emerging challenge and others exit (Ampadu-Ameyaw, Omari, Essegbey, and Dry 2016).

While a wide literature explores the functioning and impacts of IPs in SSA, little research focuses on how IPs enable farmer learning to solve their challenges (Schut et al. 2019; Probst et al. 2019). Notwithstanding, the most important learning outcome for farmers in the IPs are knowledge and skills (Brouwer et al. 2019). In IPs, farmers access knowledge and skills on crop and livestock production and value addition - along with information on inputs, credit, and markets (Mulema and Mazur 2016)-by attending training, meetings, workshops, exchange visits, and demonstrations. Thus, IPs facilitate multiple actors' engagement in learning activities. As facilitating entities, IPs help farmers to understand their common challenges, assist them to search for solutions, and make plans to realize them (Sanyang et al. 2014). Yet, a question that has persistently remained unanswered involves: how do IPs support farmers in developing knowledge and skills to make sense of and address their production, postharvest handling, and market challenges?

The literature gives, so far, only gives partial answers to this broad question. Nevertheless, value chain-based IPs identify and address commodity-specific challenges from production through to obtaining a marketable product or consumption (Magala, Najjingo Mangheni, and Miiro 2019). These IPs mainly support the following farmers' endeavors: (1) identifying challenges and potential solutions; (2) testing and refining solutions; and (3) developing the capacity to implement solutions (Probst et al. 2019). However, this support is not always successful (Faysse 2006; Warner 2005) because supporting actors in addressing specific challenges require a deep understanding of farmers' experiential learning (EL) (Gorman 2019; Pant 2012). Kolb defined EL as a context-specific process of knowledge creation through experience transformation. It involves an integrated functioning of thinking, feeling, watching, and doing (Kolb and Kolb 2005). EL represents a hands-on process to address complex challenges in which the process does not always unfold spontaneously and smoothly (Manolis et al. 2013). Addressing challenging experiences may increase farmers' attention, information, and knowledge, but also trigger negative emotions such as anxiety, fear, self-doubt, and distrust which may hinder knowledge development from experience (Vince 2010). To date, research does not shed light on if, when, and how farmers learn effectively from challenging experiences.

Therefore, this paper investigates qualitatively how coffee farmers in IPs learn from challenging experiences in their coffee value chain work. The coffee sector represents an interesting rural context where IPs were introduced to stimulate the development of agricultural enterprises (Magala, Najjingo Mangheni, and Miiro 2019). Complementing the notion that IPs mean to provide a safe environment for actors to experiment and explore solutions to their joint challenges (Adjei-Nsiah and Klerkx 2016), this paper seeks to contribute to a theory on how IPs facilitate and enable farmers' EL.

2.2. Theoretical underpinnings

Where publications on EL have more than quadrupled in the last 20 years (Kolb 2015), little of this research has empirical nature (Bergsteiner, Avery, and Neumann 2010; Jarvis 2012). In existing research, Kolb's EL theory is widely used to explain how learning occurs over time (Seaman, Sharp, and Coppens 2017; Tomkins and Ulus 2016; Kisfalvi and Oliver 2015). Kolb defined EL as the process by which knowledge is created through the transformation of experience incongruent with the environment (Kolb 2015; Kolb and Kolb 2009). Kolb's definition indicates four interlinked concepts: (1) the experiences, (2) the transformation of the experiences, (3) the knowledge created, and (4) the environment.

2.2.1. Experiences (challenges)

According to Roberts (2018), "experience" means "to test" and "to risk" as per its Latin language root. The EL process integrally involves risk, as it incorporates unique, context-specific, and ill-structured challenging experiences (Blair 2016; Asfeldt and Beames 2017). In their learning, farmers usually find solutions to expected experiences either through active experimentation, i.e., direct performing activities meant to address challenges or, indirectly, through interacting with others. Additionally, farmers find solutions to unexpected experiences or unplanned events (Krumboltz 2009). Thus, the emphasis of the concept of EL is on problem-solving (Miettinen 2000). Therefore, in line with the first of the four interlinked concepts, this study first tries to identify what challenging experiences trigger farmers' EL.

2.2.2. Making sense of challenges (experiences)

The complex nature of challenges solving involved with EL demands higher-order thinking (Collins, Sibthorp, and Gookin 2016). Thus, farmers may develop solutions to their challenges by watching what others do and thereafter perform a reflective analysis of their challenges before acting. The reflective analysis encompasses the identification of expected and unexpected challenges, root causes, and solutions (Miller and Maellaro 2016) i.e. what, how, and why it happened (Wilson and Beard 2013). Resulting from reflective analysis is abstract conceptualization, where lessons are extracted and conclusions are drawn through identifying the challenges' root causes, and solutions (Miller and Maellaro 2016), and proposing methods of action (Korthagen 2005). Thereafter implementation of solutions and alternative methods of action (active experimentation). Alternatively, farmers may also act directly or start solving challenges immediately as a direct reaction to a challenge (Kayes, Kayes, and Kolb 2005). In this process, farmers try to apply the existing knowledge to solve current (abstract conceptualization) and future challenges (active experimentation). To which transformation mode coffee farmers engage is still indistinct. In line with the four interlinked concepts, the study, secondly, tries to capture the exemplary learning activities of farmers' EL.

2.2.3. Experiential knowledge

Johanson and Vahlne (1977) defined experiential knowledge as the knowledge only gained through personal experience. experiential knowledge creation, as described by (Newman and Conrad 2000; Martín-de Castro et al. 2011), refers to a farmer's ability to develop, discover and capture solutions to problems, such as farming practices. Referring to the Knowledge-creating theory (Nonaka and Toyama 2015), knowledge is created through reflective analysis of both individual and social experiences. Typical of the farming context, problems are multi-dimensional (ill-structured) demanding more than one solution. This often involves collective action or knowledge acquisition through dialogue, which allows further deeper critical reflection (Asfeldt, Hvenegaard, and Purc-Stephenson 2018; Collins, Sibthorp, and Gookin 2016). Subsequently, knowledge is context-specific and relational (Bose 2004; Ipe 2003). Context-specific knowledge is location and time-bounded (Smith and Segbers 2018). Relationally, the complex nature of solving challenges demands knowledge development through social interactions (Harper 2018; Blair 2016) and application based on one's judgment and experience (Grant 2007). Hence, knowledge relates to one's ability to align information with own experience or the experiences of others and use it to perform 'challenge solving' activities. For example, IP farmers may learn about networks as well as associated support including farming practices information and technologies (Klerkx and Proctor 2013). Even though networks are supportive, successful learning is contingent on the proper management of relationships with diverse stakeholders (Hinnou et al. 2018). Thus, farmers may learn how to manage such relationships. Finally, farmers may understand their personal strengths and weaknesses (Welch et al. 2014). Hence, as argued in line with the four interlinked concepts of EL, this study explores-thirdly the exemplary learning outcomes of farmers' EL.

2.2.4. The EL context

With the introduction of IPs, new potentially rich learning environments for EL have emerged. They are rich, because there are diverse stakeholders, and therefore IPs provide ample possibilities for getting new experiences that may lead to EL. As facilitating entities, IPs may perform two interlinked functions including mediation and moderation of farmers' EL through enabling actors to engage in reflection and experimentation (Klerkx, Hall, and Leeuwis 2009). In terms of mediation, IPs provide space for reflective analysis through jointly identifying and prioritizing farmers' challenges, root causes, solutions, and experimentation. Regarding moderation, IPs enhance actor linkages and interactions for mutual learning through supporting and governing their activities (Martey et al. 2014). IPs support actor reflective analysis and experimentation through the following: mobilizing resources such as funds, stakeholders, land, meeting venue, seeds, transport, and research technologies (Schut 2017; Kusters et al. 2018). Correspondingly, IPs govern linkages and interactions by bringing together different stakeholders, assigning roles, stimulating their interaction, and motivating them to participate in IP activities (Cadilhon 2013). Equally, IPs manage the learning process by providing space for reflective analysis and experimentation. Then, IPs generate knowledge by enhancing communication and knowledge dissemination through training, exchange visits, look and learn (observation), and experimentation (Vellema et al. 2013). Also, IPs generate knowledge through supporting farmers' access to value chain relationships by building common ground and stimulating new relationships among stakeholders (Kabambe et al. 2012; Thiele et al. 2011). For example, farmers obtain experiential knowledge from relations, neighbors, and friends (Hoang, Dufhues, and Buchenrieder 2016) and research-based knowledge, and training from visitors outside their community (Saint Ville et al. 2016). Second, IPs broker knowledge through facilitating multi-directional flows of information and views through networks.

Finally, IPs integrate new value chain knowledge through matching knowledge demand and supply. However, in what way IPs facilitate EL is unclear. This is the fourth area of investigation of the four interlinked concepts of EL.

2.3. Methods

2.3.1. Description of the study area

The study was carried out in Kapchorwa, Manafwa, and Namisindwa districts, which are Uganda's main coffee-growing areas. Coffee contributes 20% to Uganda's total revenue, and 49% to the total agricultural exports (UBOS 2017). Despite this enormous contribution, the coffee sector is dependent on 1.7 million households that face multiple challenges (UCDA 2019b). Consequently, IPs were established to enhance learning among diverse actors, a strategy to address multiple challenges hampering coffee value chain development and upgrade (UCDA 2014; MAAIF 2013). The target IPs were established in 2015 as part of the Value Chain Innovation Platforms for Food Security (VIP4FS) project. The project aims to define values and drivers that support the scaling up of efficient and equitable innovation platforms that improve food security through greater engagement of smallholder farmers with markets. According to key informant interviews, each IP consists of approximately 25 coffee farmers. Other roles of these coffee farmers include coffee picker, processor, contact/model/trainer farmer, buyer/trader, input stockiest, transporter, IP leader/facilitator, and so on. Once a month, the IP members gather for their regular IP events, which concentrate on learning about how to solve their farming problems. Each IP has a framework in place, with the IP facilitator organizing intra- and inter-IP learning events, as well as collaborations with other networks (Appendix 6). IP activities are carried out with funds raised at the IP level from a variety of sources, including membership dues, annual subscriptions, and fines imposed on members say, for absentisim, late coming, and so on.

2.3.2. Sampling procedures and data collection

The study employed a multi-stage purposive sampling procedure starting with the districts through to the target respondents. The target respondents were selected in two sub-stages. Through a snowballing technique, the first step involved locating and interviewing (Bryman

2016; Holstein and Gubrium 2016) relevant key informants. Using a checklist, key informants were interviewed individually in their homes or offices for 1.5 hours on average to capture overall aspects of the study. The questions addressed include: 1) farmers' challenges, 2) what activities were carried out by farmers to address their challenges, how, and 3) the learning outcomes of coffee IPs farmers (Appendix 2).

The interviews with the key informants led to emerging conceptual categories of farmers' experiences that trigger learning activities, learning activities themselves besides several potential learning outcomes (Appendix 5). It also provided background information about the IP features. Secondly, based on the key informant interviews (KIIs), lists of IP facilitators/coordinators/chairpersons were crafted. After understanding the intent of the study, each district IP coordination team (the IP facilitators/coordinators) compiled a list of possible FGD participants during a one-day meeting with the researcher. This list was created based on their knowledge of the study topic. Following that, they made physical contact with participants at the IP level and later made phone calls to confirm their availability. Four members were purposively picked from each IP. Three IPs were selected per district totalling 12 participants for a district-level focus group discussion (Yin 2003). Each FGD was facilitated in a central place by two trained research assistants: a moderator and a note taker with the help of the researcher. Participants were encouraged to openly discuss the responses using their local languages. Views agreed upon by consensus or hand vote were recorded for each group. Each focus group discussion (FGD) lasted about 4 hours with a coffee break, one ice breaker, and lunch on completion.

Using the three thematic areas highlighted in appendix 2 (section A), the learning process was discussed as follows: The first set of questions relating to experiences and learning activities were posed to the participants followed by discussion and agreement. As for the learning outcomes network ranking was preferred i.e., list the name, and assign a numeric number from the smallest-big impact and biggest-smaller impact. During the discussion, the most dominating participants/speakers were men, model/contact farmers, traders, processors, opinion leaders, or those with leadership roles. These were educated, financially stable, or have well-managed coffee fields, well informed, and networked. To achieve consensus, a hand vote with at least more than half the participants won.

Finally, thematic areas from KIIs and FGD i.e., experiences, learning activities, and outcomes, were repeated at the individual coffee farmer level. At this stage of data collection, each research assistant interviewed a respondent face to face-at their home. Each interview lasted about 2 hours. All interviews were completed for one district before heading to the next until all three districts were captured, with interview results written down in notebooks and audio recorded. The data reference period is December 2018. At the end of this process, data were collected and analyzed from 6 key informants, 43 FGD participants, and 48 IP members (Figure 4).

2.3.3. Data processing and analysis

After data collection, all interviews were transcribed verbatim and coded by Atlas. ti 8 for qualitative content analysis (Schreier 2012). Coding was both concept and data driven. Concepts were derived from literature for farmer value chain learning experiences, activities, and outcomes. From data and text fragments (cues) related to the research questions (sections 2.1-2.4 & appendices 4a & b), the data analysis approach by Gioia, Corley, and Hamilton (2013) was employed. This approach is widely used to understand learning (Lindh and Thorgren 2016). In appendix 4a & b, data were coded first as first-order codes, rather than as direct quotes from interviews, to keep the narrative of the findings more readable and concise. The first order codes were aggregated to second-level codes (abstract concepts from the first-order categories in the 3 P model cluster i.e., coffee value chain nodes, also known as code groups). Finally, the overarching theoretical dimensions i.e., experiences, learning activities, and learning outcomes herewith referred to as smart codes). After coding and categorizing, the emerging patterns and commonalities for each smart code were identified to facilitate (Miles, Huberman, and Saldana 2013) understanding of the EL process.

2.4. Results

2.4.1. Experiences (challenges)

Results from the interviews indicate that farmers continuously reflect and thus learn from their production, processing, and marketing challenging experiences (Appendix 4a&5).

2.4.1.1.Production

At a *production* stage, for example, pests and diseases contribute up to 7kgs of coffee berry losses per plant. For example:

> *Pests and diseases cause considerable losses. The stem borer pest barrow into the coffee stem leading to wilt and death. Along with diseases such as coffee berry disease reduce the coffee plant population per unit area of land leading to low yields. These pests and diseases would not be a problem of great concern if the required pesticides were available, affordable, and effective (Interview 035, female, Bukhofu coffee IP).*

In all districts, the pest and disease challenge are exacerbated by limited access to inputs e.g., pest and disease-resistant coffee seedlings, adequate quality and required quantity of agrochemicals and equipment (cross cutters, sprayers), labor for production, fertile land, and coffee production knowledge. Indeed, coffee farmers are dependent on the community nursery operators are the main suppliers either directly or through the Uganda Coffee Development Authority (UCDA). However, the action of these community nursery operators is questionable. They supply immature, poor-quality seedlings and in adequate quantities. For instance:

> *The trained and licensed nursery operators are few, ill-equipped, and poorly resourced to produce and supply adequate quantities of seedlings to all farmers. In particular, the nursery operators have inadequate knowledge and skills in nursery operations. A majority cannot afford to establish nursery structures, purchase seeds, potting materials, fertilizers, and control pests and diseases. Alternatively, seedlings supplied by or through UCDA are costly. Consequently, some farmers end up planting bad seedlings or not planting at all (Interview 049, Manafwa FGD).*

According to Manafwa FGD participants, the low number of nursery operators is attributed to the inability to meet the certification criteria for UCDA. Besides, the few UCDA-certified coffee seedling suppliers experience delayed payment for the seedlings supplied thus most avoid transacting business through UCDA-the quality regulator. Apart from community seedling suppliers, sometimes the government through Operation Wealth Creation (OWC) supplies free seedlings. However, farmers complained of the uncertainty of the seedling sources i.e., among many, the nursery location, variety, and age. Moreover, often supplied during the off-planting season (dry season) the supplied seedlings are not accompanied by follow-on extension services. Similarly, farmers complained of the new coffee varieties having a short life span (for instance, 3-7 years) as compared to 45 years for the indigenous. Apart from the short lifespan, the cost of their production is high in terms of inputs such as pesticides, fertilizer, and so on.

The other factor fueling up pest and disease infestation is farmers' limited access to adequate quality and required quantity of agrochemicals as a stated farmer:

> *lack of agro-inputs like fertilizers as the accessible ones are fake and expensive. Additionally, I apply fertilizers to my soil randomly without minding whether these are suitable. My soils have not been tested to ascertain which nutrients are lacking (Interview 010, male, Arokwo coffee IP).*

The expensive nature of agrochemicals was attributed to farmers' small funding sources. The most dependable source is the Village Savings and Loans Associations (VSLAs) savings which can’t meet every member’s financial needs during production while formal financial services providers like SACCOs, MFIs, DFIs, and commercial banks as an option have high lending rates and rigid finance access regulations such as the requirement of collateral, such as land titles or agreements. An alternative, organic manure, which would otherwise complement inorganic fertilizers is inadequate to cover farmers’ coffee gardens and is slow at releasing nutrients. Moreover, very few farmers in Manafwa are aware of the existence of inorganic fertilizers.

Next, since coffee production is the main economic activity, pest and disease management labor is often inadequate. A few available laborers are expensive to hire while the strong and energetic youth who would otherwise provide labor is not available. For instance:

> *Production activities e.g., land preparation, pests, and disease management are very tedious. Family labor is not adequate making hiring inevitable. I cannot afford to hire additional labor. Coffee prices are low giving me no reason to maintain my gardens (Interview 027, Male, Butta coffee IP).*

Equally important, farmers’ minimal implementation of pest and disease management practices due to their low level of knowledge about the different coffee pests and disease-resistant varieties, management e.g. fertilizer application. As a farmer explained concerning the lack of knowledge about inputs:

> *Recently, a fellow farmer was disappointed by a colleague who ignorantly opened a bag of Calcium Ammonium Nitrate fertilizer and spread it to dry under the sun before*

applying it to his coffee. This farmer didn't know that Nitrogen is volatile and easily evaporates hence he lost everything (Interview 025, Male of Bukhofu Coffee IP).

In Manafwa and Namisindwa the low level of farmers' knowledge is attributed to limited access to extension services. The government extension service providers mandated to equip farmers with necessary pest and disease management knowledge are few and ill-equipped with the necessary knowledge and skills. Even more, the limited focus of the private sector in their interest areas, as opposed to regular extension service provision, cannot allow them to bridge the extension gap.

2.4.1.2.Harvest, Post-Harvest, and Processing

At the harvest, post-harvest, and processing stages, farmers recognize that low coffee quantity and poor quality are caused by pest and disease infestation. Results indicated that poor coffee quality was seen as having mixed colored cherries i.e., green, and yellow for unripe and red for ripe. This challenge was attributed to poor coffee harvesting methods such as stripping as compared to picking by less skilled harvesters as the quote illustrates:

I sometimes employ people who because of inadequate coffee harvesting knowledge focus on quantity i.e., filling a suck(bag) of 100kgs at 5000shs as opposed to quality. Such pickers bend coffee plants which sometimes break to achieve the agreed target. The result is poor quality cherries i.e., mixing green(immature) and red(mature), broken and diseased, small, and big from yet sorting the already mixed coffee is another cost (Interview 021, male, Busyula Coffee IP).

Moreover, the low level of knowledge on proper coffee-picking methods is attributed to limited access to training opportunities and the emergence of new market dynamics i.e., coffee demand, prices, customer preference, etc. Besides, being largely unskilled, available coffee pickers are few and costly to hire. Likewise, thieves (mostly neighbors) are a challenge as explained below:

There is a lot of theft in these villages, people steal coffee either from the garden or at home because they didn't or grew coffee which didn't do well (Interview 049).

Then coffee not processed i.e., washed, floated, sorted, pulped, and fermented within 24 hours after harvest is considered poor quality. Indeed coffee, farmers couldn't process their coffee in time due to limited access to pulping machines. The available pulping machines in the market are fake and expensive. Those available for either hire or borrowing within the community are few and expensive to hire. A farmer explained:

> *[...]obtaining pulping machines is costly i.e., involves costs of pulping and transportation. For example, on every 100kgs bag, 4kgs are deducted as pulping cost or 6000shs. After incurring this cost, often such machines crush seeds thus compromising quality. I sometimes take too long to get pulping machines and don't pulp in time, resulting in low prices, such as 4000shs (Interview 022, male, Bukusu Coffee IP).*

Likewise, all the available machines are manually run and take a long to pulp a large amount of coffee as it's also very tiring. Furthermore, most coffee pulpers are counterfeit i.e., crash and remove the seed cover during pulping instead of properly separating the chaff from the coffee beans. Sometimes farmers are forced to pulp coffee rudimentarily using local grinding stones. Similarly, knowledge of how to use the equipment is inadequate. Furthermore, the purchase of these machines is nearly impossible since a few genuine hand pulpers are expensive.

Again, coffee dried on bare earth surfaces such as soil, and roadside to moisture levels greater than 13^0celsius is poor quality coffee. Extreme weather, such as too much rain or heat, and limited access to drying materials, was attributed to poor drying across the study site. Considering the following example:

> *Before realizing the need to produce high-quality coffee, I used leaves and my night-covering blankets to dry coffee resulting in a bad coffee aroma/smell (Interview 007, male, Chema coffee IP). I also can't get quality coffee because I sometimes dry coffee on bare ground or dusty places which reduces its value (Interview 041, male, Bukoho Coffee IP).*

Finally, coffee not properly stacked on pellets and away from any contaminants such as paraffin, or livestock droppings is poor coffee. In the study site, limited access to or poor storage facilities, materials, and techniques, where farmers store their coffee in residential houses are a genuine challenge as stated:

> *I keep coffee in a congested place leading to the loss of the nice taste and marketable value (Interview 032, male, Bumbo Coffee IP). We have a problem of where to store*

coffee and how to store it, i.e., knowledge and skills in improved storage techniques (Interview 048, FGD Kapchorwa).

2.4.1.3.Marketing

At the marketing stage, farmers consider the presence of a few, untrustworthy and unreliable coffee buyers as a key challenge. For example, to make big profit margins, middlemen add chaff to good quality coffee to increase coffee quantity, don't grade coffee, use uncalibrated weighing scales, and sometimes buy coffee on credit due to their small capital base. Sadly, even key coffee-buying companies compete with middlemen to purchase poor quality ungraded coffee which is later mixed with good quality coffee. Some claim to want organic coffee but buy all coffee. While Kapchorwa District has a denser network of buyers, their conditions are unbearable: selling coffee harvested on the same day, between 1 pm to 5 pm at the buying centers, not at the village level represents a condition that farmers cannot meet due to transportation challenges. Moreover, these buyers are unreliable-don't stick to their obligations to purchase coffee from specific farmers. Farmers produce different coffee varieties with specific quality attributes which are not taken care of by coffee buyers, instead, they mix all coffees at the time of purchase. As explained by an individual farmer and FGD participants:

... untrustworthy middlemen mix up good quality coffee with chaff, use faulty weighing scales, and pay less for the coffee supplied. I don't have a reliable market. Compared to cooperatives, middlemen's income allows them to buy coffee once a year (Interview 032).

Hence, there are fluctuating, and low coffee prices as plainly illustrated below:

Coffee cherry prices fluctuate between 800 and 1800 per kilogram and the dry parchment range of 3500/= (During the harvesting period i.e. late August to September) and 5000/= (between December and January) (Interview 014, female, Mt. Elgon women coffee IP).

Other challenges faced by farmers in the marketing phase include: (1) transport means; (2) blindness to market opportunities; (3) limited access to information about coffee market prices; (4) poor collective bulking spirit among farmers; and (5) negative attitude towards coffee farming and consumption, were mentioned. As these quotes illustrate:

We still grow coffee as a traditional cash crop rather than as a business. [...]we struggle to apply fertilizers, spray, and so on yet growing coffee with such an attitude demonstrates less value attachment. Also, some farmers sell their coffee when it is in the flowering stage. [...]as coffee farmers we don't consume our coffee (Interview 049). When I visited other countries such as the United Kingdom, I noticed people drinking Ugandan coffee in coffee shops that do not exist in our communities. Our organic and inorganic coffee would attract consumers and encourage value addition and scale-up of coffee production if our IPs had such (Interview 025).

Cutting across the value chain, i.e., production to marketing is a poor division of roles and a policy gap. Referring to the former, men have control over value chain resources e.g., Land and coffee income. This limits women's ability to play a significant role in the coffee business. Concerning the latter, even though UCDA officials, extension workers, and private sector players such as Kawacom have made attempts to sensitize the farming community on existing coffee policies, Namisindwa and Manafwa farmers disagree on the effectiveness of such efforts. Since most farmers don't listen in to such radio programs, the medium of radio talk shows to sensitize the farming communities about the existing coffee policies is ineffective. Instead, the existing extension workers through various farmer groupings would be effective. Still more, the government of Uganda through its agencies should regulate the quality of coffee inputs and output markets.

2.4.2. Learning activities

Through social interaction with IP members, coffee farmers reflect on their past challenging experiences (Appendices 4a & 5).

2.4.2.1.Production

On experiencing pest and disease attacks, coffee farmers through routine IP activities such as meetings discuss their challenges before acting. Inevitably, such meetings provide a space for in-depth reflective dialogue. For example:

On experiencing such pest and disease infestation, we came together, discussed, and agreed to share experiences amongst ourselves, seek training from the local government and private sector, and collectively purchase or access certified coffee inputs (Interview 048).

Then the IP members e.g., model farmers often well-educated, informed, or experienced and networked train fellow farmers on various coffee pest and disease management methods. Additionally, to boost their efforts, these IP members bring in external actors to train farmers on pest and disease management. Depending on the trainers, the funding comes from various sources, such as membership fees, monthly contributions, volunteer service members, and external support. Specifically, the external trainers fund bigger IP level training, meetings, demonstrations, and exchange visits within and outside the community. Knowledge for such learning activities is shared by the trainee with fellow IP members and later trickles to farm families. Similarly, contributors to pest and disease management knowledge are farm families/relations. Subsequently, coffee farmers critically reflect and analyze the training content along with trying out (experiment) say planting pest and disease-resistant varieties, use of indigenous methods of pest and disease management, soil amendments, planting shade trees, phytosanitary measures, and spraying. As this quote illustrates:

> *After training, I was given Tuspan of about around 15mls to spray my coffee. After spaying, the yellow spots disappeared and the coffee pods no longer fall off (Interview 033, Male, Bumbo coffee IP).*

With experimenting, coffee farmers acquire new experiences, which experiences guide them to for example IP farmers either individually or as a group established UCDA-certified coffee nurseries from improved or indigenous coffee plants. For example:

> *After training on nursery bed operations under the KIFANGO group, I was motivated to start up my nursery bed, which I later expanded to a fully-fledged commercial nursery site (Interview 026, female, Busyula Coffee IP).*

Moreover, through collective action, coffee farmers: (1) collectively purchase production inputs from or through reputable agencies; (2) borrow from fellow farmers;(3) hire from fellow farmers; and (4) receive free donations or offers from IP-affiliated networks. As illustrated:

> *I decided to only buy my pesticides from the Bukusu coffee group because they have genuine products that are effective in pests and disease control. This limits my expenditure on fake products from other agro stockists. I got all this information from my IP members (Interview 022).*

Also, with the help of local government officials developed bi-laws to reduce fake/adulterated inputs and substandard output plus encouraging fellow farmers to listen to UCDA radio programs on coffee policies. Similarly, through collective action, farmers rotationally provide production labor among themselves or finances to hire. Finally, coffee farmers through their interactions with IP members started to expand on their coffee acreages to cover for the losses, diversify their income sources, etcetera

2.4.2.2.Harvest, Post-Harvest, and Processing

Comparable to the production stage, farmers' routine IP activities such as training, and demonstrations provide a space for in-depth reflective dialogue on *harvesting, post-harvest handling, and processing* challenges. Through IPs, coffee farmers access training on coffee harvesting namely picking red ripe cherries, transporting a home, or selling immediately after picking, sorting, floating, washing, pulp, fermenting, drying and storing/selling or roasting, grinding, packing and sell as stated below:

> *After training in coffee picking, I was able to harvest only red ripe cherries which earned me more money compared to 700/= per kilogram for stripped mixed cherries (Interview 009, female, Chema coffee IP).*

Afterward, coffee farmers critically reflect and analyze the training content along with trying out (experiment) e.g., the challenge of inadequate labor is solved through collective action e.g. collective picking, use of family, and hired labor.

> *We practice group coffee picking, pulping, drying, bulking, buying, and selling coffee (collective storage and marketing of coffee). All our members are skilled/trained coffer pickers (Interview 048).*

Furthermore, the challenge of poor quality (premature, broken, diseased coffee berries) was solved by inviting buyers to ascertain the quality of coffee before picking and picking only red ripe cherries by engaging, supervising, and motivating trained personnel. As one of the farmers recalled:

> *I train, demonstrate, and supervise people who help me in harvesting coffee to ensure coffee quality (Interview 021).*

For inadequate pulping machines, coffee farmers collectively purchase, borrow from fellow farmers or wash stations, hire, and maintain existing machines, and lobby coffee buyers and other agencies to offer pulping machines to farmers in form of loans. Also, farmers obtain machines in form of loans and free offers from their networks.

> *I borrow pulping machines from my neighbors and in return, I give them some coffee in exchange for example. In exchange for 100kg of pulped coffee, I give them 1 kg of pulped coffee. In monetary terms, pulping 100 kg of coffee can cost up to 2000/= (Interview 031, female, Bukhofu coffee IP).*

Furthermore, the inadequate storage facilities challenge was tackled through the joint construction of warehouses like Bukusu ACE for storage. For thieves, family members guard coffee gardens, hire guards, fence gardens, harvest near-ripe coffee, and sell immediately after harvest.

> *My family members sleep in the garden in turns until coffee harvesting is completed[...] (Interview 002, female, Kabeywa Coffee IP). I sell immediately after harvest so that thieves don't break into my house. Also, I stay home to keep an eye on the drying coffee (Interview 015, female, Mt. Elgon women in coffee IP)*

2.4.2.3.Marketing

Finally, as for marketing, by reflecting on information obtained through training and interactions with IP actors, coffee farmers obtained market information e.g., coffee demand. Regarding the challenge of few, unreliable and untrustworthy coffee buyers, farmers resorted to collective bulk parchment and selling as an IP. Such coffee is usually sold in January at about 6,500/= per kilogram. The first-grade coffee is bulked while the second grade is sold to other buyers. Secondly, farmers sought alternative buyers that readily purchase coffee at a fair price-1,400 shillings per kilogram of cherries, timely and if possible, offer bonuses e.g., about 20 shillings per kilogram per farmer. As one of the farmers mentioned: *Middlemen buy coffee at very low prices. As a result, I started looking for alternative coffee markets e.g., Kawacom at 1,450/= and 5,200/= per kg for cherries and parchment respectively (Interview 001, female, Kabeywa coffee IP)*. Third coffee farmers worked with IP-affiliated networks to create new markets including wash stations, IPs for cherries, and local companies.

Turning to the challenge of low and fluctuating coffee prices, farmers produced high-quality coffee and marketed it collectively as a remedy. For instance: *We formed sub-groups within the IPs to collectively sell coffee (Interview 018, female, Busyula coffee IP)*. As well, most farmers registered their coffee business- a strategy to negotiate better terms viz. prices and attain quantities required by buyers along with signing contracts with buyers.

> *There's an organization called Coffee a Cup that promised to give a good price to whoever supplies good quality coffee and so some of us registered as suppliers (Interview 030, male, Bumbo coffee IP).*

2.3.4. Learning outcomes

Based on their past experiences and activities of reflection through social interactions, evidence of how farmers learn and thus adapt their production, harvest, postharvest handling, processing, and marketing stages was found (Appendix 4b).

2.3.4.1. Production

Referring to section 2.4.2, IPs enhance communication and knowledge dissemination through training, exchange visits, look and learn, and experimentation leading to pest and disease management knowledge generation. Also, in appendix 4a and 5, IPs generated pest and management knowledge through supporting farmers' access to value chain relationships by stimulating new relationships amongst actors as well as linking farmers to other support networks. For instance, coffee farmers learned the private and public sector organizations and family members provide advice, and knowledge on assorted aspects as follows:

> *I learned to produce coffee from my father. I observed him manage his coffee (pruning, stump) (Interview 017, male, Bukhoho coffee IP).*

Again, farmers through their networks obtain offer emotional support-inspirations & encouragement:

> *My brother, a group member, and an influential farmer encouraged me to start growing coffee and gave me free seedlings in addition to coffee production advice while my aunt, gave guidance on nursery bed establishment (Interview 021).*

Likewise, these networks encouraged farmers to organize themselves into groups to produce more coffee.

International women coffee alliance encouraged us to register our group with UCDA so that we are recognized and to solve the issue of delayed payments for coffee seedlings supplied to the OWC program (Interview 048).

Furthermore, the IP serves as a point (collateral) to lobby inputs in form of loans from coffee buyers. Correspondingly, farmers pool resources as a group e.g., labor, agrochemicals, equipment, and seedlings. Not on that, IPs serve as collateral to borrow money from other sources e.g., SACCOs and Commercial Banks to purchase agro inputs. Similarly, through networks, coffee farmers learned about farming practices i.e., first, obtained knowledge and expanded their coffee acreages in addition to certifying their coffee nursery sites.

In addition to regular coffee maintenance, I established a commercial coffee tree seedlings nursery site after training, certification, and obtaining parent seeds from UCDA. After, I signed a contract to supply seedlings directly to farmers or through UCDA (Interview 046, male, Bukhokho coffee IP).

The other aspect coffee farmers learned about networks is how to manage relationships. For instance, in *interview 012, a female, Arokwo coffee IP, said...Managing IP relations involves; respecting each other, working together, being exemplary, and humble, and jointly working hard to achieve my goals.*

Zooming into a deeper level, throughout this process farmers learned about their selves. For example, they learned about their weaknesses, including limited information on pest and disease control, and that problems are steppingstones to success. Moreover, some realized they have been conservative and unexposed to modern coffee production methods. *Interview 007* said: *I was conservative and needed to be exposed to modern methods and organize myself well to be known and recognized by different value chain actors on the market. I realized that everything starts with me.* Also, the ability to carry out self-evaluation and critical thinking is deficient among farmers. *Interview 001 said I was not good at self-evaluation and critical thinking, an art I have developed because of facing coffee farming challenges over time.* Others include mindset and attitude change towards coffee management, patience and proactive (search for coffee management information), and self-belief.

I learned to be a persistent and determined coffee farmer. [...], coffee farming takes a lot of commitment to make good profits (Interview 042, male, Bukhokho Coffee IP). [...]

have the self-belief that I can perform the entire coffee value chain activities if resources allow (Interview 027).

2.4.3.2. Harvest, Post-Harvest, and Processing

Like production, farmers learned that networks are the source of knowledge e.g., picking only red ripe cherries, cleaning, sorting, floating, pulping, and drying on a raised platform.

In terms of practices, through the above networks, coffee farmers now perform activities leading to high-quality coffee e.g., picking red ripe cherries, process.

> *I now pick only red ripe cherries leaving the green ones for the next harvest making me pick more times as compared to the past when I harvested everything. Moreover, I use skilled and trained pickers. Hence, my cherries fetch 1450/= per kg at Chesiyo mixed farm buys at, a better price compared to the 800/= I earlier sold (Interview 006, male, Chema coffee IP).*
>
> *I observed my father's processing methods e.g., he washes, pulps, dries, roasts, pounds coffee in a motor, and grinds with a stone into coffee powder/beverage. He also roasts coffee and mixes it with ground nuts (Interview 017).*

Likewise, farmers learned that red ripe coffee berries weigh more than the unsorted ones while the unsorted ones weigh more than green and sorted cherries.

> *Red ripe coffee berries are usually heavier compared to mixed and so are unsorted (Interview 015).*

Additionally, these networks offered inputs such as pulping machines and inputs purchase financing. Besides, family members mainly provide labour for cleaning, washing, and sorting. Regarding self, successful coffee farming requires patience as waiting to selectively pick uniformly ripe coffee. As stated by a farmer:

> *I learned to be patient and to involve skilled labor in the coffee process like sorting and picking. Additionally, coffee being my source of income means paying workers well for better returns (Interview 022).*

Moreover, others learned to perform additional value chain roles. For instance:

> *My new role is as a professional coffee picker. Before the training I hadn't understood the importance of coffee quality compared to quantity hence I used to pick anyhow but now I only pick ripe cherries (Interview 002).*

Also, producing quality coffee requires a total change of attitude. *My perception of picking has now changed. I only pick red cherries (Interview 008, female, Chema Coffee IP).*

2.3.4.3. Marketing

Relating to the above phases, with the support obtained from networks coffee farmers learned to focus on activities relevant to the market. Similarly, the demand for high-quality coffee cherries led to improved coffee quality and bulk coffee as stated by *Interview 029, male, Butta coffee IP...I have learned to store my coffee when prices are low and sell when prices scale up. I now appreciate coffee farming as a business, and to me, coffee is black gold.* Moreover, competition among buyers led to price rise i.e., 4000 to 6500/= and 1200 to 1800/= per kg of cherries and parchment respectively as stated by *FGD Kapchorwa participants, higher coffee cherry prices per kilogram offered specifically 1800/=by Kyagalanyi, KOCAFE, and Great lakes forced Kawacom to increase theirs from 1200 to 1400/=.*

In the same vein, farmers learned that unreliable competitors and buyers of coffee on credit are an opportunity for farmers to engage in coffee trading by purchasing coffee within their IPs and untrustworthy middlemen are an opportunity to find alternative markets that give bonuses in form of finances and production, pulping drying machines. Then, the re-negotiation of terms with buyers led to better terms. Furthermore, these farmers learned coffee to properly weigh after being cheated by coffee buyers. Also succeeding in coffee farming means taking time to identify and choose partners, keep clear records, and sell several bi-products for coffee including coffee husks, and roasted and ground coffee. Additionally, obtaining coffee income requires persistence, courage, investing capital, and a positive attitude to challenges. As stated by a farmer:

> *The challenges I face in coffee farming opened my eyes to hard work and keeping busy hence challenges are a foundation for my success (Interview 025).*

Finally, coffee farming requires capital investment, self-belief, good knowledge-seeking, and sharing attitude. In terms of self, coffee farmers learned to perform multiple roles such as coffee picking, processing, trading, etc. For instance: *I was not getting a lot from just being a farmer so when I joined the IP, I learned to add value to coffee, buy more coffee from other farmers and share my experiences with other farmers and traders (Interview 049 participants).*

2.5. Discussion and Conclusion

This paper sought to shed light on four interdependent elements of farmers' EL processes in the context of the Ugandan coffee sector, namely: the challenging experiences triggering farmers' EL; farmers' exemplary learning activities and outcomes; and IP's role in farmers' EL. As discussed, this study adds to the existing literature on farmers' learning processes in IPs by zooming into farmers' experiential learning processes and the moderated mediation of IPs at various stages of this experiential process (Appendix 5).

Unlike previous IP literature that tackled fragmented challenges, especially low crop yields and poor market access (Teno and Cadilhon 2016; Njingulula et al. 2014), this study disentangles each step of the experiential process occurring in IPs from farmers' challenging experiences to their learning activities and knowledge development and across multiple value chain stages. About appendix 5, the study explicitly links value chain challenges faced by farmers to specific learning activities and knowledge in three value chain domains. Thus, first, this study found that challenges like pests and diseases at production, poor quality, and quantity at harvesting Postharvest handling coffee processing (HPHCP), and low and fluctuating coffee prices at marketing triggered farmers' EL. For example, the White Coffee Stem borer and Coffeeberry disease were responsible for coffee yield loss (Cerda et al. 2017) and poor quality. Furthermore, most farmers dry coffee naturally under the sun on bare soil, and other surfaces exposing them to dust, microbe contamination, unexpected rain showers, and high temperatures ($> 28^{o}C$) (UCDA 2019c). Finally, low, and fluctuating coffee prices were caused by poor coffee quality, which was a result of all pre-and postharvest activities. All these challenging experiences stemmed from the following: (1) farmers' limited access to necessary inputs; (2) poor production, postharvest handling, and marketing practices; (3) personal weaknesses; (4) negative attitude towards coffee; (5) market dynamics like few coffee buyers; and (6) the coffee policy gap.

Undeniably, IP farmers access value chain knowledge and skills (Mulema and Mazur 2016; Nyikahadzoi et al. 2012) through attending IP-supported/conducted training, meetings, workshops, inter-IP information sharing, demonstrations, and extension materials. Besides linking specific value chain challenges to learning activities, to learn from these challenging experiences, coffee farmers learn through interaction, pondering solutions through in-depth reflective dialogue. This finding confirms what is known about outside IP literature on how actors, including farmers, learn in social (Murphy, Wilson, and Greenberg 2017) and reflexive (Glowacki-Dudka et al. 2017) environments.

Visibly, IPs play a key role for farmers to reflect, in a socially interactive space, about their past experiences, thus generating outcomes throughout IP learning activities. Unlike previous IP literature that captured knowledge and skills at production, postharvest, and marketing practices as the most important learning outcome for farmers (Brouwer et al. 2019; Kilelu et al. 2011), these findings shed light on two new aspects. First, this study does not only capture coffee value chain practices and technologies but zooms into the knowledge domains that farmers developed along the EL process, such as knowledge about networks, and farmers' strengths and weaknesses. Second, the findings show how the IPs support and manage relationships among farmers and other stakeholders, which are at times conflictual. Thus, IPs facilitate farmers' interaction, and communication, as well as provide space for farmers to build trust as a necessary component of managing their interpersonal relationships. Furthermore, farmers improved their patience, humility, self-expression, advocacy competencies, the formation of realistic expectations, time management, leadership based on example, motivation to work hard, and team-playing spirit because of participating in IPs.

In addition to previous work on IPs and learning (Lamers et al. 2017) the empirical findings highlight how farmers learn through their social interactions. Coffee farmers engage a diversity of actors to gain access to a wide range of value chain experiential knowledge to address ill-structured challenges they face. Implying that farmers who are interested in learning and implementing modern technologies and practices across the value chain are not limited in the network types to interact with.

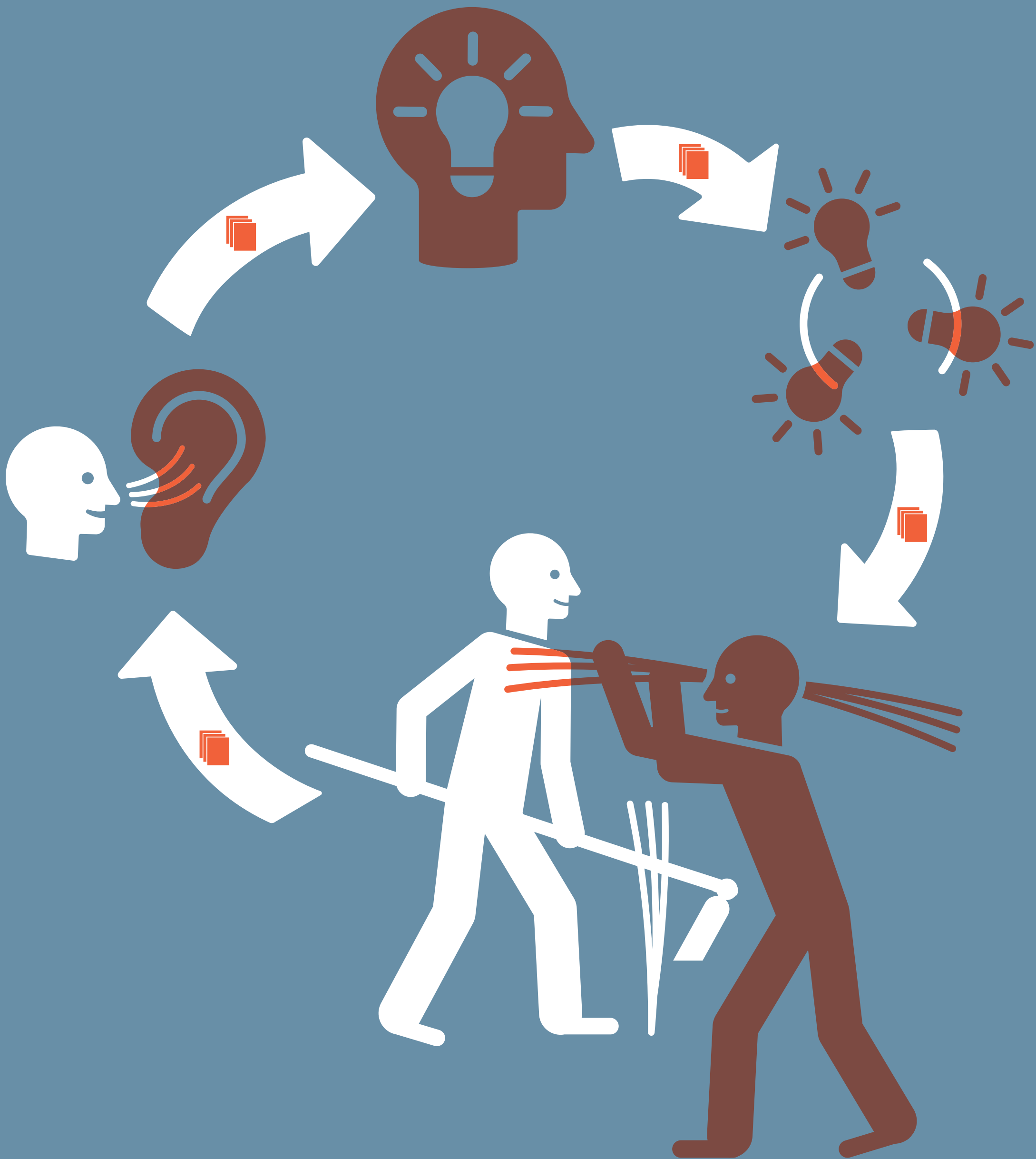
2.6. Implications

Based on the study findings, this paper suggests that – from a theoretical standpoint – learning models based on social interactions, e.g., IPs, have the potential to trigger higher-order learning from reflective analysis of challenging experiences. The current study emphasizes that EL fully unfolds when learners gauge lessons and draw conclusions through identifying the challenges, root causes, and solutions, proposing methods of action as well as the actual implementation of solutions and proposed methods of action. The study of coffee farmer learning makes a significant contribution to transformative learning theory (Schnepfleitner and Ferreira 2021; Chang 2021) by clarifying how farmers develop problem-solving knowledge by performing learning activities. In particular, the study shows that farmers use two skills i.e., reflective analysis and active experimentation to solve their problems/challenges. Therefore, coffee farmers' transformative learning is accomplished through three collaborative phases: recognizing value chain problems, acting (reflecting and testing out options), and generating problem-solving knowledge. Directly, this study contributes two things to Kolb's theory of experiential learning: First, this research unpacks the theory's core concepts, in response to (Morris 2020) who calls for clarification on what keywords in Kolb's model, such as concrete experience, mean. This gap is addressed in the current study by capturing farmers' challenging experiences along the value chain in three key value chain domains, transformation strategies, and experiential knowledge types. Second, this research fills in the gap of Kolb's experiential learning model being less widely applied in empirical contexts (Bergsteiner, Avery, and Neumann 2010; Jarvis 2012), by applying it not only to the rural value chain but also to institutional settings, such as IPs.

To learn, one must reflect on what happened and how it happened (Di Stefano et al. 2014). However, reflective learning does not happen by accident. Reflectivity must be deliberately elicited by learning interventions (Ajjawi and Boud 2018). Hence, in managerial terms, these findings suggest that coffee farmers engaging in learning activities must rely on their networks and stimulate commitment and participation in IPs to strengthen their learning outcomes. Second, IPs should emphasize awareness of the importance of sharing experiences, critical reflection, and the role of external sources, while also enabling each person to access useful information for analysis, reflection in tandem with the collective objectives. Third, IPs should encourage members to exchange information, grant freedom to express opinions to stimulate collective thinking, ensure personal development, and allow people to feel part of the ongoing IP activities.

In terms of policy implications, IPs will boost farmers' experiential learning, according to the current study. To avoid repeating the shortcomings of earlier learning methods such as farmer field schools, policymakers must carefully consider aspects of sustainability in the design and implementation of learning programs. Since IPs in the study site depend on donor support (Ragasa et al. 2016; Dabire et al. 2017; Schut et al. 2018), the following lessons may be used by policymakers while designing and implementing learning programs: To begin with, IPs such as Mt.Elgon women in coffee developed and are enforcing bi-laws to control fake inputs and coffee products in collaboration with the local government. Join development and implementation of bi-laws is an opportunity that can be drawn and used to help farmers learn more effectively. Moreover, several IPs, such as Arokwo, Chesiyo, and Bukusu, serve as cooperatives, wash stations, coffee processors, and collection centers, as well as funding their learning activities. Village savings and loan schemes, joint projects, and assets are among the income-pooling practices that these IPs have established internally. Policymakers could use this lesson to assist other IPs in obtaining legal status to improve their capacity for demand-driven learning. This policy recommendation is like that of Chilundo et al. (2020); Mdemu et al. (2020) who suggested that self-sustaining irrigation systems can be used as a measure of IP sustainability. Finally, most of the services, such as advisors, are provided by fellow farmers in the study IPs. A farmer-to-farmer approach, in which farmers learn from one another inside and through IPs, can be a good long-term learning mechanism.

Finally, despite these promising results, questions remain as follows. Firstly, the current study emphasizes solving challenging experiences, other studies could include emotions associated with challenging experiences and positive experiences. Additionally, moderated mediation effect of social factors (e.g., IP processes) and learning activities on the experiences and learning outcomes relationship remains unclear. Given the EL theory's shortage of sound empirical foundation and coffee's position in the global market, future research to address these questions is encouraged.



3

Governance of agricultural value chains: How innovation platforms govern the experiential learning process of coffee farmers in Uganda

Abstract

Purpose: While researchers, development actors and policy makers recognize value chain-based Innovation Platforms (IPs) to assist farmers in developing knowledge when attempting to address challenges, the question of how IPs' governance mechanisms impact their learning process remains unaddressed.

Design/methodology/approach: Using data from a cross-sectional survey of 214 coffee farmers organized into IPs, this study employs regression analysis and the bootstrapping method to validate relationships between IP governance and farmers' learning.

Findings: Results show that when farmers try to address their challenges, IP governance mechanisms have both positive and negative effects on their acquisition of experiential knowledge through reflection and on their active experimentation using existing knowledge. Specifically, IP members' commitment, trust, and involvement significantly and positively moderate the link between farmers' challenges and their reflection, while the influence of members' access to IP resources is insignificant. Similarly, while access to IP resources has an insignificant and negative moderation effect on the link between farmers' reflection and experiential knowledge, IP members' commitment, trust, and involvement have positive but insignificant effects on them. Farmers' commitment, trust, involvement, and access to IP resources did not affect the relationship between their experimentation and experiential knowledge. Finally, the IP members' commitment, trust, involvement, and access to IP resources have insignificant effects on the relationship between farmers' active experimentation and their challenges.

Practical implications: IPs must adopt methods for regularly examining and implementing their governance mechanisms in partnership with local entities.

Theoretical implications: This research contributes to experiential learning theory by connecting them to the relevant study of farmers' experiential learning processes.

Originality/value: This article extends knowledge of experiential learning in the IP context.

Keywords: Extension system. Multi-stakeholder platforms. Coffee value chains. Problem-oriented& value chain-based Innovation platforms. Problem-based learning.

This chapter is based on: Robert Ochago, Domenico Dentoni, Jacques Trienekens, and Maral Mahdad. " Governance of agricultural value chains: How Innovation Platforms govern the experiential learning process of coffee farmers' in Uganda." Second round of review with the *International Food and Agribusiness Management Review (IFAMR)*

CHAPTER THREE: Governance of agricultural value chains: How innovation platforms govern the experiential learning process of coffee farmers in Uganda

3.1. Introduction

For the last two decades, innovation platforms (IPs) are the most prevalent operationalization of coffee value chains in developing nations, and they have been used to assist farmers in learning how to address their challenges (Pali and Swaans 2013; Camacho-Villa et al. 2016; Kilelu, Klerkx, and Leeuwis 2014; Brown et al. 2021; Sako et al. 2021). IPs are rooted in the agricultural innovation systems (AIS) concept and take many forms. IPs are described as a multi-stakeholder forum where farmers learn (share information and exchange knowledge along the value chain) how to address their farming challenges for increased agricultural productivity and socioeconomic well-being by tapping into the capacities of diverse actors (Homann-Kee Tui et al. 2013; Homann-Kee Tui et al. 2015; Birachi et al. 2013; Hermans et al. 2017; Schut et al. 2018; Lukurugu et al. 2021). Farmers, processors, traders, transporters, input suppliers, policymakers, extension agents, and researchers may all be part of an agricultural IP (Fatunbi et al. 2016a). International research and development (R&D) organizations have been at the forefront of developing and implementing IP approaches (Dabire et al. 2017; Schut et al. 2017). The importance of the IP in supporting farmers' learning to address their challenges has been studied in a variety of contexts, including Madagascar, India, Australia, and Southern Africa (Audouin et al. 2021; Kelly, Bennett, and Starasts 2017; van Rooyen et al. 2017; Akpo et al. 2021). For example, in India, IP-supported horizontal linkages (farmer societies) were developed to help farmers learn how to solve challenges such as chickpea seed shortages (Sah et al. 2021).

However, simply initiating or activating a platform will not result in farmers learning. Consideration must be taken into how the platform governs relationships within the IP (Ochago et al. 2021; Hinnou et al. 2018; Akpo et al. 2021). The organization of relationships is known as governance (Humphrey and Schmitz 2001; Gereffi, Humphrey, and Sturgeon 2005). Simply put, this is the mechanism that regulates the division of labor and responsibilities among the actors in the value chain. For IPs, the governance is a complex set of formal and informal rules that shape and co-evolve with the multi-stakeholder process, where the aspect of participation is emphasized heavily in IP governance (Adekunle and Fatunbi 2012; Badibanga, Ragasa, and

Ulimwengu 2013). This paper defines IP governance as a set of mechanisms, that determine or regulate the activities of actors in the value chain (Miningou et al. 2021; Eidt, Pant, and Hickey 2020; Rossi, Bui, and Marsden 2019). IP governance mechanisms in existing literature entail IP members' commitment and trust, involvement, and access to IP resources. Indeed, it has been found that commitment and trust guide interactions among IP actors (Hounkonnou et al. 2018; Ansell and Gash 2008; Keijser, Belderbos, and Goedhuys 2021; Jiggins et al. 2016). Moreover, IPs set and enforce the guidelines on involvement i.e. who can be a member (Cadilhon 2013; Audouin et al. 2021; Fatunbi et al. 2016b), who does what within the IP including who participates in IP learning activities (Cadilhon 2013; Tenywa et al. 2011; Fatunbi et al. 2016b). Finally, IPs set and enforce guidelines on who has access to resources (Schut 2017; Kusters et al. 2018; Akpo et al. 2021).

Previous research in agricultural development practice suggests that an IP is a governance form for enabling multi-stakeholder interaction and farmer learning to address their challenges (Kilelu, Klerkx, and Leeuwis 2013; Cullen et al. 2014; Hermans et al. 2017; Haarich 2018). IPs promote commitment, and trust among actors so that they can share farming information and get involved in IP-level learning activities including reflecting on their challenges (Hounkonnou et al. 2018; Audouin et al. 2021; Akpo et al. 2021; Ochago et al. 2021). IP-enabled reflection results in knowledge about new farming methods, new networks, and self-awareness (Ochago et al. 2021). Besides, IP farmers engage in a variety of experimentation activities to improve their challenges-solving abilities using existing farming challenges-solving knowledge (Sako et al. 2021; Iorlamen et al. 2021). In this arrangement, the IP acts as a facilitator to build inter-personal trust among IP members through the open sharing of information (Hounkonnou et al. 2018). IPs also enhance farmer commitment, involvement (participation), and access to resources such as seeds, and research technologies (Sako et al. 2021; Iorlamen et al. 2021). The above research, as well as additional sources (Adjei-Nsiah and Klerkx 2016; Amede and Sanginga 2014; Dessie, Wurzinger, and Hauser 2012; Schut et al. 2019; Schut, Klerkx, et al. 2016), show that farmers' learning processes (learning to address their challenges) are impacted by the IP's governance mechanisms. Yet, no single quantitative study exists that specifies how such governance mechanisms impact their learning to address their challenges.

Experiential learning (EL) is an approach to learning that entails overcoming challenges (Percy 2005; Pincus et al. 2018). Kolb defines EL as a context-dependent process through which experiences are transformed into experiential knowledge (Kolb 2015; Kolb and Kolb 2009). Existing research on experiential learning describes experiences as challenges (Ochago et al. 2021; Morris 2020). Indeed, farmers are known to reflect while participating in IP-supported training, exchange visits, look and learn (observation), and experiments, as well as afterward, to address their challenges (Vellema et al. 2013; Akpo et al. 2021). Similarly, when farmers reflect on their current knowledge before and after participating in such activities and interacting with other value chain actors, their level of experiential knowledge increases (Ochago et al. 2021). For example, IP farmers learned about better agronomic practices, such as pesticide spraying, by attending IP-funded on-farm training and demonstrations (Dixon et al. 2020; Lukurugu et al. 2021). Likewise, farmers experiment more to see if they can address their challenges with what they already know (Leitgeb et al. 2014; Meynard, Dedieu, and Bos 2012a), such as using new seed varieties, alternative production processes, and so on (Akpo et al. 2021; Lukurugu et al. 2021; Miningou et al. 2021). Finally, IP farmers engage in a variety of experimentation activities (leveraging existing farming problem-solving knowledge) to improve their problem-solving abilities (Sako et al. 2021; Iorlamen et al. 2021). It is evident from this body of literature that farmers extensively engage in EL processes, but how do IP governance mechanisms support these processes? This research proposes that the links between farmers' value chain challenges and their experiential knowledge gained through reflection, as well as the links between farmers' value chain challenges and their experiential knowledge gained through experiential knowledge, are positively influenced by IP governance mechanisms: members' commitment and trust, involvement, and access to IP resources.

3.2. Literature review and hypothesis development

This study seeks to examine how IP governance mechanisms affect farmer learning when faced with challenges in their farming process using Kolb's EL theory as an analytical approach. Kolb's EL theory is widely used by scholars in contemporary research to better understand the EL process (Matsuo and Nagata 2020; Morris 2020). The emphasis is on five interconnected concepts based on Kolb's definition of experiential learning: (1) challenges, (2) reflection, (3) experiential knowledge, (4) active experimentation, and (5) context, which is, in this study, IP governance mechanisms. According to Kolb (2015), the EL process starts with actual experiences or experiential learning activities. Existing research on EL describes experiences as challenges (Ochago et al. 2021; Morris 2020). In the study of farmers' EL in coffee value chains, Ochago et al. (2021) found that challenges such as pests and diseases, poor quality and quantity of coffee, and low and unpredictable coffee prices increased farmers' EL. This study, like (Ochago. 2021), combines four interconnected elements to identify farmers' challenges, in line with coffee value chains: challenges during production, harvesting, postharvest handling, and marketing.

Farmers reflect on their learning experiences from challenges they encounter along their value chain. In the field of psychology and education, reflection involves seeing, hearing, and discussing the experience—what happened, how it happened, and why it happened (Di Stefano, Pisano, and Staats 2015b; Beard and Wilson 2013). Schön (1987)'s reflection theory breaks down reflection into two parts: reflection in action (Cajiao and Burke 2016) and reflection on action (Ajjawi and Boud 2018). Decisions made while practicing or "*how teachers think on their feet*," are referred to as "*reflection in action*", p. 12 (Farrell 2012). Reflection-in-action entails using observational analysis, listening, and/or touch or 'feel' to address challenges. Reflection on action, on the other hand, takes place after the activity has been completed (Schön 1987). In other words, reflection-on-action is the act of looking back to evaluate what happened (Ajjawi and Boud 2018). Coffee IP farmers, according to Ochago et al. (2021), reflect on their current knowledge and interactions with other value chain actors such as fellow farmers, processors, traders, transporters, input suppliers, extension agents, and researchers when faced with the coffee value chain challenges. IPs are known to provide space for farmers to reflect while engaging in IP-supported training, exchange visits, look and learn (observation), and experiments, as well as after such activities (Vellema et al. 2013; Akpo et al. 2021).

Evidence from qualitative studies suggests that when faced with coffee value chain challenges, the process by which farmers reflect on their current knowledge and interactions with other value chain actors is moderated by IP members' commitment, trust, involvement, and access to IP resources. As said by Ochago et al. (2021), Mt. Elgon region coffee IP farmers' commitment and trust, involvement, and access to IP resources aided them in reflecting on their current knowledge and interactions with other value chain actors when confronted with coffee value chain challenges. Similar findings have been reported in other IP and learning studies, for example, Sako et al. (2021) reported that farmer commitment and involvement in Kolokani Groundnut Innovation Platform (Mali) activities assisted them in reflecting on their existing knowledge. Besides that, Akpo et al. (2021); Audouin et al. (2021) found that trust fostered by

IPs among farmers and other value chain actors in sub-Saharan Africa and South Asia encourages reflection on the farming information shared. According to Swaans et al. (2014); Foster and Heeks (2013) IPs place a greater emphasis on systematic and iterative learning through reflection. Simultaneously, IP members rely heavily on IP-mobilized resources(Schut et al. 2019; Kusters et al. 2018; Sah et al. 2021) such as funds, stakeholders, land, meeting venues, seeds, transportation, and research technologies to support their learning activities, which may include reflection. Following the preceding, members' access to IP resources may influence their ability to reflect on their challenges. Hence, the following hypothesis was assessed:

> **Hypothesis 2a**: IP members' commitment, trust, involvement, and access to IP resources positively moderate the relationship between their coffee value chain challenges and reflection.

Experiential knowledge is the result of reflection on farming challenges. Knowledge is knowing something and knowing how to do something (STERNBERG 2002). Experiential knowledge is information learned solely from personal experience (Johanson 1977). Farmers that work with IPs, for example, learn about new farming methods including optimum plant spacing, line planting, composting, fertilizer application, and value chain actors through IP-regulated interactions (Ochago et al. 2021; Akpo et al. 2021; Lamers et al. 2017). According to Ochago et al. (2021), farmers' level of experiential knowledge increased when they reflected on their current knowledge during and after participating in activities such as field demonstrations and interacting with other value chain actors. Trust in the information shared encouraged commitment and involvement in IP-level activities, resulting in increased knowledge. Even though the moderating effect of IP governance mechanisms on farmers' knowledge acquisition through reflection was not statistically assessed in their study, it is implied. Therefore, Ochago's study, as well as others such as (Akpo et al., 2021b; Audouin et al., 2021; Hounkonnou et al., 2018) is used to evaluate the following hypothesis.

> **Hypothesis 2b**: IP members' commitment, trust, involvement, and access to IP resources positively moderate the relationship between their reflection, and the level of experiential knowledge (knowing new value chain actors, and farming methods).

Farmers experiment to see if they can address their challenges with what they already know (Leitgeb et al. 2014; Meynard, Dedieu, and Bos 2012a). They experiment with new seed varieties, and alternative production processes, and look for new ways to promote their products through their social networks (Akpo et al. 2021; Lukurugu et al. 2021; Miningou et al. 2021). Farmers are, in fact, part of a larger social context, emphasizing the importance of networks. Skaalsveen, Ingram, and Urquhart (2020) found that farmers experimented by utilizing existing ideas and approaches and transmitting their knowledge through informal learning networks. Farmers' level of experimentation increased when they used their current knowledge of how to address challenges and interact with other value chain actors (Miningou et al. 2021; Ochago et al. 2021). Therefore, active experimentation occurs when farmers use their existing coffee value chain challenges to solving-knowledge and interact with other value chain actors to increase their level of experiential knowledge. In terms of IP governance and farmer experimentation, IPs help farmers experiment in a variety of ways. For instance, the Burkina Faso Groundnut Innovation Platform built trust through brokering the relationship between farmers and extension service staff (in the Ministry of Agriculture), leading to the establishment of field demonstrations on groundnut production and improved varieties as a solution to the low productivity caused by limited access to improved legume varieties (Miningou et al. 2021). Similarly, with the assistance of R&D partners, IPs encouraged farmer commitment, and trust by establishing farmers' seed producer groups. Concurrently, the platform used extension agents' existing knowledge to spark the distribution of improved technology to a large number of farmers through field demonstrations (Monyo et al. 2021). IPs, according to other researchers (Schut 2017; Kusters et al. 2018; Sako et al. 2021)facilitate farmer experimentation by mobilizing resources such as information, funding, stakeholders, land, meeting venues, seeds, transportation, and research tools. The following hypotheses were assessed because of this:

> **Hypothesis 2c**: IP members' commitment, trust, involvement, and access to IP resources positively moderate the relationship between their experiential knowledge and active experimentation.

Again, IP farmers engage in a variety of experimentation activities to improve their challenges-solving abilities using existing farming challenges-solving knowledge. Ochago et al. (2021), for example, found that IPs assisted farmers in experimenting with alternative pest and disease control measures as a solution to high disease and pest infestation. When farmers realized that the root cause of the pest and disease problem was fake agrochemicals, they collectively (via their IP) purchased certified agro-chemicals in bulk from reputable dealers in their farming communities. In this arrangement, the IP acts as a facilitator to build inter-personal trust among IP members through the open sharing of information and evidence-based data (Hounkonnou et al. 2018). In other arrangements, IPs enhanced farmer commitment, involvement(participation), and access to resources such as seeds, and research technologies (Sako et al. 2021; Iorlamen et al. 2021). According to the literature reviewed above, IP governance moderates the relationship between experimentation and farmers' challenges solving. As a result, the following hypothesis was assessed:

> **Hypothesis 2d**: IP members' commitment, trust, involvement, and access to IP resources positively moderate the relationship between active experimentation, and their challenges solving abilities.

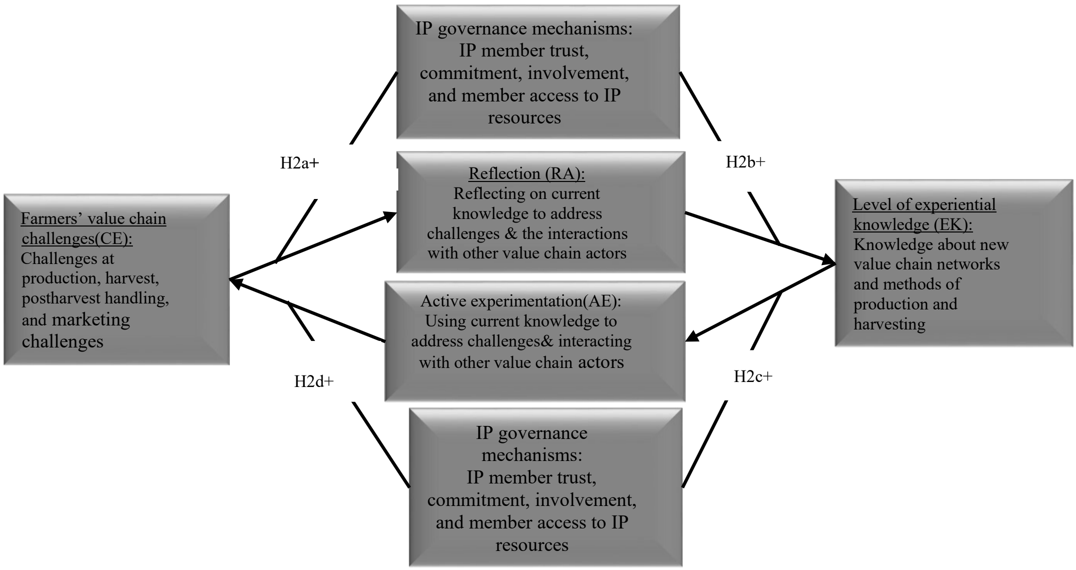


Figure 6: A dual-stage moderation mediation model - The moderating effect of IP governance mechanisms on smallholder farmers' experiential learning process (Research framework)

Based on this literature, the relationship between farmers' value chain challenges and reflection, as well as the relationship between their reflection and their level of experiential knowledge, will vary depending on the level of IP governance mechanisms (Figure 6). Then, depending on the IP governance, the interaction between farmers' experiential knowledge and their experimenting with various challenges-solving methods, as well as the relationship between their experimentation and their challenges solving, will differ.

3.3. Materials and methods

3.3.1. Description of study context

The research was conducted in the districts of Kapchorwa, Manafwa, and Namisindwa in Uganda's Eastern region's Sebei and Bugisu subregions. The district of Kapchorwa is divided into seven sub-counties. Namisindwa has seven sub-counties, while Manafwa has ten.

Subsistence agriculture is the area's principal economic activity, which is divided into three zones: highland, midland, and lowland. These topographical zones determine the types of farming operations that farmers engage in, as well as the crops that are farmed. The highlands and midlands are dominated by coffee and bananas, while the plains are dominated by maize and bananas. Coffee is grown by smallholder farmers on plots of less than one acre, which are frequently intercropped with bananas (Jassogne, Lderach, and Van Asten 2013). Coffee yields in Kapchorwa range from 1556 kg/ha to 1776 kg/ha in Manafwa/Namisindwa. When maintained appropriately, the average yields for Arabica coffee in both districts are less than the national average of 2000kg/ha. The high prevalence of insect pests and diseases is principally responsible for the low output potential(Judith Oduol 2017). Insect pests and diseases (Liebig et al. 2016a) cause up to 57 percent of coffee crop loss (Cerda et al. 2017), as well as low quality (Velmourougane, Bhat, and Gopinandhan 2010; Pimenta, Angélico, and Chalfoun 2018; Walker et al. 2019), resulting in low and volatile coffee market prices (Abrar, Solomon, and Ali 2014; Kidist, Zerihun, and Biniam 2019). This is an example of a complex coffee-growing challenge that needs several solutions. Complex farming challenges have several dimensions, are rooted in interactions across diverse social settings, and involve a variety of actors (Schut et al. 2015). As a result, a variety of actors (for example, researchers, donors, policymakers, and practitioners) have adopted the coffee value chain approach as a solution to farmers' challenges (Kaplinsky, Terheggen, and Tijaja 2011; Collins, Dent, and Bonney 2016; Ponte et al. 2014; Horton et al. 2017; Maru et al. 2018; Bisseleua et al. 2018). In low-income nations, the most prevalent operationalization of coffee value chains is through innovation platforms (IPs) (Pali and Swaans 2013; Camacho-Villa et al. 2016; Kilelu, Klerkx, and Leeuwis 2014). IPs are organized interfaces among farmers via which they can learn how to address their farming challenges by tapping into the capacities of other actors (e.g., processors, traders, transporters, input suppliers, output handlers, policymakers, extension agents, and researchers) (Homann-Kee Tui et al. 2013; Sanyang et al. 2016).

Accordingly, coffee IP farmers in Uganda's primary coffee-growing districts of Kapchorwa, Manafwa, and Namisindwa were researched to contribute to ongoing discussions about IP governance and farmer learning. There is a great deal of variation among IPs in Uganda, both in terms of supporting services and organizational structure and membership. According to key informants, several platform governance mechanisms were deployed, including a steering committee and arrangements in place to ensure those platform activities were conducted smoothly. Among others, the IP members convene once a month for their monthly IP meetings, which focus on learning how to address their farming challenges. The IP facilitator organizes intra- and inter-IP learning activities, as well as collaborations with other networks, according to the framework in place for each IP. Membership fees, annual subscriptions, and fines levied on members for reasons like absenteeism, tardiness, and other infractions are all used to fund IP activities (Appendix 7).

3.3.2. Survey design

A sample of 214 respondents (Table 2) was interviewed for an average of 1 hour and 15 minutes each using a standardized survey questionnaire that was content validated. A random selection procedure was used to pick survey participants. The structured interview instrument's applicability was tested with a comparable group that did not participate in the study. Kolb's experiential theory aided in the operationalization of the research components. Following Kolb's definition of experiential learning, this study focused on five interrelated concepts: (1) the challenges, (2) reflection, (3) the experiential knowledge, (4) active experimentation, and (5) the context, in this study specified as IP governance mechanisms.

Challenges (CE): Matsuo and Nagata (2020) depict experiences as both expected and unexpected. Morris (2020) described experiences as situational challenges. Using the aforementioned literature as well as existing coffee value chain literature, such as (Cerda et al. 2017; Pimenta, Angélico, and Chalfoun 2018; Hameed et al. 2018; Kidist, Zerihun, and Biniam 2019; Ochago et al. 2021), this study identifies four interconnected elements to define farmers' challenges: challenges during production, harvesting, postharvest handling, and marketing. The following question was posed to coffee farmers because of this: Please indicate by ticking the appropriate box how often you faced challenges in the last 5 years (2015-now) at production, harvest, postharvest handling, processing and storage and marketing (on a 5-point scale where 1 = "never" and 5 = "always)

Reflection (RA): Kolb's experiential learning cycle, according to Matsuo and Nagata (2020), should incorporate reflective analysis rather than reflective observation. This is because reflection entails identifying challenges, finding root causes, and assessing feasible solutions. Moreover, challenges-solving involves reflecting on past challenges-solving strategies as well as sharing practical ideas with others making social interactions important. Thus, based on value chain literature (Kabambe et al. 2012; Thiele et al. 2011; Ochago et al. 2021), the first component of reflection was described as a farmer's reflection on interactions with other value chain actors. As a basis, the respondents were asked the following question: How often- in the last 5 years - have you reflected on your interactions with existing relationships to tackle post-harvest and marketing challenges, compared to other IP members? I reflect on interactions with..., a) Operation Wealth Creation (OWC)/NAADS, b) National Agriculture Research Organization-Buginyanya, c) Uganda Coffee Development Authority (UCDA), d) NUCAFE, e) Makerere University, f), etc. (on a 5-point scale where 1 = “never” and 5 = “always). Additionally, Kember et al. (2000) used four items to assess reflection. These items are as follows: (1) I occasionally question how others do something and try to come up with a better way, (2) I enjoy thinking about what I've been doing and considering alternative solutions, (3) I frequently reflect on my actions to see if I could have done better, and (3) I frequently re-appraise my experience to learn from it and improve for my next performance. The second component of reflection is a farmer reflecting on their current knowledge to address coffee value chain challenges. As a response, farmers were asked to rate their level of agreement with the statement on a scale of 1 to 5: (where 1 = “never” and 5 = “always)., compared to other IP members, I ....

(i) question the way other coffee farmers production methods and try to think of a better way

(ii) like to think over my coffee harvesting methods and consider alternative ways of doing it.

(iii) re-appraise my coffee post-harvest handling and processing so I can learn from it and improve for my next performance

(iv) reflect on my coffee marketing sales to see whether I could have improved on what I did.

Experiential knowledge (EK): Matsuo and Nagata (2020) defined experiential knowledge as a learning result. According to these authors, Ochago et al. (2021) defined experiential knowledge as knowledge about new value chain networks, farming methods, and technologies, agricultural activities-farming methods, and technology, as well as self-personal strengths and weaknesses such as (Kabambe et al. 2012; Thiele et al. 2011). Following previous research, this study employs two interconnected parts: knowing new value chain actors, and farming methods to define farmers' experiential knowledge. Consequently, the respondents were asked the following question: Please indicate how much knowledge you have - compared to other IP members - in the following domains: Know about new value chain networks, and farming methods (on 5 points scale where (1) ‘‘strongly disagree’’ to (5) ‘‘strongly agree’’)

Active experimentation (AE): Active experimentation is defined by Matsuo and Nagata (2020) as "doing or putting to use current knowledge". "I learn by doing" (Alice Y Kolb et al., 2015) and "I prefer to be doing things" (Wang et al. 2020) are the most prevalent definitions of active experimentation. Active experimentation was described using two sub-components in the socially involved aspect of learning in the rural value chain environment(Ochago et al. 2021): (i) I use existing value chain networks; (ii) I use the existing coffee farming knowledge to address coffee value chain challenges. The responders were asked the following questions:

- **(i)** How often- in the last 5 years - have you used the knowledge obtained through value chain relationships to tackle production and harvesting challenges compared to other IP members? I used knowledge from..., a) Operation Wealth Creation (OWC)/NAADS, b) National Agriculture Research Organization-Buginyanya, c) Uganda Coffee Development Authority (UCDA), d) NUCAFE, e) Makerere University, f) etc. (on a 5-point scale where 1 = “never” and 5 = “always).
- **(ii)** Then, compared to other IP members, I use my knowledge about coffee:(i) Production, (ii)harvesting, (iii)post-harvest handling and processing, and (iv) marketing (on a 5-point scale where 1 = “never” and 5 = “always).

IP governance mechanisms (IPGM): IP governance mechanisms in existing literature entail IP members' commitment and trust (Hounkonnou et al. 2018; Audouin et al. 2021; Lamers et al. 2017; Schut et al. 2017), involvement (Cadilhon 2013; Audouin et al. 2021; Fatunbi et al. 2016b; Tenywa et al. 2011; Akpo et al. 2021), and access to IP resources (Schut 2017; Kusters et al. 2018; Akpo et al. 2021). Using IP evaluation literature (Table 3), the following items and questions were developed: Please specify the contribution of IP processes to your farming activities by checking the corresponding box. [on 5 points scale where (1) ‘‘strongly disagree’’ to (5) ‘‘strongly agree’’].

Table 3: IP governance mechanisms

IP governance dimension	Description	Sources
IP members' commitment and trust are all examples of trust for other actors, commitment, IP leadership, and facilitation.	Trust includes the comfort to share information with fellow IP members, and IP members feel encouraged to contribute to the betterment of the IP. Dialogue and promotion of understanding among stakeholders, as well as an avenue for them to create a common vision and mutual trust by IP leaders, are also important. IP members' commitment, i.e., IP members are committed to freely sharing knowledge, willing to forego their comfort for the sake of others, and freely participate in coffee IP activities. Leadership, i.e., the process of selecting IP's leadership, is transparent Facilitation by the IP leadership/managers, for example, coffee value chain information is widely shared among my IP members, the IP is effective in mobilizing members for agreed-upon actions and facilitating awareness and knowledge exchange through information dissemination forums, and meetings.	(Iorlamen et al. 2021; Joseph et al. 2021; Sako et al. 2021; Audouin et al. 2021; Davies et al. 2018; Lamers et al. 2017; Schut et al. 2017; Lukurugu et al. 2021; Miningou et al. 2021)
IP members' involvement includes accountability,	Accountability Specifically, IP members hold each other accountable for their actions, IP leaders facilitate upward communication, allowing weaker actors (such as small-scale farmers) to express their	(Sako et al. 2021; Lukurugu et al. 2021; Miningou et al. 2021; Puozaa et al. 2021; Sah et al. 2021; Joseph et al. 2021; Mohammed et al. 2021; Audouin et al. 2021)

equitable participation, and the recruitment process.	views on an equal footing with more powerful actors, and democratic decision-making. Participation that is equitable specifically, during IP discussions, every participating member is sufficiently heard; within the IP, any member can influence decision-making; the IP fosters a sense of ownership among members; and the interests of the actors are protected by transparency in the management of the prices obtained through negotiation. Without regard to gender or activity, free training and information on good agricultural practices were obtained. Considering each member's interest in the goals. The recruitment process includes members in my IP being selected transparently, membership being free and without distinction of gender or activity, and management being transparent.	
Member access to IP resources	Increasing/supporting resource access including inputs (seeds, fertilizers), facilities and equipment, and finance (credit, grants, loans).	(Sako et al. 2021; Schut 2017; Kusters et al. 2018; Akpo et al. 2021; Audouin et al. 2021; Davies et al. 2018; Lamers et al. 2017; Schut et al. 2017; Lukurugu et al. 2021; Miningou et al. 2021)

3.3.3. Data analysis

The survey data was entered by the main author into the SPSS version 23 program. Before data analysis, the main author edited the data in the SPSS data view section on completeness tests or data omissions by checking missing values and revising incorrectly worded items and codes. The partial least squares structural equation modeling (PLS-SEM) method was used to obtain the results (Hair, Risher, et al. 2019). PLS-SEM is a popular method for studying complex inter-relationships between observable and latent variables in a range of domains, including agricultural science and psychology (Willaby et al. 2015). PLS-SEM has advantages when working with complex models, non-normal data, and small samples (for additional information, see Hair et al., 2019), and it is especially well suited to models with higher-order components (Hair Jr et al. 2017). The PLS-SEM analysis has two components: the measurement model and the structural model (Hair, Risher, et al. 2019). The measurement model includes quality attributes such as outer loadings, Cronbach alpha, composite reliability, and average variance extracted. The structural model includes coefficients, P-values, and confidence intervals. The majority of PLS-SEM studies frame their methodology in a confirmatory sense, that is, they first conduct a literature review, then develop formal hypotheses, and finally estimate models (Henseler 2018). The current study, which is interdisciplinary and applied, is designed more for exploratory purposes than for confirmatory ones.

3.4. Results and discussion

3.4.1. Descriptive statistics and correlations

The zero-order correlations among all dependent, independent, and moderator variables are shown in Table 4. Challenges, Reflection, Active experimentation, Experiential knowledge, IP members' commitment and trust, IP members' involvement, and Member access to IP resources are correlated.

Table 4: Descriptive statistics and correlations

Constructs	Descriptive statistics		Correlations						
	Mean	Std. Deviation	CE	RA	AE	EK	IP members' commitment and trust	IP-members' involvement	member access to IP resources
Challenges (CE)	19	4	1						
Reflection (RA)	17	4	.195***	1					
Active experimentation (AE)	19	4	.284***	.285***	1				
Experiential knowledge (EK)	12	3	.138**	.299***	.255***	1			
IP members' commitment and trust	35	5	.171**	.277***	.469***	.395***	1		
IP-members' involvement	26	5	.080	.223***	.508***	.351***	.515***	1	
Member access to IP resources	3	1	.125	.266***	.269***	.301***	.398***	.311***	1

Note. Significance level (2-tailed): p value < 0.01 (***); < 0.05 (**); < 0.10 (*)

3.4.2. Assessment of the measurement models

The initial step before testing the hypothesis was to run algorithms to validate measurement reliability and validity before examining structural model linkages. At this stage, the outer loadings, Cronbach alpha value, composite reliability, and average variance extracted were obtained. For the generation of 95 percent confidence intervals for significance testing, a bootstrap using a 5,000 resampling technique was utilized. The standard error and covariance matrix estimator with heteroscedasticity was utilized. All factors that define the product, such as IP governance procedures, challenges, reflection, and active experimentation, were mean-centered. Hair, Risher, et al. (2019) have well-documented procedures for evaluating loadings, Cronbach's alpha, composite reliability, rho_A, the average variance extracted, and discriminant analysis for reflective components (Tables 5 & 6).

Table 5: Construct Reliability and Validity

Constructs	Cronbach' Alpha (α)	rho_A	Composite Reliability (CR)	Average Variance Extracted (AVE)
Challenges	.758	.773	.835	.504
Experiential Knowledge	.710	.723	.821	.535
Reflection	.723	.724	.818	.474
Active experimentation	.810	.816	.868	.569
IP members' commitment and trust	.867	.872	.894	.485
IP-members' involvement	.838	.852	.878	.508
member access to IP resources	.820	.839	.866	.481

The initial run of the PLS algorithm revealed that some items had low outer loadings (see appendix 10). After removing and rerunning the PLS algorithm, the results were satisfactory. Table 5 shows that all Cronbach's coefficients and rho_A values were greater than 0.7, demonstrating internal consistency and reliability (Hair Jr et al. 2017). The bulk of loadings in Appendix 11 was satisfactory and extremely significant ($p<0.01$). While some indicator loadings were less than 0.7, they were preserved since the constructs' composite reliabilities exceeded the acceptable requirement of 0.7 (Hair, Ringle, and Sarstedt 2011). This outcome demonstrated satisfactory indicator reliability (Hair Jr et al. 2017). Furthermore, all AVE values were significantly less than 0.5, showing high convergent validity.

For discriminant validity, the bootstrapping procedure with 5,000 samples, the no sign changes option, the bias-corrected and accelerated (BCa) bootstrap confidence interval, and two-tailed testing at the 0.05 level were used (Aguirre-Urreta and Rönkkö 2018; Cheah et al. 2019). The heterotrait-monotrait (HTMT) values were lower than the 0.85 conservative thresholds, as shown in Table 6 (Henseler, Ringle, and Sarstedt 2015). Discriminant validity was proven by these findings (Hair Jr et al. 2017).

Table 6: Discriminant validity (heterotrait-monotrait)

Constructs	Active experimentation	Challenges	Experiential knowledge	Reflection
Challenges	.331[.205; .444]			
Experiential knowledge	.344[.204; .464]	.192[.103;.289]		
Reflection	.38[.248; .502]	.259[.132; 383]	.423[.263;.571]	
IP members' commitment and trust	.558[.427;.670]	.204[.118;.279]	.504[.371;.625]	.37[.234;.493]
IP-members' involvement	.616[.476;728]	.143[.095;.156]	.456[.315;.586]	.299[.188;.396]
member access to IP resources	.326[.192;.460]	.197[.121;.228]	.380[.253;.492]	.342[.226;.490]

Note. [] 95% Confidence Intervals Bias Corrected (BCa CI)

3.4.3. Assessment of the structural models

A moderated mediation model is shown in Table 7. A moderated mediation represents a situation in which the indirect effect of an independent variable on a dependent variable via a mediator depends on a moderator. The moderated mediation effect is found when there is one or both: the effect of an independent variable on a mediator relies on a moderator and the average partial effect of a mediator on a dependent variable maintains its significance in the full model and/or the effect of an independent variable on a mediator is significant and the average partial effect of a mediator on a dependent variable depends on a moderator.

Table 7: Moderation analysis

Hypothesis No.	Relationships	β	BCa CI	R^2
Hypothesis 2a (Challenges are related to Reflection and moderated by IP member trust, commitment, and involvement)	Challenges x IP members' commitment and trust -> Reflection	.031***	.006;.055	.358***
	Challenges x IP members' involvement -> Reflection	.042***	.013;.072	.334***
	Challenges x member access to IP resources -> Reflection	-.007	-.037;.023	.326***
Hypothesis 2b (reflection is related to Experiential Knowledge and moderated by IP member trust, commitment, and involvement)	Reflection x IP members' commitment and trust -> Experiential Knowledge	.002	-.013;.017	.443***
	Reflection x IP members' involvement -> Experiential Knowledge	.008*	.008;.245	.427***
	Reflection x member access to IP resources -> Experiential Knowledge	.007	-.011;.025	.378***
Hypothesis 2c (Experiential Knowledge is related to Active experimentation and moderated by IP member trust, commitment, involvement, and member access to IP resources)	Experiential Knowledge x IP members' commitment and trust ->Active experimentation	.008	-.024;.040	.476***
	Experiential Knowledge x IP members' involvement -> Active experimentation	.033	-.017;.084	.530***
	Experiential Knowledge x member access to IP resources -> Active experimentation	.017	-.029;.062	.328***
Hypothesis 2d (Active experimentation is related to Challenges and moderated by IP member trust, commitment, involvement, and member access to IP resources)	Active experimentation x IP members' commitment and trust -> Challenges	-.001	-.028;.026	.267***
	Active experimentation x IP members' involvement -> Challenges	.019	-.004;.043	.294***
	Active experimentation x member access to IP resources -> Challenges	.007	-.016;.031	.267***

Note. Significance level (2-tailed): p value < 0.01 (***); < 0.05 (**); < 0.10 (*); β= Coefficients; 95% Confidence Intervals Bias Corrected (BCa CI)

3

Hypothesis 2a states that IP members' commitment, trust, involvement, and access to IP resources positively moderate the relationship between their coffee value chain challenges and reflection. As expected, Table 7 shows that IP members' commitment and trust had a positive and significant moderating effect on the association between challenges and reflection (β=.031). Further analysis showed that IP members' involvement has a positive and significant effect on the link between challenges and reflection (β=.042). These findings quantify what was previously reported in qualitative research. As per Ochago et al. (2021), when confronted with coffee value chain challenges, Mt. Elgon region coffee IP farmers' commitment and trust, involvement, and access to IP resources aided them in reflecting on their current knowledge and interactions with other value chain actors. Similar findings have been reported in other IP and learning studies; for example, Sako et al. (2021) reported that farmer commitment and involvement in Kolokani Groundnut Innovation Platform (Mali) activities aided them in reflecting on their existing knowledge. Besides, Akpo et al. (2021); Audouin et al. (2021) found that trust fostered by IPs among Sub-Saharan Africa and South Asia farmers and other value chain actors encourages reflection on the farming information shared. Secondly, this is the first study to examine the moderating effects of specific governance mechanisms on reflection when faced with challenges and the acquisition of experiential knowledge through reflection. Surprisingly, member access to IP resources had no effect (negative and insignificant) on the association between challenges and reflection (β=-.007). With resources (Schut 2017; Kusters et al. 2018) like money, stakeholders, land, meeting places, seeds, transportation, and research technologies, one would hope that farmers would have plenty of time to reflect on their challenges. The explanation for the results is the type of provider (who and why), the shared resources (are this demand or supply driven), and the time and context (which domain of the value chain). For example, in the study site, Kawacom is the closest and a key coffee-buying company, which trains farmers on organic coffee production (local pesticides e.g., a mixture of red pepper and water), yet the leading buyer of poor-quality coffee (every coffee in the market-whether organic or not) at a low and uniform price, e.g. at 4000/= per kilogram of dry parchment. NAADS/OWC frequently provides seedlings outside of the planting season and does not follow up.

Moving on to hypothesis 2b which states IP members' commitment, trust, involvement, and access to IP resources positively moderate the relationship between their reflection, and the level of experiential knowledge, Table 7, indicates that IP members' commitment and trust yielded positive but insignificant results (β=.002) on the relationship between reflection and experiential knowledge, an opposite to the positive and significant effects with IP members' involvement as a moderator (β=.008). Even at that, IP members' involvement had a weak effect on the relationship between reflection and experiential knowledge. This finding implies that the involvement of IP members influences knowledge, but that there are other important determinants as well. As earlier mentioned, this study quantified the findings of previous qualitative studies, such as Ochago et al. (2021), who found that farmers' level of experiential knowledge increased when they reflected on their current knowledge while participating in activities. The most plausible explanation remains in the nature of IPs, which emphasize supporting learning activities aimed at addressing diverse and dynamic farmer challenges, of which knowledge of specific farming aspects is a component but not the sole source (Sanyang et al. 2014; Probst et al. 2019). More specifically, the composition (or even the governance mechanisms) of the IP change after a specific challenge is addressed or as members take on a new challenge (Davies et al. 2018) when new stakeholders are added to address the new or emerging challenge and others exit (Ampadu-Ameyaw, Omari, Essegbey, and Dery 2016). Because most IPs are challenge-solution oriented (Probst et al. 2019; Swaans et al. 2014), it supports activities as an indirect way to increase IP members' commitment and build trust Hounkonnou et al. (2018); Akpo et al. (2021); Audouin et al. (2021), but to solve challenges rather than quantifying knowledge gained from such activities as reflection. Finally, like the relationship between challenges and reflection, member access to IP resources had no effect (negative and insignificant) on the association between challenges and reflection (β=-.007).

Hypothesis 2c which states IP members' commitment, trust, involvement, and access to IP resources positively moderate the relationship between their experiential knowledge and active experimentation, yielded positive but insignificant results as indicated in table 5 (.008,.033, and .017). So according to previous research (Leitgeb et al. 2014; Meynard, Dedieu, and Bos 2012b), farmers experiment to see if they can overcome their challenges using what they already know. They experiment with new seed varieties, alternative production processes, and new ways to promote their coffee products through social networks (Akpo et al. 2021; Lukurugu et al. 2021; Miningou et al. 2021). The relationship between farmers' level of experimentation (using their current knowledge of how to address challenges and interact with other value chain actors) and experiential knowledge (knowing new value chain actors and farming methods) is, however, low (r=.255***) and farmers' commitment, trust, involvement, and access to IP resources did not affect this relationship either. Because coffee farmers are old (mean=46 years and 17 years of growing coffee) and have interacted with the same networks for almost as long, there may not be anything new they can use (experiment).

Finally, Table 7 (hypothesis 2d), indicates that IP members’ commitment and trust yielded negative and insignificant results on the relationship between active experimentation, and their challenges, the opposite of the positive and insignificant effects of IP members’ involvement and member's access to IP resources as a moderator. This is unusual since previous qualitative studies (Sako et al. 2021; Iorlamen et al. 2021) found that IPs farmer commitment, involvement(participation), and access to resources such as seeds, and research technologies enhanced farmers solving their challenges through active experimentation.

3.5. Conclusion

The purpose of this study was to determine how IP governance mechanisms influenced farmers' experiential learning process. As per the findings, IP governance mechanisms have both positive and negative effects on farmers' experiential learning processes. First, the commitment, trust, and involvement of IP members significantly and positively moderated the relationship between challenges and reflection. Unexpectedly, member access to IP resources had a minor negative effect on the relationship. Then, in contrast to the positive and significant effects of IP members' involvement as a moderator, the commitment and trust of IP members produced positive but insignificant results on the relationship between reflection and experiential knowledge. Just like the relationship between challenges and reflection, member access to IP resources had a minor negative effect on the correlation between reflection and experiential knowledge. Farmers' commitment, trust, involvement, and access to IP resources did not affect the relationship between their experimentation and experiential knowledge. Lastly, the commitment and trust of IP members produced positive and insignificant results regarding the connection between active experimentation and their challenges, in contrast to the positive and insignificant results with IP members' involvement and members' access to IP resources as a moderator. This study dismantles the experiential learning process as a whole and later demonstrates how different IP governance mechanisms affect the acquisition of new knowledge through reflection and active experimentation. This study's evidence reveals many implications for practice and policy.

3.5.1. Implications for innovation platform practice

In terms of practice, these findings suggest that coffee farmers who are engaged in reflection should rely on their networks and stimulate commitment and involvement (participation) in IPs to strengthen their reflection and knowledge acquisition through reflection. Second, IPs should raise awareness about the value of sharing experiences, critical reflection, and the role of external sources, while also enabling everyone to access useful information for analysis, reflection, and experimentation in tandem with the collective goals. Third, IPs should encourage members to exchange information, allow members to freely express their opinions to stimulate collective thinking, ensure personal development, and make people feel a part of ongoing IP activities. This is the first step in establishing trust among IP actors. Other ways to build trust among IP actors include:

Some IPs, for example, Chesiyo, Kabeywa, Bukusu, and Bumbo incorporate other developing actions centered on issues that are not central to IP objectives to foster trust within their platforms. Again, across the study site, farmers had negative experiences with seed dealers and coffee produce buyers. Seed dealers in particular supplied immature, poor-quality seedlings in insufficient quantities, resulting in very poor output. The other challenge was that of untrustworthy coffee produce buyers who buy good quality, graded coffee from farmers and add junk/trash such as chaff and sand to obtain large volumes of cheap coffee while profiting handsomely. Experiential learning through training and demonstrations was a very effective tool in convincing farmers to produce quality seedlings. As a result, IP farmers established UCDA-certified coffee nurseries from improved or indigenous coffee plants, either individually or collectively. Farmers resorted to collective bulk parchment and selling as an IP in response to the challenge of a few, unreliable, and untrustworthy coffee buyers. Second, farmers sought alternative buyers who would readily purchase coffee at a fair price (1,400 shillings per kilogram of cherries), promptly, and if possible, offer bonuses of up to 20 shillings per kilogram per farmer. Third, coffee farmers collaborated with IP-connected networks to develop new markets such as wash stations, IPs for cherries, and local companies. Even more, IPs should continue to broker relationships. For instance, the Burkina Faso Groundnut Innovation Platform built trust through brokering the relationship between farmers and extension service staff (in the Ministry of Agriculture), leading to the establishment of field demonstrations on groundnut production and improved varieties as a solution to the low productivity caused by limited access to improved legume varieties (Miningou et al. 2021).

Similarly, with the assistance of R&D partners, IPs encouraged farmer commitment, and trust through establishing farmers' seed producer groups. Concurrently, the platform used extension agents' existing knowledge to spark the distribution of improved technology to a large number of farmers through field demonstrations (Lukurugu et al. 2021).

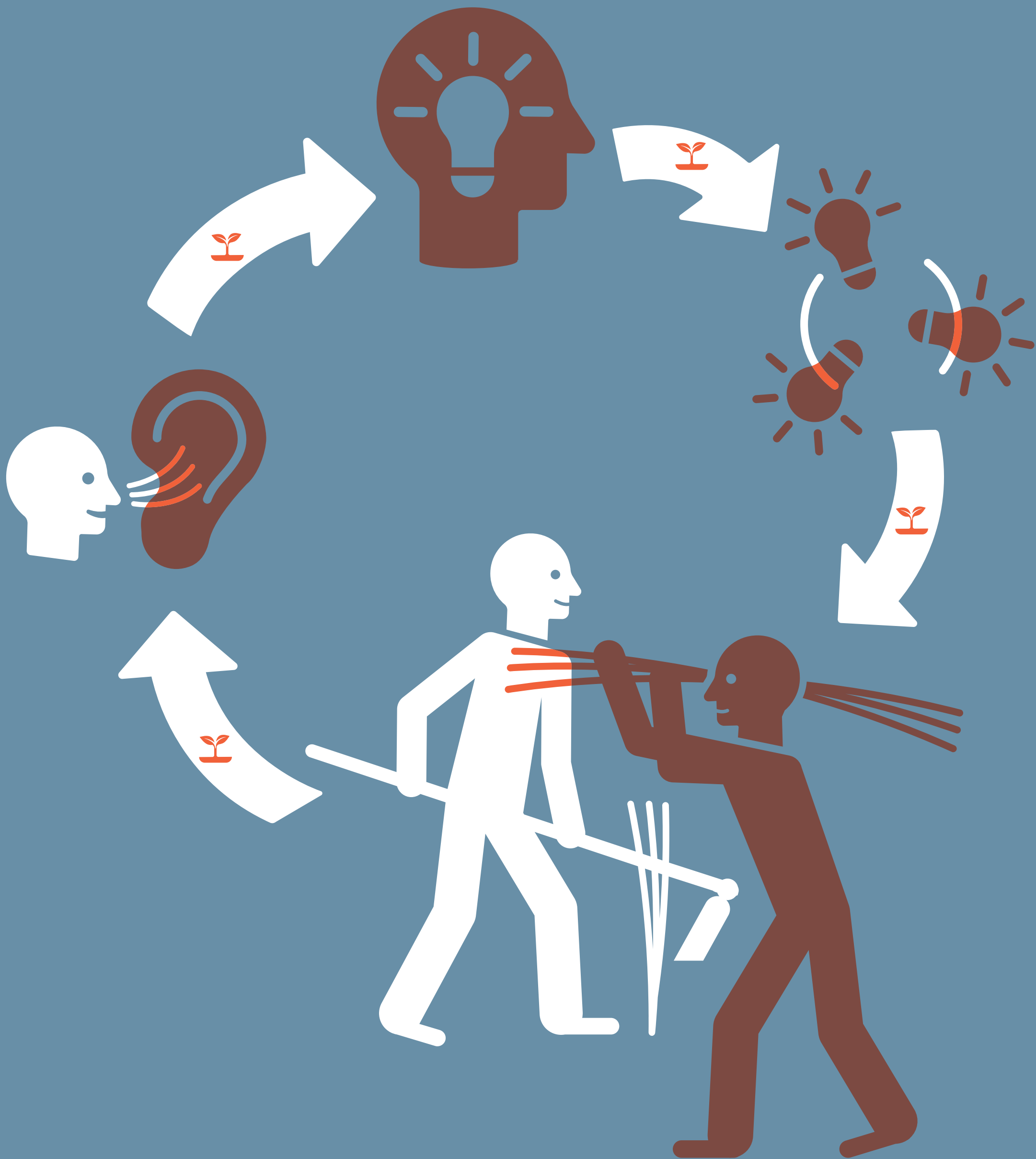
Regarding resources, service providers (IP and IP-affiliated partners) first determine demand and assess needs. Again, since IPs in the study site depend on donor support (Ragasa et al. 2016; Dabire et al. 2017; Schut et al. 2018), policymakers should encourage farmers to adopt more IP sustainability measures rather than fostering resource dependence: To start, many IPs act as cooperatives, wash stations, coffee processors, and collection centers in addition to supporting their learning activities. These IPs' internal income pooling practices include joint projects, assets, and village savings and loan programs. To increase other IPs' capacity for demand-driven learning, policymakers may use this lesson to help them obtain legal status. Finally, most of the services, like advisors, are offered by other farmers in the study IPs. Farmers sharing knowledge inside and through IPs can be useful resources.

3.5.2. Implications for innovation platform policy

Policymakers can use the IP as a unit to identify practical interventions to local challenges and improve targeted rural agriculture value chains by connecting different stakeholders to farmers at the community level because reflection as a learning activity must be elicited consciously by learning actions (Ajjawi and Boud 2018). The IP encompasses a wide range of actors through which new ideas, processes, seeds, and other resources move. A valuable endeavor is the continuous facilitation of interactions among actors resulting in the identification of practical solutions to farmer challenges throughout the learning process. Visualizing a farmer's challenges, for example, can help with concrete experiences, whereas reflective analysis can help during and after facilitated dialogues. Policymakers will then be able to plan rural agriculture research and development strategies that are relevant to the challenges faced by farming households, recognizing them as critical actors in agricultural knowledge production and dissemination (Dabire et al. 2017; Téno and Cadilhon 2017; Vissoh et al. 2017; Ingram et al. 2018; Moschitz et al. 2015; Tisenkopfs et al. 2015). This includes a better understanding of local, indigenous, technical, and informal knowledge, as well as individual farmers' innovative capacity (Šūmane et al. 2018).

3.5.3. Areas for further research

Finally, while this study looked at IP governance from the perspective of farmers, future studies may look at it from different (or multiple) perspectives. Furthermore, other studies would run the PLS analysis separately for the IPs with the most respondents to see if there were any differences between them. In addition, the current study modifies four of Kember et al (2000) reflection measurement items. Additionally to the four items, the qualitative findings-driven social networks of farmers are also included (Ochago et al. 2021). None of these topics have ever been theorized about, grouped, or utilized in the manner that the current study does. It's possible to conduct additional studies that take such item combinations into account.



4

The effect of Ugandan coffee farmers' role identity on their experiential learning

Abstract

Purpose: Although the literature on education and learning sciences determined how farmer identities influence their experiential learning process, this link is less clear in the agricultural context, where farmers have faced unique value chain challenges i.e., production to marketing. This study contributes to examining how farmers' role identities support or hamper farmers' experiential learning processes.

Methodology: First, a qualitative analysis of 91 interviews with coffee farmers in Uganda was carried out to understand the nature and relevance of farmers' role identities. Second, using partial least squares regression-based path analysis, the moderating effect of 214 coffee farmers' production role identity on their experiential learning was assessed.

Findings: Findings reveal that farmers' identification as coffee farmers shapes what, how, and when they learn from their value chain challenges. Farmers' role identity supports their reflection on past challenges to increase their challenge-solving knowledge, as well as experimentation to solve their challenges.

Practical implications: This study integrates role identity theories in the study of learning processes in rural coffee value chains.

Theoretical implications: Moreover, the findings suggest that agricultural extension workers should understand farmers' identities and their influence on their learning to select the targets and developments of their training programs.

Originality/value: This article extends knowledge of experiential learning and farmer role identity in the IPs context.

Keywords: Learning Sciences, Mixed methods, Africa, Rural Agriculture setting, Experiential learning

This chapter is based on: Robert Ochago, Domenico Dentoni, and Maral Mahdad. "The effect of Ugandan coffee farmers' role identity on their experiential learning". Second round of review with the *Journal of Experiential Education.*

CHAPTER FOUR: The effect of Ugandan coffee farmers' role identity on their experiential learning

4.1. Introduction

The agriculture sector provides 80% of the world's food, employment, and income worth $2.2 trillion (Bosc et al. 2013; Graeub et al. 2016). Coffee is the most important source of income in low-income countries in terms of earnings for agricultural enterprises (Kuma et al. 2019).. The export earnings of the top five coffee producers in Africa are Ethiopia ($1.4 billion), Uganda ($494 million), Côte d'Ivoire $ (22 million), Tanzania ($17.3 million), and Kenya ($16.6 million). Despite its potential as Africa's second-largest Arabica coffee exporter after Ethiopia, Uganda's coffee exports are low when compared to African counterparts such as Ethiopia, Kenya, and Rwanda (ICO 2020b). This is primarily due to the sector's reliance on smallholder farmers, who face several challenges in their farming process (i.e. production, harvest, postharvest handling, and marketing) including insect pests and diseases, recurrent drought, reduced soil fertility, low product pricing, high input costs, and poor quality coffee seed varieties (Tadesse, Tesfaye, and Abera 2020; Wang et al. 2015; Wagner et al. 2021). Insect pests and diseases, for example, cause up to 57% coffee yield loss (Cerda et al. 2017), as well as low quality (Pimenta, Angélico, and Chalfoun 2018; Walker et al. 2019) which in turn leads to low and fluctuating coffee market prices (Kidist, Zerihun, and Biniam 2019). Enhancing farmer learning to address challenges is seen as a crucial way to close the gap (Ochago et al. 2021). Finding solutions to farmers' challenges in turn requires the involvement of multiple actors. Extensive research has shown that a range of actors (e.g., researchers, donors, and practitioners) have embraced a coffee value chain approach – to understand interconnected challenges ranging from agricultural production to marketing - as a way to understand and address farmers' challenges (Bisseleua et al. 2018; Horton et al. 2017; Davies et al. 2018).

These actors have used various organizing forms to help farmers learn to solve their challenges. Innovation platforms (IPs) are the most common operationalization of coffee value chains in low-income countries (Camacho-Villa et al. 2016; Kilelu, Klerkx, and Leeuwis 2014). IPs are structured interfaces among farmers where they tap into the capacities of diverse actors to learn to address their farming challenges (Homann-Kee Tui et al. 2013). There is extensive research demonstrating that farmers have indeed learned to solve their challenging through such arrangements as IPs (Chichaybelu et al. 2021; Mahiya 2021; Vissoh et al. 2017). Despite the existence of such literature, the question of how exactly farmers learn to address their challenges has persisted (Schut et al. 2019). Existing research reveals two main findings in response to this question. First, when confronted with a challenge, farmers engage in a variety of learning activities to improve their problem-solving skills in many geographical and sectoral contexts. For example, Ochago et al. (2021) found that when Ugandan coffee farmers were confronted with pest and disease infestations, they engaged in learning activities such as reflection to gain knowledge on different pest and disease management measures. Farmers collectively purchased agrochemicals from a reputable dealer using their pest and disease management knowledge—a solution to their pest and disease management challenges. Moreover, studies conducted in contexts other than Uganda, indicate that individuals learn to overcome challenges through reflecting on prior challenges, sharing practical ideas with others, and working together to solve challenges (Laforge and McLachlan 2018; Lubell, Niles, and Hoffman 2014; Okumah et al. 2021). There should be a link between farmers' challenges, learning activities such as reflection and experimentation, and knowledge when synthesizing studies under farmer learning to solve their challenges. However, these studies did not go on to explain how farmers learned to solve their challenges by clearly identifying which value chain challenges were reflected on to gain challenges-solving knowledge. Did farmers address their challenges by experimenting with the knowledge they had gained through reflection? Existing studies are mostly qualitative and descriptive in nature, and with a focus on farmer knowledge (Okumah et al. 2021). Knowledge is only one aspect of farmers learning to solve their challenges. The current study fills this gap by demonstrating that farmers' knowledge to address their challenges is a product of reflection, which is triggered by challenges. Additionally, this research bridges this gap by demonstrating that farmers' ability to address challenges is a result of experimentation, which in turn is a product of existing problem/challenge-solving knowledge.

Second, under the IPs arrangement, farmers seek guidance on various challenges in the value chain, and as a result, farmers are willing to learn from others when they assume a specific role in their farmer identity. Thus, farmers' role identity, or how farmers see their role in the farming society, as well as the meanings and expectations that come with those roles and their performance (Burke and Stets 2009), may positively influence farmer learning (McGuire et al. 2015). Indeed, farmers may identify themselves, or be seen, as productivists (Burton and Wilson 2006), and ‘good farmers’ (Riley 2016; Burton et al. 2020). Recent evidence suggests that when faced with the challenge of pests and diseases, farmers (who just produce) develop knowledge about pest and disease management methods such as organic pesticide production and application, and inorganic pesticide spraying on plants (Iorlamen et al. 2021; Tahir et al. 2020). Farmers who are also input suppliers and traders develop knowledge about agrochemicals to sell to other farmers and cost-benefit analysis (Homann-Kee Tui et al. 2015), among other things. It is obvious from this research that farmers' learning processes (learning to solve their challenges) are shaped by their role identities; the effect of farmer role identities on their learning process remains unclear. The following is well-known from the existing literature on farmer role identities and learning: Farmers hold multiple role identities (Burton et al. 2020; Burton and Wilson 2006; McGuire, Morton, and Cast 2013). Farmers' identities influence their learning by influencing the learning activities they participate in, such as training, meetings, seminars, exchange trips, and demonstrations (Yirzagla et al. 2021) leading to increased challenges solve knowledge (Ochago et al. 2021). While the authors discovered a link between farmer identities and learning, it is less clear how farmers' identities influence their knowledge acquisition when faced with challenges through a range of learning activities. Furthermore, it is unclear if farmers will be able to address their challenges because of experimenting, which is based on existing problem-solving knowledge. Existing research is primarily qualitative (Carlsson, Wängqvist, and Frisén 2015; Syed and McLean 2016), descriptive (Wahlhütter, Vogl, and Eberhart 2016), and focused on the social and biophysical environment (McGuire, Morton, and Cast 2013; McGuire et al. 2015; Sulemana and James 2014; Burke and Running 2019), and focused on a knowledge, which is one component of the experiential learning process (McGuire, Morton, and Cast 2013; McGuire et al. 2015). The focus on the environment is because agriculture is environmentally damaging (Lavoie and Wardropper 2021). The current paper addressed this gap by testing the hypothesis that farmers' identity influences the process of farmers' experiential learning. In other words, a farmer may learn through experience when planting (producer role), but they do not learn as much when selling to the market (marketer role) because they do not experience the act of selling/marketing as frequently. As a result, when they take on certain roles, they learn more.

4.2. Theoretical foundation

Kolb's EL theory is widely used in current research to describe how learning takes place (Kolb and Kolb 2017; Matsuo and Nagata 2020; Morris 2020). Experiential learning, according to

Kolb's model, is a cyclical and context-dependent process in which experiences are transformed into experiential knowledge (Kolb 2015; Kolb and Kolb 2009). Kolb’s definition of experiential learning indicates five interlinked concepts: (1) concrete experiences, (2) reflective observations, (3) experiential knowledge, (4) active experimentation, and (5) the context, for example, farmers' role identities.

4.2.1. Concrete experiences

Kolb (2015) suggests that the experiential learning process begins with actual experiences or experiential learning activities based on a concept. Experiences are described as challenges in existing research on experiential learning (Ochago et al. 2021; Morris 2020). The EL process entails resolving context-specific and ill-structured challenges (Blair 2016; Asfeldt and Beames 2017). This article focuses on the value chain challenges that smallholder coffee farmers confront. Smallholder farmers grow most of the coffee, but they face a range of challenges throughout the value chain, including up to 57% yield loss caused by pests and diseases (Cerda et al. 2017; Liebig et al. 2016a). Furthermore, during drying and hulling, poor harvesting and postharvest techniques account for more than 60% of a coffee bean's overall quality loss (Hameed et al. 2018). Finally, low and fluctuating coffee market prices are due to poor coffee quality, which is a result of both pre-and post-harvest operations (Kidist, Zerihun, and Biniam 2019). Even though these challenges are well-known, there is little research in the agricultural value chains and learning literature on how challenges help farmers get started with their EL (Schut et al. 2019; Probst et al. 2019). In their study of farmers' experiential learning in coffee value chains, Ochago et al. (2021) found that challenges such as pests and diseases, poor quality and quantity of coffee, and low and unpredictable coffee prices increased farmers' EL. This study combines four interconnected elements to identify farmers' challenges, in line with coffee value chains: challenges during production, harvesting, postharvest handling, and marketing.

4.2.2. Reflection observation

Learners begin to build a better understanding of the concept by observing and reflecting on their experiential learning experiences (Kolb 2015). Reflection observation, according to Di Stefano, Pisano, and Staats (2015b); Beard and Wilson (2013) entails seeing, hearing, and discussing the experience—what happened, how it happened, and why it happened. Schön

(1987)'s reflection theory was revised by Cajiao and Burke (2016); Ajjawi and Boud (2018) who viewed reflection as two parts: reflection in action and reflection on action. "Reflection in action" refers to decisions made while in the scenario, or "how teachers think on their feet", p. 12 (Farrell 2012). Reflection-in-action is almost totally concerned with the process of problem-solving. According to Moon (2013), people are said to be reflecting when they are deeply thinking about how to address complex challenges. To address challenges, reflection-in-action requires using observational analysis, listening, and/or touch or 'feel.' Moreover, the multi-dimensional nature of farming challenges necessitates complex solutions. This frequently entails challenge-solving and knowledge acquisition via an adaptive process of experimentation (Cajiao and Burke 2016; Di Stefano, Pisano, and Staats 2015b). On the other hand, reflection on action occurs after the activity has been done (Schön 1987). Reflection-on-action is the act of looking back to assess what has occurred (Ajjawi and Boud 2018). Identifying challenges, determining root causes, and exploring feasible solutions are all part of the reflection process (Miller and Maellaro 2016). When faced with coffee value chain challenges, farmers, according to Ochago et al. (2021), reflect on their current knowledge to solve challenges and interactions with other value chain actors such as fellow farmers, processors, traders, etc. A farmer reflecting on their current knowledge and interactions with other value chain actors is defined as reflection in this study. Hence, the following hypotheses were tested:

> **H1a.** Farmers reflect on their existing knowledge and interact with other actors when faced with (production, harvesting, postharvest handling, and marketing) challenges.

4.2.3. Experiential knowledge

Experiential knowledge, according to Johanson and Vahlne (1977), is information gained purely via personal experience. When a farmer generates, finds, and record solutions to challenges, they create experiential knowledge (Newman and Conrad 2000; Andreeva and Kianto 2011). Experiential knowledge, then, refers to a farmer's ability to align information with his or her own or other farmers' skills and knowledge and apply it to problem-solving activities. Farmers that work with coffee IPs, for example, learn about new farming methods including optimum plant spacing, line planting, composting, fertilizer application, pest and disease spraying, selective picking of red ripe cherries, and so on (Chichaybelu et al. 2021; Ochago et al. 2021). According to other scholars, farmers learned about value chain actors (such as fellow farmers, processors, traders, etc.) and farming methods through their IPs (Ochago et al. 2021). This study employs two interconnected aspects to define farmers' experiential knowledge, based on existing research: knowing new value chain actors and farming methods. When farmers thought about their current knowledge and interactions with other value chain actors, their level of experiential knowledge (knowing new value chain actors and farming practices) grew (Ochago et al. 2021). As a basis, the following hypothesis was put to the test:

H1b. Farmers' reflection relates to experiential knowledge.

4.2.4. Active experimentation

Farmers experiment to see whether they can solve their challenges by applying what they already know (Leitgeb et al. 2014; Meynard, Dedieu, and Bos 2012a). They try out new seed varieties, alternative production procedures, and innovative ways to market their products through social networks. Farmers are part of a larger social context, which emphasizes the necessity of networks. Farmers' level of experimenting, according to Skaalsveen, Ingram, and Urquhart (2020), is mostly influenced by their exploitation of new ideas and approaches and transmitting this experiential knowledge through informal learning networks. Farmers' level of experimentation increased their application of current knowledge to address challenges and interact with other value chain actors. Accordingly, active experimentation happens when a farmer applies his or her current knowledge to address challenges and interacts with other value chain actors to increase their level of challenge-solving abilities. So, the following hypothesis was tested:

H1c. Farmers' experiential knowledge relates to their active experimentation (using their existing knowledge and interacting with other value chain actors).

Farmers engage in a variety of experimentation activities to improve their challenges-solving abilities using existing farming challenges-solving knowledge. For example, Ochago et al. (2021) found that experimented with alternative pest and disease control measures after realizing that the root of the high disease and pest infestation is due to fake agrochemicals. They collectively purchased certified agrochemicals in bulk from reputable dealers within their farming communities. Based on this, the following hypothesis was tested:

H1d. Farmers' active experimentation relates to their resolution of (coffee production, harvesting, postharvest handling, and marketing) challenges.

4.2.5. Farmer's role identities

According to Stryker (1968)'s identity theory, the person is made up of several identities that are structured and hierarchical, and are linked to the various roles and positions one holds within a social context. Burton (2004) examined the British grain farmer through the lens of a general theory of identity. He found an intense relationship between the farmers' person, role, and group identities. A person's identity is made up of meanings that are unique to the individual (Stets 2006). These meanings serve as a standard or a reference for the identity. Person identities reflect individuals' understandings of themselves as having particular traits and qualities. Because of this, they tend to be relevant across roles and within a variety of situations making them quite high in an individual's identity salience hierarchy (Stets 2006). Since a more salient identity is likely to be activated more often, it becomes possible to predict how a person may act in specific situations (Burke and Stets 2009). The person identity (e.g. coffee farmer) is often considered the organizer and modifier of a person's social (group) and role identities (Burton 2004)

A social identity is how one characterizes oneself in terms of how they are similar to or distinct from an abstract social grouping (Stets 2006). When an individual is able to connect their role and person identities with an abstract group identity, that individual connects to that group identity more completely than if their role and person identities are not as closely linked to the group identity (Stets and Burke 2000). The farmers described in this research have developed a social identity of being farmers within the coffee Innovation platforms (IPs). One significant distinction between social identity and role identity is that when one adopts a social identity, he or she compares oneself to the set of criteria maintained by the reference group. In contrast, role identifiers place a greater emphasis on effectiveness, or the ability to perform that role: "What one does in one's role identity is more important than who one is based on one's group identification" (Stets 2006; Stets and Burke 2000).

A role identity operates similarly to the person identity, however, role identity encompasses all of the meanings that a person attaches to himself while executing a role (Stets 2006). Burton and Wilson (2006) created a typology to describe how farmer identities were organized in a hierarchy, with the most important identity being the most influential. The agricultural producer was the most common farmer identity category. Farmers' roles in this farmer identity revolve around on-farm management practices and methods such as 'correct' fertilizer, pesticide, and other agricultural chemical application, as well as marketing. Moreover, such roles come with behavioral and action expectations (Stryker 2008; Dukerich 2001; Burke and Stets 2009). Simply put, roles have an impact on how people perceive how they should act (Stets 2006). As a result, when people assume a role, they frequently think or act differently than when they assume a different role.

To better understand farmer role identities, current identity research has focused on the meanings people assign to themselves as occupants of specific positions in the farming society. Many FRI typologies and how they are socially created have been described (Burton et al. 2020; Burton and Wilson 2006; Kaplan and Garner 2017; Kaplan, Neuber, and Garner 2019), but not in the context of rural agricultural value chains. Instead, in terms of role composition, agricultural value chain literature lists the following: farmers, processors, traders, transporters, and input providers (Ochago et al. 2021; Fatunbi et al. 2016b). This literature does not capture farmer role identities along the value chain in a systematic way. Hence the first part of this paper gathered qualitative information regarding farmer role identities and their relevance to the experiential learning process.

4.2.6. The moderated indirect effect of farmer role identities on their experiential learning process.

According to Ashforth, Harrison, and Corley (2008), role identity encompasses both competence (e.g., experience, skills, abilities, and traits) as well as motivation (e.g., values and goals). The impact of role identity on role-related learning is unavoidable. Role identity, for example, influences problem-solving knowledge (Cardon et al. 2009). Unfortunately, there is research linking individual identities to specific learning activities, let alone research focusing especially on farmer knowledge is scanty. As a result, this study used the findings from the qualitative study to see if and how farmers' role identities influenced their EL (see section 4.4). These findings provide a preliminary indication that the indirect linkages between farmers' value chain challenges and their experiential knowledge via reflection of farmers' value chain challenges may be conditional on farmer role identity. Then the indirect linkages between farmers' experiential knowledge and their value chain challenges via active experimentation may be conditional on farmer role identity. As such, this paper employs 'role identity' as a moderator in a mediation process that links challenges to experiential knowledge at various stages (H2).

> **Hypothesis 2a**: Farmer role identity positively moderates the relationship between their coffee (production, harvesting, postharvest handling, and marketing) challenges and reflection.
>
> **Hypothesis 2b**: Farmer role identity positively moderates the relationship between their reflection and experiential knowledge.
>
> **Hypothesis 2c**: Farmer role identity positively moderates the relationship between their experiential knowledge and active experimentation.
>
> **Hypothesis 2d**: Farmer role identity positively moderates the relationship between their active experimentation and resolution of challenges.

4.3. Methodology

4.3.1. Participants

Data was gathered and considered Men and women in coffee IPs are the target population. This study was approved by Wageningen University School of Social Sciences. In total, responses from 305 coffee Innovation Platform farmers were considered.

4.3.2. Design

This study examined coffee IP farmers in Uganda's key coffee-growing districts of Kapchorwa, Manafwa, and Namisindwa. The study started by defining farmer role identities to see if there was a link between them and experiential learning. Following a mixed-methods sequential-embedded approach, phase 1 exploratory interviews with farmers inspired the formulation of a phase 2 questionnaire (Creswell and Clark 2017; Harrison, Reilly, and Creswell 2020). This approach was chosen because it would allow the results of the first round of data collecting and analysis to inform the content of a subsequent survey (Farmer et al. 2014).

4.3.3. Materials

4.3.3.1. Materials for Phase 1: Qualitative study

A checklist was created as a reference to define the agenda for the focus group discussions(FGDs) before conducting the focus groups. Krueger (2014)'s guidelines were used to structure the facilitator guide. Following studies such as (Brasier et al. 2014), a semi-structured format to offer a platform for discussion was incorporated to explicitly capture farmer's family resources as follows: (a) In terms of division of roles in coffee farming, how would you define yourself? (b) Has your traditional identity (production) changed since 2014? (c) If so, which processes did you go through to learn the new identity? and (d) How has the shift in your identity helped you learn new ways to solve your farming challenges?

4.3.3.2. Materials for Phase 2: Quantitative study

The respondents were interviewed using a standardized survey questionnaire that had been content validated by a panel of experts. This survey instrument was created in response to qualitative findings and existing literature (Appendix 11).

4.3.4. Procedures

4.3.4.1. Procedures for Phase 1: Qualitative study

With the help of key informants, lists of IP facilitators/coordinators were produced to capture the study's overall aspects. After learning about the study's goals, each district IP coordination team (the IP facilitators/coordinators) developed a list of potential FGD participants during a one-day meeting with the researcher. Then, at the IP level, they made actual contact with participants before calling by phone to check their availability. From each IP, four people were chosen purposively. Their choice was impacted by their grasp of the study's components. Coffee farmer-picker-processor-contact farmer, coffee farmer-Coffee buyer-Coffee IP or group leader-Coffee Transporter-Input stockiest-opinion leader, and coffee farmer-trainer were among the roles identified by the key informants (Appendix 8a).

Each focus group discussion took place in a meeting room with respondents seated in a semi-circular fashion, writing supplies such as flip chart papers and different colored marker pens, and audio recording equipment. With the support of the researcher, each FGD was facilitated in a central location by two trained research assistants: a moderator and a note-taker. Participants were asked to speak freely about their responses in their native tongues. For each group, the views reached by consensus or by hand vote were recorded. This is due to the fact that the majority of the speakers were men, model/contact farmers, traders, processors, opinion leaders, or those in positions of leadership. These people were well educated, financially secure, or had well-managed coffee fields, as well as well informed and networked. I acted as an observer and took independent notes on the discussion. The discussions were audio-recorded with the participant's permission. Data was collected and analyzed from 43 FGD participants at the end of this process (Figure 4).

Finally, topic areas from FGD were replicated at the individual coffee farmer level. Each research assistant conducted a face-to-face interview with a respondent at their home during this round of data collecting. All interview results were written down in notebooks and audio recorded. Data was collected and analyzed from 48 IP members at the end of this process (Figure 4). Through the back-and-forth between data analysis and data collection (Gioia, Corley, and Hamilton 2013), the number of interviews was determined using the saturation logic (Yin 2018).

4.3.4.2. Procedure for Phase 2: Quantitative study

A sample of 214 respondents (Table 3) was interviewed using a standardized survey questionnaire that was content validated by a panel of experts for an average of 1 hour and 15 minutes each. The survey participants were chosen using a random selection technique. The structured interview instrument's applicability was assessed using pretesting with a comparable group who did not engage in the study. The items for the variables that were developed utilizing the existing literature can be found in Appendix E. All study components were investigated using Likert scale items. Respondents can use Likert-type scales to reflect their true feelings. The responses were rated on a scale of strongly agree (5) to strongly disagree (1). The main author trained the enumerators who were fluent in the local dialects to ensure data quality. Every day after the data collection operation, team debriefings were held to share lessons and issues to ensure a consistent interpretation of the survey questions.

4.3.5. Analytical strategy

4.3.5.1. Qualitative analysis

All interviews were transcribed verbatim and coded using Atlas ti 8, a qualitative data analysis program. The Gioia method (Gioia, Corley, and Hamilton 2013) was used because this research is loosely guided by past literature. Iterations among the data, established literature, and continuous fieldwork influenced the coding. Codes were created using words and concepts often mentioned by participants during interviews in three coding rounds. The first round entailed open coding, which involved going through the data sentence by sentence and transcript by transcript to assign meaning to text chunks including phrases, sentences, words, and entire paragraphs (Corbin and Strauss 2014). Words and concepts commonly used by participants during interviews were used to construct first-order codes that describe the roles. Then, by combining first-order codes, based on their commonalities in terms of meanings and themes, second-level codes were developed (role as per coffee value chain nodes, also known as code groups). Finally, the overarching theoretical dimensions were established by code groups (non-traditional farmer identity, Coffee dealer, advisory service provider, and manager, hereafter referred to as smart codes). During data analysis, patterns within and between cases were taken into account (Miles, Huberman, and Saldana 2019).

4.3.5.2. Quantitative analysis

The partial least squares structural equation modeling (PLS-SEM) method was used to obtain the results (Hair, Risher, et al. 2019). The original plan was to use the statistical program SmartPLS 3 (Henseler, Ringle, and Sarstedt 2015) for the structural model analysis, but this was only possible for the measurement. PLS-SEM analysis is divided into two parts: the measurement model and the structural model (Hair, Risher, et al. 2019). On one hand, the measurement model uses quality attributes such as outer loadings, Cronbach alpha value, composite reliability, and average variance extracted. The structural model, on the other hand, uses coefficients, P-values, and Confidence Intervals). The Hayes Process analysis was used to evaluate the structural model. Hayes's conditional process analysis, also known as "moderated mediation analysis," uses partial least squares regression-based path analysis to estimate mediation models that allow for system moderation (Hayes, Montoya, and Rockwood 2017; Hayes and Rockwood 2020). The process macro, as introduced by Hayes, is a computational tool that estimates all the path analyses for each equation separately using pre-programmed models. The Hayes process was chosen because it allowed all four arrows that make up the structural model to connect (cyclic nature), something that SmartPLS did not allow.

Controlling for the effects of network size (total bonding, bridging, and linking ties), and statistically removing their possible impacts on the paths in the Hayes process models, the study hypotheses were tested. The Hayes process analysis model 4 was used to assess the mediation models with reflection and active experimentation. Second, the dual stage moderated farmer production role identity mediation effects in CE→RA→EK and EK→AE→CE were tested using model 21 of the Hayes process. To generate a 95 percent confidence interval for significance testing, all measures were bootstrapped with a 5,000-resampling procedure. The standard error and covariance matrix estimator were heteroscedasticities compatible. Before analysis, all variables that define the product, such as farmer production role Identity, CE, RA, and AE, were mean-focused. Several iterations with the respondent aided in the interpretation of the results.

4.4. Findings

4.4.1. Qualitative study: Understanding farmer role identities

Appendices B2, 3 & 4 results showed that all respondents performed more than one role, i.e. being a coffee farmer and others. The predominant farmer role identity as mentioned below in the results of interviews captured modern coffee farmer:

> *My identity has changed from a traditional coffee farmer to a modern coffee farmer. Those days I used to stick to my old ways of farming but now I practice good agronomy as well as other aspects of the value chain. (Interview 039, male, Bumbo coffee IP, Namisindwa).*

For the following reasons, the majority of respondents identified as non-traditional coffee farmers: Coffee farmers, in particular, believed that they were the foundation of the coffee industry as a whole, which is why they maintained their farmer identities. The other explanation for the same role is that coffee cultivation was inherited/passed down through the family and is the identity of the household. Another reason for retaining the role's non-traditional farmer identity is its less tedious nature, as stated by a farmer.

> *As a person, it's very complicated for me to trade as it requires a lot of movement and money. To me, farming/production is more settled in one place and can run other errands. I can plant more crops because I am always around which a trader will not manage as they always move to source for coffee.(Interview 036, male, Butta coffee IP, Manafwa).*

Another farmer role identity mentioned in the interview results is the coffee trader:

> *I perform many roles, but for the sake of our discussion, let me refer to myself as coffee buyer. I perform this particular role a lot in the coffee value chain. A facilitator, trainer*

(field officer), and coffee farmer are additional roles (Interview 001,female, Kabeywa Coffee IP, Kapchorwa)

Coffee farmers also serve as contact persons/model farmers/prominent farmers/extension agents/trainers, opinion leaders, recorders/secretaries, IP facilitators, church leaders, elders, and so on.

I am a coffee farmer, a reverend, a counselor, a coffee trader, and the leader of a women's group. (Interview 018,female, Bukhofu coffee IP, Manafwa)

I am a coffee farmer, nursery operator, trainer, IPs district coordinator, and opinion leader, according to another farmer *(Interview 047,male,Bumbo coffee IP, Namisindwa)*

Although it is evident that farmers identify themselves with more than one role, the question remains as to how they learn to do so. The findings (94% for individual interviews and 100% for FGD) suggest that learning to perform more roles is a shared obligation. To put it another way, coffee farmers learn to modify their production roles through engaging in collective learning activities such as reflecting and experimenting. In terms of reflection, when farmers were not in IPs, they admitted to reflecting less. Coffee farmers serve their fellow farmers, traders, and stakeholders by providing advice. The feedback provided by these stakeholders helps farmers to assess themselves. Working in a similar position (role) encourages people to exchange information, such as about seasonal planting, market prices, and good coffee farming practices, which contributes to further thought. A change in the rate of reflection can be explained by increased interaction between group members:

I now learn from many different IP-affiliated organizations like Makerere University and Great lakes. Through trying to compare the information I get from these sources and the old information I had, I discovered the knowledge gap which led me to learn more through interaction. (Interview 007, male, Chema coffee IP, Kapchorwa).

Regarding experimentation, attending IP leadership-organized training (on various coffee production, harvest, postharvest handling, and marketing methods), interactions with trainers and fellow IP members during and after training, and sharing ideas along the coffee value chain between IP members and other stakeholders are all consistent themes in all interviews. Then there are practical learning sessions and demonstrations on-site, as well as personal farm areas. Consider the following scenario:

In the coffee marketing state, I would confront the challenge of having my coffee rejected frequently due to poor quality and being offered a very low price per kilogram *of coffee. This prompted me to seek advice from other farmers in the community (for example, our local council's three chairperson). I learned to perform new roles because of my interactions with other farmers and stakeholders. Now, in addition to being a farmer, my new identity is being a good coffee picker and trader. (Interview 009, female, Chema coffee IP, Kapchorwa)*

Interestingly, while coffee farmers learn to modify their production roles through engaging in collective learning activities, the new roles also drive their EL process. For example, when faced with pest and disease attacks, coffee farmers can discuss their challenges through routine IP activities such as meetings before acting. As stated below, such meetings invariably provide a space for in-depth reflective dialogue:

I used to use pangas for pruning, but I realized that I was damaging my coffee, specifically the stems. Because we lacked proper pruning equipment, the coffee trees dried out quickly. We discussed and decided as a group to invite District Local Government (DLG) personnel to train us on coffee management. [...]. The DLG provided us with some equipment to use, and after learning how they work, we decided to purchase them on the market. (Interview 007, male, Chema coffee IP, Kapchorwa.)

Always reflect on the new knowledge I gained, I take time to think through and relate with the humble beginning where the IP picked me from, there is a lot of difference for that reason I work so hard to do even better (Respondent D: Interview 50, FGD Namisindwa).

The IP members, who are often well educated, informed, or experienced, and well-connected, then train fellow farmers on various coffee pest and disease management methods. Furthermore, to supplement their efforts, these IP members bring in outside actors to train farmers on pest and disease management. Following that, coffee farmers critically reflect and analyze the training content to gain insights (knowledge) to put into practice. As demonstrated by the following quote:

My knowledge of coffee increased hence instead of being idle I took up a trader role. I too got a lot of coffee-trading encouragement from my experienced neighbor. I likewise took up the role of a picker to pick quality coffee along with training and monitoring the actions of my hired pickers. (Interview 016, female, Mt. Elgon Women in coffee IP, Kapchorwa).

Farmers do try out (experiment), for example, planting pest and disease-resistant varieties, using indigenous pest and disease management methods, soil amendments, planting shade trees, phytosanitary measures, and spraying. As this quote illustrates:

> *I'm constantly weeding, pruning, spraying, and managing water and soil these days. I occasionally use locally grown herbs that we ferment and spray for leaf rust and stem borers. All of this I learned through the training I attend. (Interview 020, male, Bukhofu Coffee IP, Manafwa).*

With experimenting, coffee farmers acquire new experiences, which experiences guide them to for example IP farmers either individually or as a group established Uganda Coffee Development Authority (UCDA)-certified coffee nurseries from improved or indigenous coffee plants. For example:

> *After training on nursery bed operations under the KIFANGO group, I was motivated to start up my nursery bed, which I later expanded to a fully-fledged commercial nursery site. (Interview 026, female, Busyula Coffee IP, Manafwa)*

4.4.2. Quantitative study: How farmer role identities shape experiential learning

4.4.2.1. Measurement model

PLS-SEM includes algorithms to verify measurement reliability and validity before evaluating structural model links. Hair, Risher, et al. (2019) have well-documented procedures for evaluating loadings, Cronbach's alpha, composite reliability, ρA, the average variance extracted, and discriminant analysis for reflective components (Tables 8 & 9).

Table 8: Construct reliability

Constructs	Cronbach' alpha	rho_A	Composite reliability	Average variance extracted
Challenges (CE)	.758	.772	.835	.504
Experiential knowledge (EK)	.710	.727	.820	.535
Reflection (RA)	.723	.728	.816	.471
Active experimentation (AE)	.810	.811	.868	.569
Coffee input dealer-processor-transporter-manager/leader (FRI)	.720	.793	.811	.524
Coffee picker-trader-contact/advisor-Sacco member (Control FRI)	.566	.688	.731	.416

Table 8 shows that all Cronbach's coefficients and rho_A values were greater than 0.7, demonstrating internal consistency and reliability (Hair Jr et al. 2017). The bulk of loadings in Appendix E was satisfactory and extremely significant ($p<0.01$). While some indicator loadings were less than 0.7, they were preserved since the constructs' composite reliabilities exceeded the acceptable requirement of 0.7 (Hair, Ringle, and Sarstedt 2011). This outcome demonstrated that the indication was accurate (Hair Jr et al. 2017). Furthermore, all AVE values were significantly less than 0.5, showing high convergent validity. For discriminant validity, the bootstrapping procedure with 5,000 samples, the no sign changes option, the bias-corrected and accelerated (BCa) bootstrap confidence interval, and two-tailed testing at the 0.05 level were used (Aguirre-Urreta and Rönkkö 2018; Cheah et al. 2019). The heterotrait-monotrait (HTMT) values were lower than the 0.85 conservative criteria, as shown in Table 9. (Henseler, Ringle, and Sarstedt 2015). Discriminant validity was proven by these findings (Hair Jr et al. 2017).

Table 9: Discriminant validity

Constructs/Relationships	Coefficients	95% Confidence Intervals Bias Corrected
Challenges->Experiential knowledge	.192	[.100;.285]
Challenges -> Active experimentation	.331	[.203; .446]
Challenges->Reflection	.259	[.140; .378]
Challenges-> FRI	.131	[.086; .141]
Active experimentation->Experiential knowledge	.344	[.215; .463]
Active experimentation-> FRI	.205	[.107; .267]
Active experimentation->Reflection	.380	[.253; .502]
Farmer role identity -> Experiential knowledge	.134	[.059; .145]
Reflection ->Experiential knowledge	.423	[.270; .580]
Reflection -> FRI	.205	[.117; .233]

4.4.2.2. Structural model

Table 10: Descriptive statistics and correlations

S/No	Constructs	1	2	3	4	5	6	7	8	9	10
1	Age (AGE)	1									
2	Educational level (EDUC)	-.196**	1								
3	Coffee growing experiences (CGE)	.687**	-.136*	1							
4	Network size (NK)	.034	.209**	.004	1						
5	Challenges (CEs)	-.028	.043	-.088	.135*	1					
6	Experiential knowledge (EK)	.002	.037	.077	.275**	.130	1				
7	Reflective analysis (RA)	-.110	.058	-.139*	.281**	.186**	.299**	1			
8	Active experimentation (AE)	-.098	.106	-.170*	.287**	.257**	.255**	.285**	1		
9	Coffee input dealer-processor-transporter-manager/leader (FRI)	.075	.104	-.035	.274**	-.051	-.037	-.032	-.118	1	
10	Coffee picker-trader-contact/advisory-Sacco member (Control FRI)	.042	.087	-.102	.270**	.005	.059	.202**	.146*	.626**	1

Note. Significant at ***p<0.01; **p<0.05; *p<0.1 level (2-tailed)

Based on the correlation analysis (Table 10), the first analysis step tested the mediation effect of farmers' reflection and active experimentation during their experiential learning process (H1a-d). Figure 7 illustrates that challenges and reflection have a strong positive relationship. The variable's coefficients (β=.178) and bootstrap values [.037; .319] indicate significant impacts. As a result, H1a is endorsed, which stipulates that farmers who have confronted coffee value chain challenges reflect on their current knowledge and interactions with other value chain actors. Additionally, the relationship between reflection and experiential knowledge had a positive and significant relationship as depicted by the coefficients (β=.238) and bootstrap values [.130;.347]. Therefore, H1b was supported. The results of the relationships between experiential knowledge-active experimentation and active experimentation-challenges were all positive and significant with bootstrap values of [.146;454] and [.113;.392] respectively. As a result, H2c&d are supported. Table 11 confirms the mediation effect of reflection and active experimentation on the links between challenges and experiential knowledge, as well as between experiential knowledge and challenges.

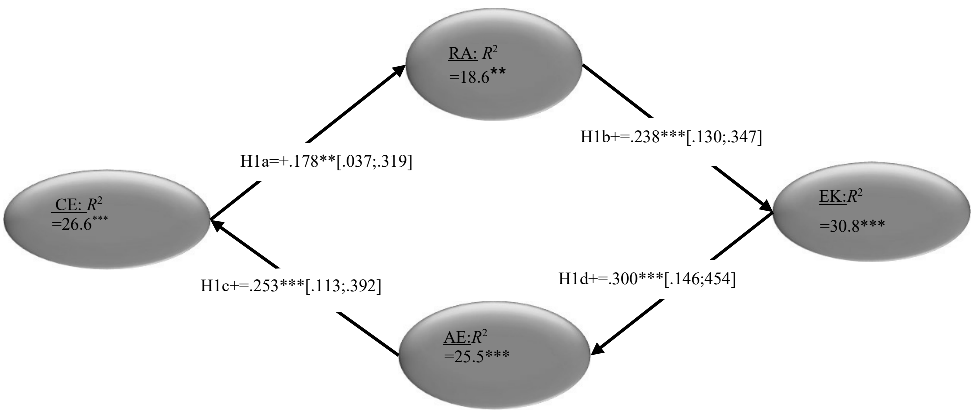


Figure 7: The simple mediation path model results

Table 11: Mediation Analysis (Indirect effects of X on Y)

	Effect	BootSE	CI
Reflection	.042	.019	[.008; .084]
Active Experimentation	.076	.030	[.027; .142]

Note. CI= Bootstrap Confidence Interval at 95%

The moderating influence of FRI on reflective analysis as a mediator of farmers' experiential learning was investigated in the second step of the analysis (H2a & b). FRI had a positive but non-significant effect on the link between challenges and reflection (β=.036), as indicated in Table 12. Therefore, H2a was not supported. Farmers' network size, including bonding, bridging, and linking social capital (β=.250) positively moderated the association between challenges and reflection when combined with FRI. Similar results are observed in the relationship between reflection and experiential knowledge.

Table 12: Moderation analysis with reflective analysis as the mediator

Constructs/relationships	H2a: Challenges→ reflection		H2b: reflection→ experiential knowledge	
	Coefficient	CI	Coefficient	CI
Control variable 1: Network size	.250***	.028;.076	.039**	.011;.067
Control variable 2: Control FRI	-.443***	-.739; -.147	-.132	-.397;.134
Moderator variable: Challenges*farmer role identity (FRI)→reflection	.036	-.193;.266		
Moderator variable: Reflection*farmer role identity (FRI)→experiential knowledge			.001	-.187;.188
R^2	.414***		.347***	

Note. Significant at ***p<0.01; **p<0.05 level (2-tailed); CI= Bootstrap Confidence Interval at 95%

The third stage of the research looked at the effect of FRI as a moderator of active experimentation as another mediator of farmers' experiential learning (H2b&d). The interaction term between CE and FPRI (β=.041) was positive but did not predict active experimentation, as shown in Table 13. However, the interaction term between AE and FRI (β=-.087) was negative and did not predict CE, according to the findings. As a result, both H2c&d are not supported. Farmers' networks, like all previous relationships, positively moderated the relationship between EK and AE.

Table 13: Moderation analysis with active experimentation as the mediator

Constructs/relationships	H2c: Experiential knowledge → Active experimentation		H2d: Active experimentation → Challenges	
	Coefficient	CI	Coefficient	CI
Control variable 1: Network size	.055***	.014;.095	.014	-.029;.057
Control variable 2: FRIb	-.586***	-.881; -.290	.015	-.369;.399
Moderator variable: experiential knowledge *farmer role identity (FRI)→Active experimentation	.041	-.441;.358		
Moderator variable: Active experimentation*farmer role identity (FRI)→ Challenges			-.087	-.171;.345
R^2	.451***		.281***	

Note. Significant at ***p<0.01; **p<0.05 level (2-tailed); CI= Bootstrap Confidence Interval at 95%.

4

4.5. Discussion

This paper connects farmers' EL process to their role identities in the context of IPs in the Ugandan coffee sector. This research qualitatively established coffee farmers' role identities in the learning process before quantitatively evaluating the effect on farmers learning activities and acquisition of experiential knowledge through learning activities. The first question in this study sought to determine if and how farmers' role identities might relate to farmers' experiential learning (EL) processes. The most common farmer role identity is coffee farmer-trader. This identity has a lot to do with coffee production and marketing (See appendix C). The coffee farmer identity is right behind the coffee farmer-trader identity. This identity type places a strong focus on-farm management practices and methods such as the 'correct' application of fertilizer, pesticides, and other agricultural chemicals (Burton, Kuczera, and Schwarz 2008). The coffee farmer identity in the study is a springboard, contrary to the role identity theory's assertion that people must move out of their old role identity for the new identity to become a driving force and motivation. These findings (farmers having multiple identities) are consistent with that of (Burton et al. 2020; Burton and Wilson 2006; McGuire, Morton, and Cast 2013) who found that in non-IP settings of the developed contexts, farmers wear several hats. Similarly significant, these findings add to existing labels for farmer identities by scholars or farmers themselves. For instance, in previous research farmer identity(production) is labeled as productivist (Burton and Wilson 2006), good farmer (McGuire, Morton, and Cast 2013; Riley 2016; Burton et al. 2020), steward (Comito, Wolseth, and Morton 2013). Aside from these studies, the current research examines the components of one's identity. The most plausible explanation is that farmers no longer have the luxury of performing only one role in the coffee sector, which is becoming more commercialized with a focus on strengthening structures, farming technologies, and institutions e.g., IPs.

Another important finding of this research is that forming a new identity is a social learning process. These findings support prior research on farmer identity, such as those of Burton and Wilson (2006) who found that new identity development involves a social activity. In contrast to earlier studies, the current study examines it from the perspective of a rural coffee value chain, focusing on social networks and how new identities emerge (Appendix 10). The IPs provide a socially engaging space for coffee farmers to reflect on their past challenging experiences, generating knowledge about new identities through supporting farmer learning activities (Schut 2017; Kusters et al. 2018). Also, the IP environment unlocks locally available resources such as that of farm families, which supports the execution of role-related tasks.

Again, this study found that challenges kick start the process of assuming new roles, such as coffee trader. Farmers must acquire knowledge and experience in order to be successful in the new roles. This identity will only take precedence while learning and experimenting; after that, the farmer identity will take control once more. The study demonstrates how the farmers learn through interactions and experimentation as a result of taking on new roles. Because of this, a significant percentage of participants in the interviews identified as "modern" coffee farmers. In terms of relating identity and learning, this finding prompts one to ask the following questions: "who am I?" (and what am I doing?) and "what else can I or should I do?" and "what should I or am I learning about what else I want to do or do?" This result enriches the earlier study by Ochago et al. (2021) who found when faced with challenges such as low coffee prices engaged in performing a range of activities such as consulting fellow farmers (some of who double as traders), reflecting on their previous coffee sale experiences with family members, etc. attained new roles as coffee farmer-trader. In addition to prior research, this study also finds that assuming new roles, in turn, shapes farmers' EL. Unfortunately, no statistically significant moderation effect of farmer role identity on farmers' EL process was discovered in this study. The size of farmer networks, instead, moderated the farmer's experiential learning process. The most plausible explanation is that farmers do not abandon their person identity (farmers) in order to assume another. They simply took on new roles. These additional roles are difficult to distinguish from the person's identity as a farmer. This explains why no significant moderating effects were observed.

4.6. Implications

This study contributes significantly to EL and role identity theories, and practice in various ways. Initially, the study findings contribute to role theory in comparison to recent non-agriculture literature van der Gaag, Albers, and Kunnen (2017); Galliher, Rivas-Drake, and Dubow (2017); Galliher, McLean, and Syed (2017); Kaplan and Garner (2017); Seaman, Sharp, and Coppens (2017); Wang, Douglass, and Yip (2017) as follows. First, the respondents' most common role identity is that of a coffee farmer-trader. This identity type places a strong focus on-farm management practices and methods such as the 'correct' application of fertilizer, pesticides, and other agricultural chemicals as well as marketing. The coffee farmer identity in the study is the foundation, contrary to the role identity theory's assertion that people must move out of their old role identity for the new identity to become a driving force and motivational. According to this study, farmers' decision to take on a new identity is dominated by a productivist identity (Burton 2004; Burton and Wilson 2006). Productivitism is frequently legitimized by government programs that emphasize that increasing output is in the national interest.

Second, this study not only captures farmer role identities and social background in the coffee sector but also role identities (church leader, elder, opinion leaders) (Stets and Carter 2006; Stets and Carter 2012; Stets et al. 2008), a factor that social identity theorists have overlooked. In other words, this research broadens the core construct (farmer role identity) to include a variety of identities. Consequently, scholars will be able to better understand and keep up with essential identity-related phenomena in agricultural value chains and IP-level learning.

Third, the effect of coffee farmer role identity on learning activities to develop problems solving-knowledge makes a significant contribution to the role identity (Dukerich 2001; Burke and Stets 2009; Stryker 2008) and EL theory (Kolb 2015; Kolb and Kolb 2009), in the rural coffee value chain and institutional context such as IPs. To begin with, the saliency of the identity is dependent on the value chain node and the role of social networks/institutional context, according to this analysis, which adds to the role identity theory. Situational contexts for collective learning among farmers, such as IPs, play an important role in the social shaping of a farmer's identity. Furthermore, the farmers' new roles influence the farmers' reflection of their challenge in order to gain knowledge of challenges-solving. Besides, farmers' new roles enabled them to deal with challenges by experimenting with the knowledge they had gained. This implies that the farmer's experiential learning process is influenced by new roles as a contextual factor. This finding extends Kolb's experiential learning cycle by connecting farmer role identities to their experiential learning process in the rural farming context.

Fourth, according to role identity theory, the self is made up of several role identities that are organized in an identity hierarchy, with more important identities at the top and less important identities lower down (Stets and Burke 2014). The findings show that a social and EL process that necessitates the acquisition of new information, skills, and networks is dependent on the farmer's role identification.

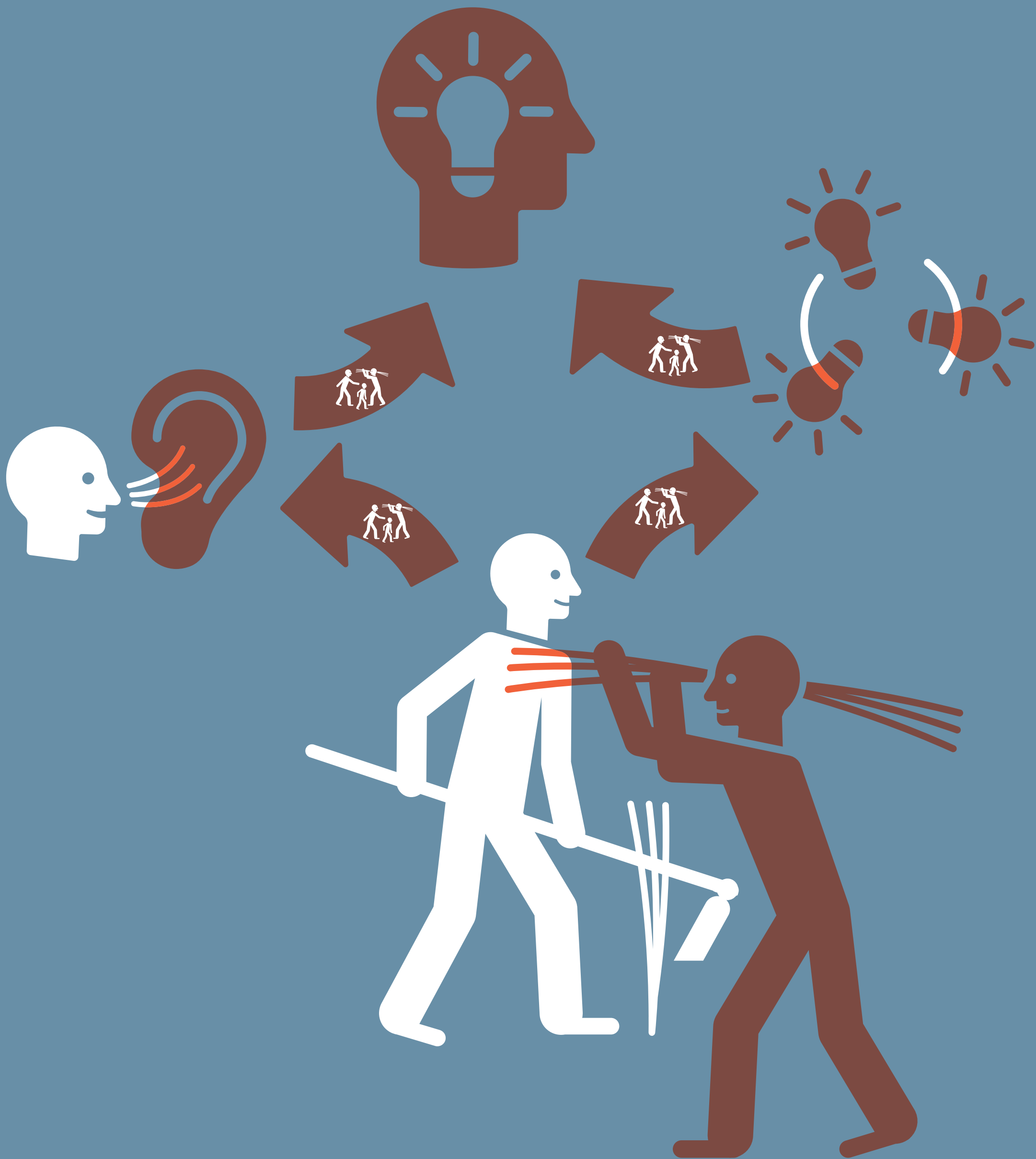
Based on these empirical contributions, agricultural extension workers can tailor the design and application of current learning initiatives to the right farmer group by assessing the impact of farmers' identity on their learning process. In essence, the findings point to how policies and interventions can be aligned with interpersonal processes, as well as what farmers can focus on as part of efforts to promote competence growth. Depending on the desired shift, farmers, and their representatives in farmer organizations – as well as programs seeking to sustain farmers' endeavors - may create rationales and road maps to direct the creation of desired role identities among farmers.

Additionally, the study results can be used to direct IP farmers' role identity development, allowing them to follow the types of activities and situations that will help them improve their awareness and make the necessary role identity change. This finding strengthens the connection between two institutions, namely the IP and the farm family, in the development of farmers' identities and, as a result, their EL.

Once more, the findings point to more flexible structures for collective and social learning to allow for diverse farmer roles. In this way, experienced coffee farmers may help others learn or improve their level of problem-solving knowledge. These farmers assist others in reflecting on and experimenting with coffee value chain learning practices, resulting in increased knowledge levels. Farmers' new roles encourage reflection on their challenges in order to gain problem-solving knowledge. The new role encourages people to exchange information relevant to the role at hand, which contributes to further thought. Indeed, increased interaction between group members with varying roles can explain the increased rate of reflection. The feedback provided by these stakeholders in the IP setting assists farmers in evaluating themselves. Farmers admitted to reflecting less when they were not enrolled in IPs. This implies that agricultural extension workers should intentionally or through their routine extension activities provide space/time for farmers to reflect on their challenges. Even so, in the IP setting, farmers were assigned to perform certain roles such as model farmers based on their exceptional performance in such roles/tasks related to the role. Agricultural extension workers (along with IP leaders) thus should act as facilitators in collective settings such as IPs, allowing farmers to access diverse stakeholders to reflect with. Additionally, farmers' new roles enabled them to deal with challenges by experimenting with the knowledge they had gained. Farmers do try (experiment) with indigenous pest and disease management methods, for example. This experimentation is primarily the result of joint activities such as attending IP leadership-organized training, interacting with trainers and fellow IP members during and after training, and sharing ideas along the coffee value chain between IP members and other stakeholders. There are also on-site practical learning sessions and demonstrations, as well as personal farm areas. As a result, agricultural extension workers and IP leaders can continue to design, implement, and encourage farmers to participate in joint role-based learning activities as part of their EL process.

Then, since new role identities are elicited by learning interventions, agricultural extension workers can use IP at the local level to identify practical solutions to local problems and improve the targeted agriculture value chain by linking different stakeholders at the community level or grassroots level (Fatunbi et al. 2016b). Identifying these practical solutions can be done through platform activities such as field days, exchange visits, training, and workshops to mention but a few. This helps to improve the skills of stakeholders in addressing various challenges facing them and improves productivity.

Still, in contrast to prior IP literature (Fatunbi et al. 2016b), which indicated that people identify with a single role or identity, this study discovered that a single farmer plays many roles. This is per the coffee production cycle/value chain challenges, prevalent value chain activities, and the networks with which the farmers interact to re-enforce their identity. Besides, having IP members serve numerous roles is a sustainability strategy for agricultural extension workers to embrace. IPs rely on donor support to carry out their activities, including recruiting members (Ragasa et al. 2016; Dabire et al. 2017; Schut et al. 2018). This is one of the reasons why the IP's composition varies after a given challenge is addressed or as members take on a new challenge (Davies et al. 2018) when new stakeholders are brought in to address a new or emergent challenge while others leave (Ampadu-Ameyaw, Omari, Essegbey, and Dery 2016). Finally, the current study adapts four items used by Kember et al. (2000) to measure reflection. Farmers' social networks are included in addition to the four items, as guided by qualitative findings Ochago et al. (2021). None of these items have ever been theorized, grouped, or used in the way that this study does. Other studies that consider such item combinations may be conducted.



5

Unraveling the connection between coffee farmers’ value chain challenges and experiential knowledge: The role of farm family resources

Abstract

Purpose: Multiple value chain challenges confront smallholder farmers, which necessitate context-specific solutions. Family resources, such as information and production inputs, are valuable assets for farmers. When properly used, farmers' family resources can help them in learning how to address value chain challenges. Yet, the learning in rural agricultural value chain literature still does not inform how family resources influence farmers' learning.

Design/methodology/approach: Face-to-face interviews with 214 coffee farmers were used to investigate how family resources shape farmers' experiential learning process. The data was analyzed using PLS-SEM.

Findings: Results show that family resources play a crucial role in farmers' experiential learning process, particularly in reflecting on and addressing value chain challenges they are confronted with.

Practical implications: Smallholder farms, as a collective and farmer-centered experiential learning context, can serve as a source of inspiration for extension agents bringing the paradigm shift from technology transfer to participatory advisory services to reality.

Theoretical implications: The study contributes to experiential theory in the context of agriculture by advancing a model on how rural family support can function as a resource to change the mechanisms underlying farmers' experiential learning.

Originality/value: The smallholder farm is a node in larger social learning networks (e.g., Innovation platform), where resources such as information, labor, emotional support, and production inputs, circulate.

Keywords: Agriculture; Coffee value chains; Social learning; Experiential learning process; Family resources; Smallholder farmers.

This chapter is based on: Robert Ochago, Domenico Dentoni, and Jacques H. Trienekens. 2023 "Unraveling the connection between coffee farmers' value chain challenging experiences and experiential knowledge: The role of farm family resources ". The Journal of Agricultural Education and Extension. https://doi.org/10.1080/1389224X.2023.2169479

CHAPTER FIVE: Unraveling the connection between coffee farmers' value chain challenges and experiential knowledge: The role of farm family resources

5.1. Introduction

Approximately 90% of farms around the globe are operated by families (Graeub et al. 2016; Lowder, Sánchez, and Bertini 2021). They provide 80 percent of the world's food, jobs, and 2.2 trillion dollars in income (Bosc et al. 2013; Graeub et al. 2016). With a value of 19 billion USD or 70% of total coffee exports, coffee is the most important crop enterprise for over 50 low-income countries in terms of export earnings (Kuma et al. 2019). Coffee contributes 20% of Uganda's total exports and provides a significant source of income for 1.7 million smallholder coffee farmers (UCDA 2020). However, Uganda's coffee exports are low when compared to African counterparts such as Ethiopia, Kenya, and Rwanda, despite its potential as Africa's second-largest Arabica coffee exporter after Ethiopia (ICO 2020a). This is mostly due to the sector's reliance on smallholder farmers[3], who face several challenges in their farming process i.e., production, harvest, postharvest handling, and marketing. At production, for example, insect pests and diseases (Liebig et al. 2016b), cause up to 57 percent coffee yield loss (Cerda et al. 2017), as well as low quality (Velmourougane, Bhat, and Gopinandhan 2010; Pimenta, Angélico, and Chalfoun 2018; Walker et al. 2019) which in turn leads to low and fluctuating coffee market prices (Abrar, Solomon, and Ali 2014; Kidist, Zerihun, and Biniam 2019). The latter is a typical example of a complex coffee farming challenge that necessitates multiple solutions. Complex farming challenges have several dimensions (Schut et al. 2015), are embedded in interactions across different organizational and social settings (Giller et al. 2008), and involve multiple actors (Hemmati 2012). As a basis, a range of actors (e.g., researchers, donors, policymakers, and practitioners) have embraced the coffee value chain approach as a solution to farmers' challenges (Kaplinsky, Terheggen, and Tijaja 2011; Collins, Dent, and Bonney 2016; Ponte et al. 2014).

[3] Smallholders are farmers who own small pieces of land and rely almost completely on family labor to raise subsistence crops and one or two cash crops. They are defined by their restricted resource endowment. Because of smallholder farmer's restricted resource endowment, the terms "family farm" and "smallholder farm" are frequently interchanged. See (Kostov, Davidova, and Bailey 2019; Garner and de la O Campos 2014; Lowder, Skoet, and Raney 2016).

Innovation platforms (IPs) are the most common operationalization of coffee value chains in low-income countries (Pali and Swaans 2013; Camacho-Villa et al. 2016; Kilelu, Klerkx, and Leeuwis 2014). IPs are structured interfaces among farmers where they tap into the capacities of diverse actors (e.g. processors, traders, transporters, input suppliers, output handlers, policymakers, extension agents, and researchers) to learn how to address their farming challenges (Tui et al. 2013). For instance, Ochago et al. (2021) found that when challenged with pest and disease infestation, coffee farmers joined together, deliberated, shared their experiences, and purchased certified coffee inputs as a group. In this case, farmers rely particularly on experience-based knowledge as it has practical, personal, and local relevance and is accumulated over long periods by doing, experimenting, and watching (reflective observation) (Šūmane et al. 2018). Consequently, farmers who learn to address their challenges are more able to generate context-specific solutions (Janssen and Swinnen 2019).

Experiential learning (EL) is a learning approach that involves addressing challenges in the farming process (Percy 2005; Pincus et al. 2018). Individuals learn to overcome challenges through reflecting on prior challenges, sharing practical ideas with others, and working together to solve challenges (Laforge and McLachlan 2018; Oreszczyn, Lane, and Carr 2010; Milestad et al. 2010; Lubell, Niles, and Hoffman 2014; Okumah et al. 2021). The existing research indicates that farmers' EL processes are reliant on resources obtained through family relationships, among other factors. When faced with challenges along the coffee value chain, for example, Ochago et al. (2021) found that farmers rely on information, labor, emotional support, coffee production inputs, linkages to training avenues, and supportive actors by family members. These resources help to engage in learning activities that lead to the development of challenges-solving knowledge. Farmers learned how to properly space coffee plants, apply fertilizers, and spray against pests and diseases through observing and interacting with fellow family members during regular farming tasks (e.g., planting, pest, and disease scouting and control). In agreement are studies by (Hoang, Dufhues, and Buchenrieder 2016; Fisher 2013; Sutherland and Burton 2011; Hoang, Castella, and Novosad 2006; Pratiwi and Suzuki 2017; Danielsen et al. 2020) that found that family relationships increased farmers' experiential knowledge. For example, farmers acquire information about pest and disease management through their spouses, friends, and neighbors, according to Danielsen et al. (2020). A few studies, on the other hand, argue that family interactions create homogeneous and redundant knowledge within the family (Fisher 2013), inhibiting the acquisition of new knowledge outside the family (Smith, Anderson, and Moore 2012; MacGillivray 2018). Family relationships, from this perspective, may isolate farmers from knowledge brokers (such as advisors and extension staff), reducing their ability to carry out farm tasks, let alone develop new knowledge about farm techniques (Fisher 2013; Tregear and Cooper 2016). Nevertheless, a variety of research has now demonstrated a favorable association between family resources and farmer learning, i.e., the relationship between challenges in the farming process and the level of knowledge gained through learning activities. However, the extant studies on family resources and farmer learning are primarily qualitative, descriptive in character, and focused on the relationship between family resources and knowledge—one component of the experiential learning process. It is still unknown how family resources influence the experiential learning process. As a starting point, the goal of this study is to understand how the farmer's EL process is influenced by the resources he or she has access to through family ties.

5.2. Theoretical foundation

Many scholars agree that EL is an important component of learning methodologies for farmers in rural areas who want to improve their ability to cope effectively with various complex farming challenges (Pincus et al. 2018; Roberts 2006; Ochago et al. 2021). Experiential learning has been used as a foundation for extension interventions in the context of adult learning (Roberts 2006) including interventions at family farms (Abbey, Dowsett, and Sullivan 2017). Kolb's experiential learning theory is commonly employed in existing research to explain how learning unfolds (Matsuo and Nagata 2020; Morris 2020). Experiential learning, according to Kolb's model, is a context-dependent process in which experiences are transformed into experiential knowledge (Kolb 2015; Kolb and Kolb 2009). Kolb's definition of experiential learning indicates four interlinked concepts: (1) the experiences, (2) the knowledge created, (3) the transformation of the experiences, and (4) the context, for example, farmers' families and their resources.

5.2.1. The experiential learning process

5.2.1.1. Experiences (challenges)

According to Kolb (1984), learners must have tangible experiences to learn. Existing research on experiential learning describes experiences as challenges (Ochago et al. 2021; Morris 2020). The EL process comprises solving unique, context-specific, and ill-structured challenges (Blair 2016; Asfeldt and Beames 2017). In this paper, the value chain challenges faced by smallholder coffee farmers are highlighted. Smallholder farmers produce most coffee, but they face a variety of challenges throughout the coffee value chain. Next to pests and diseases (Liebig et al. 2016b) harvesting and postharvest practices account for more than 60% of a coffee bean's overall quality loss during drying and hulling (Hameed et al. 2018). Finally, coffee quality, which is a product of both pre-and post-harvest operations, is the cause of low and fluctuating coffee market prices (Abrar, Solomon, and Ali 2014; Kidist, Zerihun, and Biniam 2019). Although these challenges are well-known, there is little research in the agricultural value chains and learning literature on how challenges kick-start farmers' EL (Schut et al. 2019; Probst et al. 2019). For example, Ochago et al. (2021) in their research of farmers' experiential learning in coffee value chains found that challenges like pests and diseases, poor quality and quantity of coffee, and low and variable coffee prices stimulated farmers' EL. In line with a coffee value chain perspective, this study uses these interrelated elements to identify farmers' challenges: challenges during production, harvesting, postharvest handling, and marketing.

5.2.1.2. Experiential knowledge

Knowledge is knowing something and knowing how to do something (STERNBERG 2002). According to Johanson and Vahlne (1977), experiential knowledge is information learned solely from personal experience. Experiential knowledge is created when a farmer generates, finds, and captures solutions to challenges in its value chain (Newman and Conrad 2000; Martín-de Castro et al. 2011). Accordingly, experiential knowledge refers to a farmer's ability to align information with one's own or with knowledge from other farmers and apply it to challenges-solving activities. Coffee IP farmers, for example, gain knowledge on new farming methods such as proper plant spacing, line planting, composting, fertilizer application, spray against pests and diseases, selective picking of red ripe cherries, etc. (Tahir et al. 2020; Iorlamen et al. 2021; Chichaybelu et al. 2021). Farmers get to know about value chain actors (e.g fellow farmers, processors, traders, transporters, input suppliers, extension agents, researchers, governmental, and non-governmental organizations), and farming techniques through their IPs (Ochago et al. 2021; Lamers et al. 2017). Following extant research, this study uses two interconnected parts: knowing new value chain actors, and farming methods to define farmers' experiential knowledge

5.2.1.3. The transformation of farmer challenges into knowledge

In the Experiential Learning theory model, two ways of transforming experience are reflective observation and active experimentation (Kolb, Boyatzis, and Mainemelis 2001). According to Di Stefano, Pisano, and Staats (2015b); Beard and Wilson (2013), reflective observation requires seeing, hearing, and discussing the experience—what happened, how it happened, and why it happened. Schön (1987)'s reflection theory breaks down reflection into two parts: reflection in action (Cajiao and Burke 2016) and reflection on action (Ajjawi and Boud 2018). Decisions made while practicing or "*how teachers think on their feet*," are referred to as "*reflection in action*", p. 12 (Farrell 2012). Reflection-in-action is entirely concerned with the challenges-solving process. People claim they are reflecting, for example, when they are deeply thinking about how to address complex challenges, according to Moon (2013). Reflection-in-action entails using observational analysis, listening, and/or touch or 'feel' to solve challenges. Because challenges in farming are multi-dimensional, these necessitate complex solutions. This often involves challenges solving-knowledge acquisition through the adaptive process of experimentation (Cajiao and Burke 2016; Di Stefano, Pisano, and Staats 2015b). Reflection on action, on the other hand, takes place after the activity has been completed (Schön 1987). In other words, reflection-on-action is the act of looking back to evaluate what happened (Ajjawi and Boud 2018). So, the reflection includes identifying challenges, determining root causes, and considering viable remedies (Miller and Maellaro 2016). When faced with coffee value chain challenges (challenges at production, harvest, postharvest handling, and marketing), farmers, according to Ochago et al. (2021), reflect on their current knowledge and interactions with other value chain actors such as fellow farmers, processors, traders, transporters, input suppliers, extension agents, and researchers. Farmers' level of experiential knowledge (knowing new value chain actors, and farming methods) increased when they reflected on their current knowledge. Hence, the following hypotheses were assessed:

> **H1a.** Farmers reflect on their current knowledge and interactions with other value chain actors when confronted with challenges.

H1b. Farmers who reflect on their current knowledge and interactions with other value chain actors increase their knowledge of farming methods and value chain actors.

Alternatively, as a direct response to challenges, farmers can act immediately through active experimentation (Kayes, Kayes, and Kolb 2005). Farmers are known to experiment (Leitgeb et al. 2014; Meynard, Dedieu, and Bos 2012a). They experiment with new seed varieties and alternative production processes and look for new ways to promote their products through their social networks. Farmers are, in fact, part of a larger social context, emphasizing the importance of networks. Skaalsveen, Ingram, and Urquhart (2020) found that the level of knowledge and experience among farmers was affected by the experimentation of farmers on their farms while exploring new ideas and techniques and communicating this experiential knowledge through informal learning networks. When farmers used their current knowledge to solve challenges and interact with other value chain actors, their level of experiential knowledge increased (Ochago et al. 2021). Therefore, active experimentation occurs when farmers use their existing coffee value chain challenges solving-knowledge and interact with other value chain actors to increase their level of experiential knowledge. The following hypotheses were assessed:

H1c. Farmers who face coffee value chain challenges use their current knowledge and interact with other value chain actors.

H1d. Farmers who use their current knowledge and interact with other value chain actors increase their knowledge of farming methods and value chain actors.

5.2.1.4. The moderated effect of farmer family resources

A family is a social construct that includes grandparents, parents, siblings, spouses, and eventually children and grandchildren (Pylyser, Buysse, and Loeys 2018; Finch 2007). Interactions among family members enable farmers to learn to overcome challenges through sharing resources including information, knowledge, labor, emotional support, coffee production inputs, linkages to training avenues, and supportive actors (Ochago et al. 2021). In their study, Ochago et al. (2021) found that when farmers faced challenges in their farming activities, they utilized their family resources to perform two main learning activities i.e. reflection and experimentation. Farmers sought advice from family members on good agronomic practices such as seed selection, land preparation, pest, and disease management, pruning, mulching, postharvest handling techniques such as proper harvesting techniques, sorting, and drying well, storage, and marketing aspects such as collective marketing and alternative buyer sourcing. The challenge of inadequate labor was overcome by enlisting the help of family members to dig and maintain the coffee plantations, harvest coffee, aid in the supervision of other hired pickers, guard coffee against thieves, and transport products to the sale point, to name a few responsibilities. While this study found that family resources regulate the association between challenges and learning activities in rural value chain contexts, it does leave a vacuum that has to be filled, in particular, to test the effect of family resources on the relationship between challenges and learning activities. This study hypothesizes (H2) that.

Hypothesis 2a: Farmers' access to family resources positively moderates the relationship between their coffee value chain challenges and reflection on current knowledge and interactions with other value chain actors.
Hypothesis 2b: Farmers' access to family resources positively moderates the relationship between their reflection on current knowledge and interactions with other value chain actors and their knowledge of farming methods and value chain actors.

Farmers' ways of transforming experience (reflection and experimentation) have been related to the acquisition of experiential knowledge using the farmer's family resources. Farmers' family resources enable farmers to reflect on and experiment with their existing coffee value chain knowledge, as well as interact with other value chain actors to increase their experiential knowledge, according to Ochago et al. (2021). Even though this research suggests that family resources influence the association between farmers' ways of transforming experience and their experiential knowledge in coffee value chain contexts, no research associates individual farmers' family resources with experiential knowledge. This study hypothesizes that.

Hypothesis 2c: Farmers' access to family resources positively moderates the relationship between their coffee value chain challenges and their use of current knowledge as well as interaction with other value chain actors.
Hypothesis 2d: Farmers' access to family resources positively moderates the relationship between their use of current knowledge as well as interaction with other value chain actors, and their knowledge of farming methods and value chain actors.

Integrating the previous sections suggests that the indirect relationships between farmers' value chain challenges and their experiential knowledge via reflection and experimentation may be conditional on-farm family resources. Figure 8 depicts this dual stage moderated mediation model. According to the model used in this study, the relationship between farmers' value chain challenges and their reflection, as well as the relationship between their reflection and their level of experiential knowledge, will vary significantly depending on the level of family resources they have access to. Then, the relationship between farmers' value chain challenges and their experimentation, as well as the relationship between their experimentation and their level of experiential knowledge, will vary significantly depending on the level of family resources they have access to.

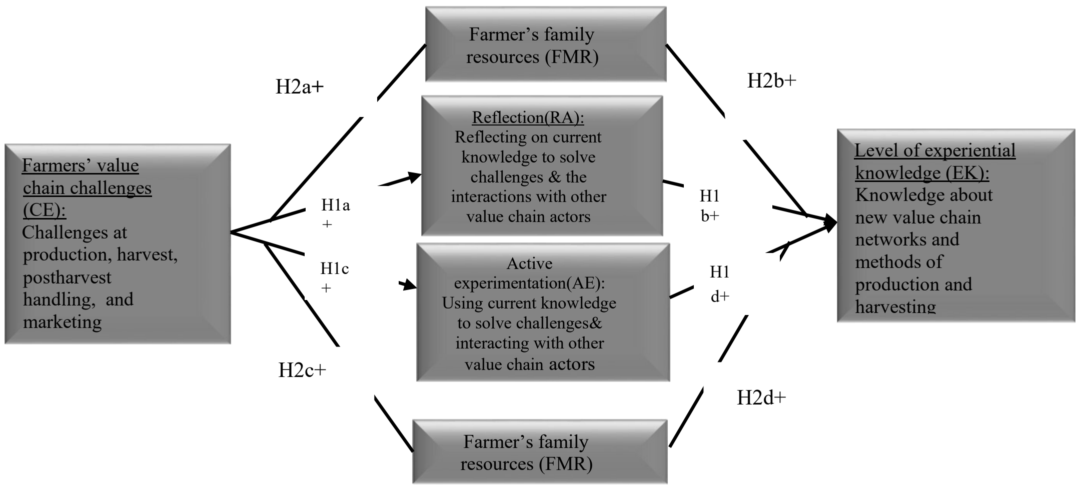


Figure 8: A dual-stage moderation mediation model - The moderated effect of farmer-farm family resources on their experiential learning process (Research framework)

5.3. Methods

5.3.1. Study location

The study took place in the districts of Kapchorwa, Manafwa, and Namisindwa in the Bugisu Sub Region of Uganda's Eastern region. The district of Kapchorwa is divided into seven sub-counties. Manafwa is made up of ten sub-counties, whereas Namisindwa is made up of seven.

Kapchorwa and Manafwa districts' coordinates are 1.3350° N, 34.3976° E, and 0.9064° N, 34.2866° E, respectively (Google Earth, 2022). Kapchorwa, Manafwa, and Namisindwa have population estimates of 113,500, 157,900, and 220,000 people, respectively, according to the Uganda Bureau of Statistics (UBOS 2017).

Agriculture is the principal economic activity in the area, which is divided into three zones: highland, midland, and lowland. These terrain zones determine the types of farming activities that farmers engage in, as well as the crops that are grown. The highlands and midlands are dominated by coffee and bananas, while the lowlands are dominated by maize and bananas. Coffee is mostly grown by smallholder farmers on farms that are less than one acre in size, often intercropped with bananas (Jassogne, Lderach, and Van Asten 2013). Coffee yields in Kapchorwa range from 1556 kg/ha to 1776 kg/ha in Manafwa/Namisindwa. Under good management methods, the average yields for Arabica coffee in both districts are below the national average of 2000kg/ha. The high occurrence of diseases and pests is mostly to blame for the low output potential(Judith Oduol 2017).

5.3.2. Target population, sampling, and data collection

Coffee IP farmers in Uganda's main coffee-growing regions of Kapchorwa, Manafwa, and Namisindwa were studied. IPs represent dynamic learning environments that support the adoption of innovations and where farmers interact. At the same time, there is a lot of heterogeneity among IPs in Uganda, in supporting services as well as in structure and membership. This is more advantageous since it gives a more level playing field for evaluating farmer learning than selecting individual farm households. Finally, due to their horizontal and vertical connections, the innovation platforms are currently the most popular farmer grouping. A total of 214 respondents (Table 3) were interviewed for an average of 1 hour and 15 minutes each using a standardized survey questionnaire. A stratified random sampling procedure was applied to recruit participants for the survey. As a sampling frame, a list of 450 current coffee IP farmers in the study site was used. The main author obtained a list from the research assistants at Makerere University's Value Chain Innovation platforms for food security (VIP4FS) project coordination office, which was validated by the district IP coordination team (IP facilitators/coordinators/chairpersons) during a one-day meeting with the main author. Because coffee is a male-dominated enterprise, the main author stratified the names obtained by gender. After that, he sorted the names and used Excel's RAND function to select every second name on the sheet. Pretesting with a comparable group who did not participate in the study was used to assess the applicability of the structured interview instrument. Face-to-face interviews were conducted with twenty-two respondents (twenty by research assistants and two by the main author) in two central locations: Tegeres Sub County, Kapchorwa district, and Butta Sub County, Manafwa district. The pre-test helped to ensure interview time, question clarity, and a mutual understanding of the interviewing code words in the local languages. The main author used the completed questionnaires to create data templates and analysis of emerging results. The preliminary data analysis resulted in the refinement of the survey tool for the actual data collection. Appendix 11 contains the items for the variables that were constructed using the existing literature. Likert scale items were used to investigate all study components. Respondents can express their real feelings using Likert-type scales. Factors like reliability influence the number of response categories on a scale (Bendig 1954; Dawes 2008; Preston and Colman 2000; Krosnick 2018). Leung (2011) observed no differences in reliability, mean, or standard deviation for 4, 5, 6, and 1-point Likert-type scales. For both the research attributes and the responders' group in this study, a five-point Likert scale seemed appropriate. The responses were graded, with options ranging from strongly agree (5) to strongly disagree (1). During the data collection stage, each research assistant conducted a face-to-face interview with a respondent at their home. All interviews were completed for one district before moving on to the next, and the interview results were recorded during the interviews on hard copy questionnaires. The main author interviewed one respondent on the first day and one respondent halfway through the interviews for each district as a quality measure and to formalize how he would later analyze this data. He ensured data quality through thorough training of research assistants and using research assistants who are proficient in the local dialects. He held three separate training sessions for the research assistants. Also, he held team debriefs every day after the data collection exercises to share lessons and challenges to ensure a uniform interpretation of the survey questions.

5.3.3. Data analysis

The partial least squares structural equation modeling (PLS-SEM) approach (Hair, Risher, et al. 2019) with the support of statistical software SmartPLS 3 was used to obtain the PLS-SEM results (Henseler, Ringle, and Sarstedt 2015). In a range of areas, including agricultural science and psychology, partial least squares structural equation modeling (PLS-SEM) is a frequently used method for analyzing complex inter-relationships between observable and latent variables (Willaby et al. 2015). PLS-SEM has advantages when working with complex models, non-normal data, and small samples (see Hair et al., 2019 for more information), and it is ideal for models with higher-order constructs (Hair Jr et al. 2017), like in this study. Almost all PLS-SEM studies frame their approach in a confirmatory sense, that is, a literature review is followed by the development of formal hypotheses, and finally the model estimation (Henseler 2018). In the current study, which is interdisciplinary and which addresses a new field of research on experiential learning, multi-variate statistics are used more in exploratory than confirmatory ways (Henseler 2018). Specifically, this study bridges the gap between formal and informal education by integrating educational psychology, experiential learning, and agricultural systems, i.e., an innovation platform/agriculture value chain as organizational learning settings/community program. PLS-SEM analysis is divided into two parts: the measurement model and the structural model (Hair, Risher, et al. 2019). On one hand, the measurement model uses quality attributes such as outer loadings, Cronbach alpha value, composite reliability, and average variance extracted. The structural model, on the other hand, uses coefficients, P-values, and Confidence Intervals.

5.4. Results

5.4.1. Assessment of the measurement models

Before evaluating the structural model linkages, PLS-SEM provides routines to test for measurement reliability and validity. Hair, Risher, et al. (2019) have well-documented corresponding guidelines, which include: the evaluation of the loadings, Cronbach's alpha, ρA, composite reliability, the average variance extracted, and discriminant analysis for reflective constructs (Tables 14 & 15).

Table 14: Construct Reliability and Validity

Constructs	CA	ρA	CR	AVE
Challenges (CE)	.711	.715	.811	.465
Experiential knowledge (EK)	.772	.785	.843	.519
Reflective (RA)	.728	.728	.817	.472
Active experimentation (AE)	.836	.844	.879	.548
Farm family resources (FMRa)	.784	.804	.847	.481

Farm family resources (FMRb)	.696	.712	.802	.451

Note. significant at ***p<0.01; **p<0.05 level (2-tailed), CA = Cronbach' alphas, ρA = rho_A, CR= composite reliability, and AVE =average variance extracted

Outer loadings, reliability, and validity measures are used to select items to include in the model. The first PLS algorithm run revealed that some items had low outer loadings (see appendix 11). The results were satisfactory after removing the items with low loading and rerunning the PLS algorithm. All Cronbach alpha values and rho A (ρA) values in Table 14 were greater than 0.7, indicating internal consistency and reliability (Hair Jr et al. 2017). In appendix B, most loadings were satisfactory and extremely significant (p<0.01). While certain indicator loadings were less than 0.7, they were kept since the composite reliabilities of the constructs were more than the acceptability criterion of 0.70 (Hair, Ringle, and Sarstedt 2011). This result showed that the indication was reliable enough (Hair Jr et al. 2017). Furthermore, all AVE values were significant within the 0.5 thresholds, indicating good convergent validity. The bootstrapping procedure with 5,000 samples was used for discriminant validity with the no sign changes option, bias-corrected and accelerated (BCa) bootstrap confidence interval, and two-tailed testing at the 0.05 level (Aguirre-Urreta and Rönkkö 2018; Cheah et al. 2019). Results in Table 15 revealed that the heterotrait-monotrait (HTMT) values were lower than the 0.85 conservative thresholds (Henseler, Ringle, and Sarstedt 2015). These findings demonstrated discriminant validity (Hair Jr et al. 2017).

Table 15: Discriminant validity

	AE	CE	EK	FMRa	FMRb
CE	.352 [.233;.454]				
EK	.305 [.180;410]	.214 [.115;301]			
FMRa	.393 [.267;.507]	.161 [.110;.162]	.569 [.437;.697]		
FMRb	.487 [.345;.617]	.135 [.106;.117]	.332 [.185;.451]	.675 [.543;.787]	
RA	.364[.256;.485]	.278 [.144;.348]	.41 [.280;.558]	.445 [.323;.599]	.312 [.172;.365]

Note. [] 95% Confidence Intervals Bias Corrected (BCa CI); AE=Active experimentation; CE=Challenges; EK=Experiential Knowledge; FMR=Farm family resources; RA=Reflection

5.2.2. Assessment of the structural model

5.2.2.1. Mediation analysis

Mediation analysis measures the degree to which a variable contributes to the transmission of change from a cause to its effect. Table 16 shows a considerable beneficial correlation between challenges and reflection. The bootstrap (.023; .306) and statistics (β= 1.94) values for the variable suggest substantial effects. For this reason, H1a which states that the farmers reflect on their current knowledge and interactions with other value chain actors when confronted with challenges is endorsed. The findings strongly indicate H1b because its statistics (β= .027) is a substantial path. This variable's coefficients and bootstrap results are both highly significant at $p<0.01$. Hereafter, hypothesis 1b, which posited that farmers who reflect on their current knowledge and interactions with other value chain actors increase their knowledge of farming methods and value chain actors, was accepted. Furthermore, the results of the H1c&d tests (β= .233 & .160) were identical to those of the H1a-b tests. Henceforth, H1d was approved.

Table 16: Model relationships between Challenges, Reflection and Experimentation, and Experiential knowledge

Hypothesis	Relationships	Coefficients	95% Confidence Intervals Bias Corrected (BCa CI)
Hypothesis 1a Farmers reflect on their current knowledge and interactions with other value chain actors when confronted with challenges.	Challenges ->Reflection (H1a)	1.94**	[.023; .306]
Hypothesis 1b Farmers who reflect on their current knowledge and interactions with other value chain actors increase their knowledge of farming methods and value chain actors.	Reflection -> Experiential knowledge (H1b)	.027***	[.135; .371]
Hypothesis 1c Farmers who face coffee value chain challenges use their current knowledge and interact with other value chain actors.	Challenges -> Active experimentation (H1c)	.233***	[.097; .332]
Hypothesis 1d Farmers who use their current knowledge and interact with other value chain actors increase their knowledge of farming methods and value chain actors.	Active experimentation->Experiential knowledge (H1d)	.160**	[.006; .288]

Note. significant at ***p<0.01; **p<0.05 level (2-tailed)

Both reflection and active experimentation were used to buffer the relationship between challenges and experiential knowledge (Table 17).

Table 17: Mediation effects of the farmer's reflection and active experimentation on the relationship between challenges and experiential knowledge

Relationships	Coefficients	95% Confidence Intervals Bias Corrected (BCa CI)
Challenges->Reflection-> Experiential knowledge	.052**	[.001 to .084]
Challenges->Active experimentation-> Experiential knowledge	.037*	[.009 to .094]

Note. significant at **p<0.05, * 0.1 level (2-tailed); Reflection ->Active experimentation (β=.284***,.157;.384)

5.2.2.2. Moderation analysis

The next step analyzed the moderating role of farmer family resources on reflection and active experimentation as mediators of farmers' experiential learning (H2a-d). In a moderated mediation model, the moderating variable strengthens or weakens the relationship between the independent and mediator variables, as well as the mediator and the outcome (dependent) variable; thus, mediating effects shift as the moderating variable changes. Table 18 shows the positive and significant regression coefficient of the interaction effect between challenges and farmers' family resources on reflection (β =.112, $p<0.1$). The interaction effect of reflection and family resources on experiential knowledge had a positive and significant regression coefficient (β =.131, $p < 0.05$). This provides preliminary support for a conditional indirect effect. The moderation effect was further verified by the bootstrapping test, with a 95 percent BCCI of [.008;0.227] for the link between challenges and reflection as well as [.023;.238] for the link between reflection and experiential knowledge (Table 18). Because farm family resources have a positive and moderating effect on the relationship between challenges-reflection, farmers' ability to think about their current knowledge and interactions with other value chain actors is enhanced when they attempt to address their coffee value chain challenges. Furthermore, family resources positively moderate the relationship between farmers' reflection and their knowledge of farming methods and value chain actors, implying that if farmers have access to farm family resources, their knowledge of farming methods and value chain actors increases after thinking about their current knowledge and interactions with other value chain actors. Thus, H2a & c is supported.

Table 18: Moderation effects of farmer family resources on the mediated relationship between challenges and experiential knowledge

Hypothesis	Relationships	Coefficients	95% Confidence Intervals Bias Corrected
Hypothesis 2a: Farmers' access to family resources positively moderates the relationship between their coffee value chain challenges and reflection on current knowledge and interactions with other value chain actors.	Challenges×Farm family resources->Reflection (H2a)	.112*	[.008;.227]
Hypothesis 2b: Farmers' access to family resources positively moderates the relationship between their reflection on current knowledge and interactions with other value chain actors and their knowledge of farming methods and value chain actors.	Reflection×Farm family resources->Experiential knowledge (H2b)	.131**	[.023;.238]
Hypothesis 2c: Farmers' access to family resources positively moderates the relationship between their coffee value chain challenges and the use of current knowledge and interaction with other value chain actors.	Challenges×Farm family resources-> Active experimentation (H2c)	-.120**	[-.235; -.015]
Hypothesis 2d: Farmers' access to family resources positively moderates the relationship between their use of current knowledge as well as interaction with other value chain actors, and their knowledge of farming methods and value chain actors.	Active experimentation×Farm family resources-> Experiential knowledge (H2d)	-.140**	[-.283; -.009]

Note. significant at **p<0.05, * 0.1 level (2-tailed)

Using the same method, the moderating effects of family resources on the connection between challenges and experiential knowledge via experimentation were investigated. The interaction effect of challenges and farm family resources on active experimenting yielded a negative and significant regression coefficient (β= -.120), as shown in Table 18. Table 5 also reveals that the interaction effect of active experimentation and farm family resources on experiential knowledge had a negative and significant regression coefficient (β=.140). This lends preliminary credence to the idea of a conditional indirect impact. The bootstrapping test confirmed the moderation effect, with a 95 percent BCCI of [.008;.227] for the link between challenges and active experimentation and [-.235; -.015] for the link between active experimentation and experiential knowledge (Table 5). The farmer's access to family resources has a negative moderating influence on the relationships: Farmer challenges – farmer active experimentation and farmer experiential knowledge imply that if farmers have access to farm family resources, their ability (capacity) to use their current knowledge and interactions with other value chain actors when attempting to address their coffee value chain challenges is diminished. Again, there is no knowledge of farming methods and value chain actors acquired because of their present knowledge and interactions with other value chain actors. Consequently, H2b&d is not supported.

5.4. Discussion

In prior agricultural extension studies on social networks and farmer learning in rural areas, family relationships were found to be crucial in farmer access to knowledge-learning outcomes e.g., (Fisher 2013; Tregear and Cooper 2016; Pratiwi and Suzuki 2017). Farmers learn from their past experiences and through interactions with other family members, according to this strand of literature (Chantre, Cerf, and Le Bail 2015; Burton et al. 2020; Dolinska and d'Aquino 2016). Indeed, family interactions encourage trust-based peer-to-peer learning through the exchange of experiences, challenges, and hands-on learning (Berkvens 2012; Kroma 2006; Abbey, Dowsett, and Sullivan 2017). However, the literature does not indicate how, and under what conditions, farmer experiential learning takes place. The goal of this study was to determine how the farmer's access to family resources influenced their experiential learning process. The role of challenges in experiential knowledge is discussed from the perspective of farm-family resource access in this study, which is in line with Kolb's EL theory (Kolb 2015). The farmer's access to farm family resources affected their experiential learning process in several ways, according to this study. The interaction between challenges and farm family resources has a positive and negative impact on farmer learning activities. The farm family's resources are more important to the relationships: challenges-reflection and reflection-acquisition of experiential knowledge rather than challenges-experimentation and experimentation-acquisition of experience knowledge.

5.4.1. The moderating of effect farmers' access to farm family resources on the relationship between challenges and reflection, as well as the relationship between reflection and experiential knowledge.

First, having access to farm family resources allows farmers to reflect on previous solutions to value chain challenges to gain new knowledge for solving future value chain challenges. To put it another way, farmer family members' involvement in their farming decision-making, advice, and encouragement helped farmers to reflect on their current knowledge and interactions with other value chain actors. This finding is congruent with the findings of (Ochago et al. 2021), who found that when confronted with coffee value chain challenges, farmers reflect on their present knowledge and interact with other value chain actors such as fellow family farmers. Then, by reflecting on their current knowledge and interactions with other value chain actors, farmer family members' involvement in their farming decision-making, advice, and encouragement improved their knowledge of new networks and farming practices. These findings add to (Hoang, Dufhues, and Buchenrieder 2016; Fisher 2013; Sutherland and Burton 2011; Hoang, Castella, and Novosad 2006; Pratiwi and Suzuki 2017; Danielsen et al. 2020; Ingram 2010; Samiee and Rezaei-Moghaddam 2017)'s studies of social networks in learning, which found that family ties increase the acquisition of experiential knowledge. This study's findings add to this earlier research by systematically relating farmer's family resources to the experiential learning process, rather than just isolated parts of learning i.e., the experiential knowledge outcome of this process. This research reveals that specific family resources (for example, farmer family members' involvement in farming decision-making, advice, and encouragement) have a positive effect on the acquisition of new knowledge through reflection when faced with challenges.

5.4.2. The moderating of effect farmers' access to farm family resources on the relationship between challenges and active experimentation, as well as the relationship between active experimentation and experiential knowledge.

In contrast, access to farm family resources hinders active experimentation. Family resources have a negative effect on active experimentation and the acquisition of new knowledge through active experimentation. These findings agree with studies on social networks and learning such as those Fisher (2013); Tregear and Cooper (2016), who found that strong bonding network ties such as those of the family have a negative influence on farmer learning. Differently from their study, though, this study reveals indirect conditional effects of family resources that lower farmer active experimentation. Particularly, farmers' ability for active experimentation was negatively impacted by family emotional support, trust, and engagement in coffee marketing decisions, restricting their ability to build knowledge about new networks and farming methods. These findings are explained by the nature of the active experimentation. Unlike reflection, which was mostly an individual activity, experimentation was collaborative. Farmers require significantly more resources to experiment than those provided by the family due to the nature of the rural coffee value chain setting. For example, the land at the study site is small and already allotted, tests on phytosanitary measures and spraying to control coffee pests will have to be conducted on rented/purchased land. At this point, farmer experimentation is backed by collaboratively mobilized resources such as land, labor, seeds, and so on, via networks other than the family (Schut 2017; Kusters et al. 2018). Farmers then develop knowledge through exchange visits, look and learn (observation), and so on (Vellema et al. 2013). In this respect, the existing knowledge within the family network can explain the negative outcome. Experimentation requires existing information inside a specific network. Family interactions are closed networks that generate homogeneous and redundant knowledge within the network (Fisher 2013), preventing the acquisition of new knowledge outside the family (Smith, Anderson, and Moore 2012; MacGillivray 2018). Because family members rely on other family members for resources such as advice, they have been removed from knowledge brokers (such as extension personnel) over the years, resulting in a limited ability to explore and gain new knowledge through experimentation.

5.5. Implications

These findings have significant implications for family learning, in terms of theory, management, and policy. From a theoretical perspective, learning models based on social interactions, such as those found in a farm family, can stimulate as well as hinder higher-order learning through challenges. In terms of reflection, this study fills in the empirical gaps in Kolb's experiential learning model by demonstrating, through the integration of family embeddedness-based and experiential learning theories, that the availability of family resource support can potentially increase experiential learning. Regarding active experimentation, this study fills in the empirical gaps in Kolb's experiential learning model by demonstrating, equally supported by the integrative approach of family embeddedness-based and experiential learning theories, that the availability of family resource support can potentially decrease experiential learning (Bergsteiner, Avery, and Neumann 2010; Jarvis 2012).

Farm family resources are often the most beneficial resource for coffee producers who engage in transformative learning. Farmers can participate in transformative learning activities targeted at addressing their challenges in a context-specific and socially interactive way, challenging interventions to change (Leeuwis 2004). Smallholder farms, as a collective and farmer-centered experiential learning context, can serve as a source of inspiration for extension agents bringing the paradigm change from technology transfer to participatory advisory services to fruition. The use of tools like Participatory Rural Appraisal (Mwongera et al. 2017), which allows for a more extensive gradual, and iterative definition of challenges and solutions in direct exchanges with key stakeholders—farmers—could provide useful insights for possible adjustments in agricultural extension research and development. First, given that farm families rely on guidance on how to conduct their value chain activities, a viable method in the family farm form of agriculture would be to target influential household members for challenges-based learning actions. This entails experienced mentors providing individual home coaching, with an emphasis on things such as family assets, value chains, and people. This approach leads to more adaptable transformative and social learning arrangements in which farmers can openly share their previous challenges, knowledge of potential solutions produced and implemented, and other resources with EL. This is especially advantageous in developing countries, where rural extension and agricultural information services are still in short supply. Second, farm households should raise awareness about the necessity of sharing experiences while also providing everyone with access to useful information for reflection. Consequently, extension agents and policymakers should identify key decision-makers in farm households (household heads) as a starting point for encouraging farmer reflection when confronted with challenges and the acquisition of new knowledge through reflection. This is because, there are distinct preferences among household members in a household farm system, and these preferences can influence their learning activities and outcomes. For example, it is known that women and children in coffee farm households are involved in coffee production through harvesting rather than marketing or allocating coffee sales revenues. In Appendix 12, all additional family resources that facilitate farmers' experiential learning process are related to decision-making. Because reflection necessitates seeing, hearing, and talking about the experience Di Stefano, Pisano, and Staats (2015b); Beard and Wilson (2013), sensitizing decision-makers on the importance of equity in coffee-growing activities would improve reflection and knowledge development through reflection.

Family resources have a detrimental impact on farmers' active experimentation when faced with challenges, as well as knowledge acquisition through active experimentation. According to the findings, coffee farmers that actively experiment rely on new knowledge and external networks to expand their learning. As a result of these findings, extension agents and policymakers should continue to develop learning interventions, such as cooperative experiments involving various farm household members, when faced with challenges. This will coincide with the emphasis on agricultural knowledge production, which corresponds to a broader interest in multi-actor learning networks involving various stakeholders and bringing together and capitalizing on the diverse forms of knowledge possessed by those (Ingram et al. 2018; Moschitz et al. 2015).

Also, because reflection as a learning activity must be elicited consciously by learning actions (Ajjawi and Boud 2018), policy-makers can use the family as a unit to identify practical interventions to local challenges and improve targeted rural agriculture value chains by connecting different stakeholders to farm households at the community level. The family farm is frequently a node in larger learning networks (e.g., Innovation platforms) where new ideas, techniques, seeds, and other items circulate. Learning activities can help farmers to identify practical solutions by having discussions with peers and experts, comparing practices in similar contexts to their own, and participating in hands-on activities (Adamsone-Fiskovica and Grivins 2022; Ingram et al. 2018; Chancellor, Priebe, and Mkenda 2019) throughout the learning process. Concrete experiences, for example, can be aided by visualizing a farmer's challenges, whereas reflection can be aided by facilitated discussions. Planned joint experimentation activities beyond farm families can aid experimentation. Subsequently, policymakers will be able to incorporate the role of farming households into rural agriculture research and development strategies, acknowledging them as crucial actors in agricultural knowledge production and dissemination (Dabire et al. 2017; Téno and Cadilhon 2017; Vissoh et al. 2017; Ingram et al. 2020; Moschitz et al. 2015; Tisenkopfs et al. 2015). This also entails a greater appreciation of local, indigenous, technical, and informal knowledge, as well as individual farmers' innovative potential (Šūmane et al. 2018).

5.6. Conclusion

Consistent with the idea of social embeddedness (Granovetter 1985; Granovetter 1973), resources accessed through ongoing personal relations (i.e., embedded) may moderate the mediating effect of learning activities on the challenging experiences to experiential knowledge relationship. Hence, more challenged farmers demand more family resources to engage in a variety of learning activities that result in high levels of experiential knowledge. Thus, the goal of this research was to find out how the farmer's access to family resources influenced their experiential learning process. This study dissects the experiential learning process as a whole and then shows how different farmer's family resources influence the acquisition of new knowledge through reflection and active experimentation.

Farmers' family resources, according to the findings, have both positive and negative effects on their experiential learning processes. The evidence in this study has numerous implications for theory, practice, and policy. The results demonstrate how the availability of family resource support can potentially increase or decrease experiential learning by integrating the family embeddedness perspective—a nuanced lens of the social embeddedness perspective (Granovetter 1985; Granovetter 1973; Uzzi 1997) that focuses on embeddedness within the specific context of family ties and experiential learning theorization (Kolb 2015). This study's findings, in particular, add to previous research e.g. (Danielsen et al. 2020) by systematically relating farmer's family resources to the experiential learning process, rather than just isolated components of the learning process. The existing study focuses on the knowledge gained by farmers rather than the learning process and its associated context. Specific family resources (for example, farmer family members' involvement in farming decision-making, advice, and encouragement) have a positive effect on the acquisition of new knowledge through reflection when confronted with challenges according to this study. Furthermore, these findings are consistent with previous research on social networks and learning (Fisher 2013; Tregear and Cooper 2016), which found that strong bonding network ties, such as those of the family, had a negative impact on farmer learning. However, unlike their work, this analysis indicates indirect conditional effects of family resources on farmer active experimentation.

5.7. Areas for further research

While the current study focuses on the moderating effect of farmers' farm family resources on their experiential learning process in the IP environment, other studies in non-IP settings may be undertaken. Moreover, the current study adapts four items used to measure reflection by Kember et al. (2000). Farmers' social networks, as guided by qualitative findings (Ochago et 2021), are included in addition to the four items. None of these items have previously been theorized, grouped, or used in the way that the current study does. Other studies that take such item combinations into account may be conducted.

6

General discussion and conclusions

CHAPTER SIX: General discussion and conclusions

This chapter takes stock from the analysis and interpretation in each empirical chapter by synthesizing the main findings, discussing their theoretical, practical, and policy implications, and suggesting future research. Thus, section 6.1 focuses on the main findings and discussions of the primary research questions. Section 6.2 explains the contributions to the literature on the experiential learning process of smallholder coffee farmers and the impact of their social setting from the viewpoints of theory, practice, and policy. Section 6.3 identifies areas for further research.

6.1. Main findings and discussion

6.1.1. Innovation Platform's role in farmers' experiential learning (Chapter 2)

Unlike previous IP literature, which focused on fragmented aspects of farmer learning to address their challenges (Teno and Cadilhon 2016; Njingulula et al. 2014), chapter 2 sought to shed light on four interdependent elements of farmers' EL processes in the Ugandan coffee sector, namely: the challenges that triggered farmers' EL; farmers' exemplary learning activities and outcomes; and IP's role in farmers' EL (Appendice 5 & 6).

In terms of challenges, results indicate that pests and diseases during production, poor quality and quantity at harvesting, postharvest handling and coffee processing (HPHCP), and low and fluctuating coffee prices during marketing all triggered farmers' EL. Farmers engaged in a variety of learning activities to address challenges, including attending IP-supported/conducted training, meetings, workshops, inter-IP information sharing, demonstrations, and extension materials (Audouin et al. 2021; Davies et al. 2018; Lamers et al. 2017; Schut et al. 2017; Lukurugu et al. 2021; Miningou et al. 2021). Aside from integrating specific value chain challenges into learning activities, coffee farmers learn from these challenges through engagement, considering solutions through in-depth reflective discourse (Lamers et al. 2017). This finding supports what is known about how actors, especially farmers, learn in social (Murphy, Wilson, and Greenberg 2017) and reflective (Glowacki-Dudka et al. 2017) environments. Knowledge and skills are gained because of participating in various learning activities (Mulema and Mazur 2016; Nyikahadzoi et al. 2012). Unlike previous IP research (Brouwer et al. 2019; Kilelu et al. 2011), this study delves deeper to capture farmers' knowledge in three dimensions: knowledge about new value chain networks, farming methods and technologies, and personal strengths and weaknesses. Finally, IPs serve a significant role in allowing farmers to reflect and experiment in a socially engaged environment, resulting in outcomes from IP learning activities. Moreover, the findings show how IPs promote and manage often conflicting relationships between farmers and other stakeholders. Thus, IPs enhance farmer interaction and communication while also allowing farmers to build trust as a vital component of managing their interpersonal relationships. Additionally, because of participation in IPs, farmers increased their patience, humility, self-expression, advocacy competences, the formulation of realistic expectations, time management, leadership by example, willingness to work hard, and team-playing spirit.

6.1.2. The effect of IP governance mechanisms on smallholder farmers' experiential learning process

In chapter 3, I determined how IP governance mechanisms influenced farmers' experiential learning process. One fascinating finding was that the commitment and trust of IP members significantly and positively moderated the relationship between challenges and reflection. Further investigation revealed that the involvement of IP members had a positive and significant effect on the link between challenges and reflection. These findings support earlier qualitative study findings. When presented with coffee value chain challenges, Mt. Elgon region coffee IP farmers' commitment and trust, involvement, and access to IP resources, according to Ochago et al. (2021), supported them in reflecting on their current knowledge and interactions with other value chain actors. Other IP and learning studies have revealed similar effects; for example, Sako et al. (2021) found that farmer commitment and involvement in Kolokani Groundnut Innovation Platform (Mali) activities helped them in reflecting on their existing knowledge. Besides, (Akpo et al. 2021; Audouin et al. 2021), found that trust in the farmer of fellow farmers and other value chain actors encourages reflection on the farming information shared. Surprisingly, member access to IP resources did not affect the relationship between challenges and reflection. With the availability of resources such as information, production inputs, linkages to training avenues, and supportive actors (Schut 2017; Kusters et al. 2018; Sako et al. 2021), one would assume that farmers would have plenty of time to reflect on their challenges. It should be noted that both seeking resources such as information to address a specific challenge and reflecting on one's prior challenge are time-consuming actions. Because time is a scarce resource, taking time to look back and engage in reflecting on prior challenges would be much easier if resources such as information/solutions about such challenges were available. This, however, is not the case. The outcomes are most likely explained by the type of provider (who and why), the shared resources (are these demand or supply driven), and the time and context (which domain of the value chain). In the study site, for example, Kawacom is the closest and a key coffee-buying company, which trains farmers on organic coffee production (local bio-pesticides such as a mixture of red pepper and water). While organic coffee production methods are expensive to implement and produce unsatisfactory outcomes, Kawacom is the leading buyer of poor-quality coffee as well (every coffee in the market-whether organic or not) at a low and uniform price, such as at 4000/= per kilogram of dry parchment. Kawacom gives resources such as information to farmers, but due to their actions, the available information, which should ideally help farmers reflect on the pest and disease challenges, turns out to be a challenge instead. Another example is NAADS/OWC providing free coffee seedlings. Farmers complained of the uncertainty of the seedling sources i.e., among many, the nursery location, variety, and age. Moreover, often supplied during the off-planting season (dry season) the supplied seedlings are not accompanied by follow-on extension services. In the second example, the act of delivering free seedlings to farmers is admirable and would encourage farmer reflection, but this is not the case. They will have to spend even more time determining whether these seedlings are clear (not diseased). This is because the seedlings are not accompanied by information regarding crucial attributes such as variety type.

Another significant finding was that IP members' commitment and trust yielded positive though insignificant results on the relationship between reflection and experiential knowledge, an opposite to the positive and significant, although weak, effects of IP members' involvement. This finding implies that the involvement of IP members influences knowledge creation, but that there are other important determinants as well. The most plausible explanation remains in the IP setting, which emphasize supporting learning activities aimed at addressing diverse and dynamic farmer challenges, of which knowledge of specific farming aspects is a component of the learning outcomes (Sanyang et al. 2014; Probst et al. 2019). Then, member access to IP resources had no effect (negative and insignificant) on the association between reflection and experiential knowledge.

Furthermore, IP members' commitment, trust, involvement, and access to IP resources, yielded positive but insignificant moderating effects on the relationship between their experiential knowledge and active experimentation. Because coffee farmers are relatively old (mean=46 years and 17 years of coffee growing) and have interacted with nearly the same networks for nearly as long, there may not be anything new they can employ (experiment).

Finally, the commitment and trust of IP members weaken the relationship between experimentation and challenges. In contrast, IP members' involvement and access to IP resources strengthened the relationship between farmers' experimentation and challenges. Prior qualitative studies (Sako et al. 2021; Iorlamen et al. 2021) found that IPs boosted farmer involvement (participation), and access to resources such as seeds and research technology.

6.1.3. The effect of coffee IP farmer's role identities on their experiential learning process

After, I proceeded to relate farmers' EL processes to their role identities in the context of IPs in the Ugandan coffee sector (chapter 4). At first, I established coffee farmers' role identities in the learning process before statistically assessing the moderating effect on farmers' learning activities and the acquisition of experiential knowledge through learning activities. The most common farmer role identity in this article is coffee farmer-trader. This role has a great deal to do with coffee production and marketing (See appendix 6). The coffee farmer identity is closely followed by the coffee farmer-trader role identity. This identity type places a heavy emphasis on farm management strategies and methods such as 'proper' fertilizer, pesticide, and other agricultural chemical use (Burton, Kuczera, and Schwarz 2008). Contrary to the role identity theory's premise (Stryker and Burke 2000) that people must move out of their old role identity for the new identity to become a driving force and motivational force, the coffee farmer identity, also known as farmer production role identity in the study, is a springboard to new identity formation. This finding (farmers having many identities) is congruent with that of (Burton et al. 2020; Burton and Wilson 2006; McGuire, Morton, and Cast 2013), who discovered that farmers wear multiple hats in non-IP settings in developed countries. Similarly, these findings contribute to existing labels for farmer identities developed by scholars or farmers themselves. For example, in an earlier study, farmer identity (production) has been labeled as productivist (Burton and Wilson 2006), good farmer (McGuire, Morton, and Cast 2013; Riley 2016; Burton et al. 2020), and steward (Comito, Wolseth, and Morton 2013). Aside from these studies, the present research looks at the various aspects of one's identity. The most plausible explanation of my findings is that farmers no longer have the luxury of performing only one role in coffee production, which is becoming increasingly commercialized with an emphasis on improving structures, farming technologies, and institutions such as IP.

Another significant finding from this study is that developing a new identity involves a social learning process. These findings back up previous studies on farmer identity, such as Burton and Wilson (2006), who found that new identity building is a social activity. Unlike previous research, this research looks at it from the perspective of a rural coffee value chain, concentrating on social networks and how new identities arise (Appendix 6). The IPs provide a socially engaging space for coffee farmers to reflect on their previous challenging experiences while also generating knowledge about new identities by supporting farmer learning activities (e.g. mobilizing resources such as funds, stakeholders, meeting venues, and research technologies) (Schut 2017; Kusters et al. 2018). Furthermore, the IP environment unlocks locally available resources, such as farm families' resources, which aids in the execution of role-related activities.

Once more, this study found that challenges kick start the process of assuming new roles, such as coffee trader. Farmers must acquire knowledge and experience in order to be successful in the new roles. This identity will only take precedence while learning and experimenting; after that, the farmer identity will take control once more. The study demonstrates how the farmers learn through interactions and experimentation as a result of taking on new roles. Because of this, a significant percentage of participants in the interviews identified as "modern" coffee farmers. In terms of relating identity and learning, this finding prompts one to ask the following questions: "who am I?" (and what am I doing?) and "what else can I or should I do?" and "what should I or am I learning about what else I want to do or do?" This finding adds to the findings of an earlier study by Ochago et al. (2021), who revealed that when faced with challenges such as low coffee prices, farmers engaged in a variety of activities such as consulting fellow farmers (some of whom double as traders), reflecting on previous coffee sale experiences with family members, and so on, to achieve new roles as coffee farmer-traders. In addition to prior research, this study also finds that assuming new roles, in turn, shapes farmers' EL. Unfortunately, no statistically significant moderation effect of farmer role identity on farmers' EL process was discovered in this study. The size of farmer networks, instead, moderated the farmer's experiential learning process. The most plausible explanation is that farmers do not abandon their person identity (farmers) in order to assume another. They simply took on new roles.

These additional roles are difficult to distinguish from the person's identity as a farmer. This explains why no significant moderating effects were observed.

6.1.4. The moderated indirect effect of farmer farm family resources on their experiential learning process (chapter 5)

Then I went on to see how the farmers' access to family resources affected their experiential learning (chapter 3). The farmer's access to farm family resources affected their experiential learning process in two ways, according to this study. The resources of the farm family are more vital to the relationships: challenges-reflection and reflection-experiential knowledge gain rather than challenges-experimentation and experimentation-experiential knowledge. To begin with, farmer family members' involvement in farming decision-making, advice, and encouragement assisted farmers in reflecting on their current knowledge and interactions with other value chain actors. Farmers' involvement in farming decision-making, advice, and encouragement also increased their knowledge of new networks and farming techniques by reflecting on their current knowledge and interactions with other value chain actors. These findings complement (Hoang, Dufhues, and Buchenrieder 2016; Fisher 2013; Sutherland and Burton 2011; Hoang, Castella, and Novosad 2006; Pratiwi and Suzuki 2017; Danielsen et al. 2020; Ingram 2010; Samiee and Rezaei-Moghaddam 2017) on social networks in learning, which indicated that family ties promote the acquisition of experiential knowledge.

Access to farm family resources, on the other hand, limits active experimentation. Family resources have a negative impact on active experimentation and knowledge gained through active experimentation. These findings are consistent with previous research on social networks and learning (Fisher 2013; Tregear and Cooper 2016), which established that strong bonding network links, such as those of the family, had a negative effect on farmer learning.

The nature of the active experimentation is most likely to be responsible for the aforesaid negative findings. In contrast to reflection, which was essentially an individual activity, experimentation was mostly a group effort. Due to the nature of the rural coffee value chain context, farmers require substantially more resources to experiment than those provided by the family (Schut 2017; Kusters et al. 2018). Furthermore, the detrimental impact can be explained by existing knowledge inside the family network. Experimentation necessitates the use of pre-existing information inside a given network. Family interactions are closed networks that generate homogeneous and redundant knowledge within the network (Fisher 2013), restricting the acquisition of new knowledge outside the family (Smith, Anderson, and Moore 2012; MacGillivray 2018). Because family members rely on other family members for resources such as advice, they have been isolated from knowledge brokers (such as extension personnel) over the years, resulting in a limited ability to explore and gain knowledge through experimentation.

6.2. Scientific contribution

My thesis connects to many scholarly debates in farmer learning and social context literature. In essence, I shed light on four interconnected parts of farmers' EL processes in the context of Uganda's coffee sector, namely: the challenging experiences that trigger farmers' EL; farmers' exemplary learning activities and outcomes; and IP's role in farmers' EL. This study adds to the existing literature on farmers' learning processes in IPs by zooming into farmers' experiential learning processes and on the moderated mediation effects of the social context on different stages of this experiential process. This study contributes three alternative models to farmers' experiential learning process: The moderating effect of IP governance mechanisms, farmer role identity, and farmer farm family resources on their experiential learning process. The subsection below delves into specific theoretical, practical, and policy implications.

6.2.1. Theoretical implications

This thesis' findings contribute to experiential learning, innovation platform, farmer role identity, and family embeddedness-based theories. The study findings fill a gap in the empirical application of Kolb's experiential learning model (Bergsteiner, Avery, and Neumann 2010; Jarvis 2012), by applying it not only to the rural value chain but also to institutional settings, such as IPs. Specifically, chapter 2 unpacks the theory's essential notions in response to (Morris 2020), who requests clarity on the meaning of key terminology in Kolb's model, such as concrete experience. The current study addresses this gap by investigating farmers' challenging experiences along the value chain in three important value chain domains (at production, harvest, and postharvest handling, marketing challenges), transformation strategies (reflection and active experimentation), and experiential knowledge types (knowledge about new value chain networks, farming methods and technologies, and personal strengths and weaknesses). This study indicates that EL is a process rather than different components of farmer learning such as challenges faced(Kelly, Bennett, and Starasts 2017; van Rooyen et al. 2017), learning activities, and knowledge gained (Akpo et al. 2021). This chapter 2 suggests that – from a theoretical standpoint – learning models based on social interactions, e.g., in IPs, have the potential to trigger higher-order learning from reflective analysis of challenging experiences. The current study emphasizes that EL fully unfolds when learners gauge lessons and draw conclusions by identifying the challenges, root causes, and solutions, proposing methods of action as well as the actual implementation of solutions and proposed methods of action. Moreover, the study of coffee farmer learning makes a significant contribution to transformative learning theory (Schnepfleitner and Ferreira 2021; Chang 2021) by clarifying how farmers develop challenge-solving knowledge by performing learning activities. In particular, the study shows that farmers use two skills i.e., reflective analysis and active experimentation to solve their challenges. Therefore, coffee farmers' transformative learning is accomplished through three collaborative phases: recognizing value chain challenges, acting (reflecting and testing out options), and generating challenge-solving knowledge. In so doing this study's findings agree with previous IP and learning literature that IPs indeed serve a significant role in allowing farmers to reflect and experiment in a socially engaged environment, resulting in outcomes from IP learning activities. Aside from this, the findings add to existing literature (Hinnou et al. 2018; Kilelu, Klerkx, and Leeuwis 2013, 2017) by showing how IPs promote and manage often conflicting relationships between farmers and other stakeholders. Managing conflicting relationships between farmers and other stakeholders is critical to farmer learning since innovation platforms are notorious for becoming battlegrounds, with solutions for some members creating new challenges for others. Conflicts between members (for example, farmer versus government official) frequently emerge because of power imbalances, unequal discussion, and negotiating skills (Brouwer et al. 2013; Cullen et al. 2014; Dror et al. 2016). To manage such conflicts, interactions, collaborations, and actions must be facilitated. Innovation Platforms are indeed documented to have successfully contributed to conflict prevention and resolution (Davies et al. 2018). I am referring to 'brokerage' when I say facilitation (Madzudzo 2011). Brokerage enables effective interaction among network or system components (Rivera and Sulaiman 2009). IPs can manage conflicting relationships between farmers and other stakeholders by supporting (organizing and funding) learning activities such as field demonstrations, look-and-learn sessions, and training meetings. IPs provide a forum for conflicts to be discussed and solutions found during such learning activity sessions, or they mediate the same.

Chapter 4 makes four significant contributions to current literature (van der Gaag, Albers, and Kunnen 2017; Galliher, Rivas-Drake, and Dubow 2017; Galliher, McLean, and Syed 2017; Kaplan and Garner 2017; Seaman, Sharp, and Coppens 2017; Wang, Douglass, and Yip 2017). First, the most prevalent role identity among respondents is that of a coffee farmer. Contrary to the role identity theory's assertion that people must move out of their previous role identity for the new identity to become a driving force and motivator. According to this study, a farmer/producer/productivist identity determines farmers' decision to adopt a new identity (Burton 2004; Burton and Wilson 2006). The farmer/producer/productivist identity type places a strong emphasis on farm management practices and methods such as 'correct' fertilizer, pesticide, and other agricultural chemical applications (Burton, Kuczera, and Schwarz 2008). Whatever other identities coffee farmers acquire, the farmer/producer identity serves as the foundation and involves a back and-forth between farmer/producer/productivist and any other new identity. The value chain node and the involvement of social networks determine the identity's saliency. Each identity corresponds to a specific coffee value chain node; for example, the identity of a coffee farmer/producer/productivit corresponds to the value chain's production production node, that of a coffee picker to harvesting, that of a processor to postharvest handling and coffee processing, and so on. Because coffee farmers at the research site participate in almost every node of the value chain, they assume identities as needed or in combination. Burton and Wilson (2006) regard new identity formation as a social activity. The IPs provide much-needed socially engaging space for coffee farmers to develop new role identities.

Second, Chapter 4 captures not just farmer role identities and social backgrounds in the coffee sector, but also role identities (church leader, elder, opinion leader) (Stets and Carter 2006; Stets and Carter 2012; Stets et al. 2008), which social identity theorists have missed. To put it another way, this study broadens the main construct (farmer role identity) to incorporate a range of identities. So, future research will be better equipped to grasp and keep up with critical identity-related phenomena in agricultural value chains and IP-level learning.

Chapter 5 shows how the availability of family resource support can potentially increase experiential learning by integrating the family embeddedness perspective—a nuanced lens of the social embeddedness perspective that focuses on embeddedness within the specific context of family ties and experiential learning theorization. From a theoretical perspective, learning models based on social interactions, such as those found in a farm family, can stimulate as well as hinder higher-order learning through challenges. In terms of reflection, this study fills in the empirical gaps in Kolb's experiential learning model by demonstrating, through the integration of family embeddedness-based and experiential learning theories, that the availability of family resource support can potentially increase experiential learning. Regarding active experimentation, this study fills in the empirical gaps in Kolb's experiential learning model by demonstrating, equally supported by the integrative approach of family embeddedness-based and experiential learning theories, that the availability of family resource support can potentially decrease experiential learning (Bergsteiner, Avery, and Neumann 2010; Jarvis 2012).

6.2.2. Implications for IP organization

Findings in chapter 2 imply that to learn, one must reflect on what happened and how it happened (Di Stefano et al. 2014). However, reflective learning does not happen by accident. Reflectivity must be deliberately elicited by learning interventions (Ajjawi and Boud 2018). Hence, in managerial terms, these findings suggest that coffee farmers engaging in learning activities must rely on their networks and stimulate commitment and participation in IPs to strengthen their learning outcomes. Second, IPs should emphasize awareness of the importance of sharing experiences, critical reflection, and the role of external sources, while also enabling each person to access useful information for analysis, reflection in tandem with the collective objectives. Third, IPs should encourage members to exchange information, grant freedom to express opinions to stimulate collective thinking, ensure personal development, and allow people to feel part of the ongoing IP activities.

In terms of IP practice, chapter 3 findings imply that coffee farmers who are active in reflection should rely on their networks and encourage commitment and involvement (participation) in IPs to increase their reflection and knowledge acquisition through reflection. Second, IPs should create awareness about the importance of sharing experiences, critical reflection, and the role of external sources, while also providing everyone with valuable information for reflective analysis in line with the collective goals. Third, IPs should encourage members to share information and freely voice their viewpoints to stimulate collective thought, ensure personal development, and make people feel that they are a part of ongoing IP activities. The

IP management should achieve the three points listed above by establishing regular IP meetings that include feedback on agreed-upon actions (Njuki et al. 2010; Nederlof, Wongtschowshi, and Van der lee 2011). IP meeting reports, which included issues discussed and decisions made, feedback from previous activities, and participant lists, provide evidence of this. Another source is the project team reflection session, which is held halfway through and at the end of the project and allows participants to discuss progress and underlying reasons. This is one step toward increasing trust amongst IP actors.

Moreover, to promote trust within their platforms, certain IPs, such as Chesiyo, Kabeywa, Bukusu, and Bumbo, combine additional development efforts based on aspects that are not core to IP objectives. Farmers had poor encounters with seed sellers and coffee crop buyers across the study site. Seed dealers sold immature, low-quality seedlings in insufficient amounts, resulting in extremely low output. Another issue was untrustworthy coffee crop buyers who buy good quality, graded coffee from farmers and add junk/trash such as chaff and sand to obtain big volumes of inexpensive coffee while earning handsomely. Experiential learning via training and demonstrations proved a powerful strategy in motivating farmers to grow high-quality seedlings. As a result, either individually or jointly, IP farmers created UCDA-certified coffee nurseries from improved or indigenous coffee plants. In response to the challenge of few, unreliable, and untrustworthy coffee buyers, farmers turned to collective bulk parchment and selling as an IP. Second, farmers looked for alternative buyers who would buy coffee at a reasonable price (1,400 shillings per kilogram of cherries), promptly, and, if possible, pay bonuses of up to twenty shillings per kilogram to each farmer. Third, coffee farmers worked with IP-connected networks to create new marketplaces such as wash stations, IPs for cherries, and local companies. The Burkina Faso Groundnut Innovation Platform established trust by mediating the relationship between farmers and extension service personnel (from the Ministry of Agriculture), resulting in the establishment of field demonstrations on groundnut production and improved varieties as a solution to low productivity caused by limited access to improved legume varieties (Miningou et al. 2021). Similarly, IPs boosted farmer commitment and trust by establishing farmer seed production groups with the help of R&D partners. Concurrently, the platform leveraged extension agents' existing knowledge to accelerate the delivery of upgraded technologies to a large number of farmers via field demonstrations(Monyo et al. 2021). To summarize, IPs should foster trust among stakeholders by encouraging/facilitating regular physical interactions.

Finally, chapter 3 contends that because the investigated IPs are locally driven and challenge and solution-oriented, it is critical for IP management to pay attention to farmer involvement (participation) in IP learning activities if farmers' experiential learning is to be attained. To gain knowledge relevant to addressing their challenges, all actors should be involved and interact with one another (Schut, Klerkx, et al. 2016; Flor et al. 2016; Sanyang et al. 2014). The involvement of farmers is critical for three reasons. First, farmers together with other stakeholders can provide complementary insights into the various dimensions of farmer problems, thus broadening the knowledge base. Second, through interaction and participation, farmers become aware of their diverse interests, needs, and goals, as well as their need for fellow farmers and other stakeholders- important to overcome their challenges (Leeuwis 2000; Messely, Rogge, and Dessein 2013; Schut, Leeuwis, and van Paassen 2013). Third, when farmers are involved in the decision-making process, they are more likely to support the solutions (Neef and Neubert 2011). Farmers' participation in learning has been successfully facilitated by innovation platform management through establishing IP guidelines during formation and establishing regular IP meetings that include feedback in line with agreed-upon actions. Scoping, analysis, and planning are three critical steps in developing an IP for farmer participation. At the scoping stage, stakeholder meetings are held to narrow down the platform's focus. During the analysis stage, stakeholders identify knowledge, skills, and interests, as well as capacity requirements and joint analysis of challenges and opportunities in the IP focus area. A stakeholder analysis is conducted at this stage to map the connections between the various actors relevant to the IP. Finally, at the planning meeting, the main points raised during the analysis are narrowed down further, and an action plan detailing the stakeholder roles, timelines, rules that guide the IP operations, how such rules will be implemented and by whom, and resource use is developed (Nederlof, Wongtschowshi, and Van der lee 2011). Coupled with the commitment and trust of IP members (Hounkonnou et al. 2018; Ansell and Gash 2008; Keijser, Belderbos, and Goedhuys 2021; Jiggins et al. 2016), and access to IP resources (Schut 2017; Kusters et al. 2018; Akpo et al. 2021), every member should take part in IP learning activities (Cadilhon 2013; Tenywa et al. 2011; Fatunbi et al. 2016b). This was not the situation at the study location, where most participants were men, model/contact farmers, traders, processors, opinion leaders, or those in positions of leadership. These individuals were well educated, financially stable, or had well-managed coffee fields, as well as were well informed and networked.

Based on the empirical findings of chapter 4, agricultural extension workers can customize the design and implementation of current learning efforts to the appropriate farmer group by evaluating the impact of farmers' identity on their learning process. For instance, farmers who identify themselves as input suppliers and traders require knowledge about agrochemicals to sell to other farmers and knowledge of cost-benefit analysis (Homann-Kee Tui et al. 2015), and their learning programs should be designed in line with such topical areas. The findings suggest how policies and interventions can be matched with interpersonal processes, as well as what farmers should focus on as part of efforts to encourage competence growth. Farmers and their representatives in farmer organizations, as well as programs trying to sustain farmers' initiatives, may develop rationales and road maps to lead the establishment of desirable role identities among farmers, depending on the intended change.

Importantly, the findings of chapter 4 can be utilized to guide the development of IP farmers' role identities, allowing them to identify the types of activities and situations that will help them enhance their awareness and make the necessary role identity changes. This finding underlines the link between two institutions, namely the IP and the farm family, in the formation of farmers' identities and, as a result, their EL.

Similarly, the findings in chapter 4 lead to more adaptable systems for collective and social learning to accommodate a variety of farmer roles. While all the respondents at the study location were farmers, they defined themselves in many ways, such as processors, traders, transporters, and input providers, among others. This means that learning requirements vary over time. This indicates that policymakers and development actors should create or adapt current learning materials to meet the needs of the target farmers rather than broadening their learning intervention areas. In this way, experienced coffee farmers can assist others in learning or improving their challenge-solving knowledge. These farmers help others reflect on and experiment with coffee value chain learning approaches, resulting in higher knowledge levels.

Then, because chapter 4 shows that learning interventions (e.g., exchange visits, demonstrations, and so on) elicit new role identities, practitioners can use IPs to identify practical solutions to local challenges and improve the targeted agriculture value chain by connecting different stakeholders at the community or grassroots level to stakeholders who support role-based learning interventions (Fatunbi et al., 2015). Farmers, as previously stated, have multiple role identities that are shaped by their respective value chain nodes and social affiliations/connections. This implies that IP management should facilitate their learning and/or advocate for stakeholders (individuals and organizations) who provide role-based learning based on the coffee calendar/production cycle. Farmers who only produce (Coffee farmer role identity) and are interested in on-farm management practices and methods such as land preparation, planting, weeding, 'correct' application of fertilizer, pesticides, and other agricultural chemicals, and so on, can participate in learning activities between February and April. Farmers who also work as traders (harvest, process, bulk, and sale) would benefit from training between May and August (fly coffee crop harvest) and November and January (main coffee crop harvest). Between September and October, other value chain support services, such as farmers who also double as leaders (Coffee farmer-leader role identity), can be provided. Furthermore, the IPs in the study site already collaborate with a variety of organizations, including but not limited to KADLAAC, ICRAF, Kawacom, Kyagalanyi, NUCAFE, DLG, UCDA, Omutindo, Coffe A Cup, BCU, Great Lakes Company, Financial institutions, cooperatives, Makerere University, and the University of Adelaide, among others. The respective IP only needs to schedule meetings to scope, analyze, and plan learning interventions based on prevalent role identities and requests for these stakeholders' services at the appropriate time.

Finally, contrary to previous IP research (Fatunbi et al. 2016b), which found that people identify with a single role or identity, chapter 4 found that a single farmer plays multiple roles. This is following the coffee production cycle/value chain challenges, prevalent value chain activities, and networks with which farmers connect to reinforce their identity. Furthermore, having IP members serve several roles is a sustainable method. IPs rely on donor funding to carry out their activities, including member recruitment (Ragasa et al. 2016; Dabire et al. 2017; Schut et al. 2018). To reduce their reliance on donor support or external funding, IP management should enlist the help of model/prominent/contact farmers, traders, processors, opinion leaders, or those in positions of leadership. These individuals were well educated, financially stable, or had well-managed coffee fields, as well as well-informed and networked. These already provide free services to their respective IP addresses. Sam, Dan, and Wilbroad in Kapchorwa provide free training and share ideas on all aspects of the coffee value chain. Maganda, David, and Steven encouraged us to join the group in Manafwa and Namisindwa and trained us in coffee sorting, washing, and picking red cherries. David is a village neighbor who works as a commissioner for the Ministry of Finance. He has assisted in advising young people on coffee planting and spacing. He encourages young people to grow coffee and work hard to make a living. He also cultivates coffee on a large scale. He owns over 5 acres of coffee. Mr. Steven advises fellow farmers on coffee growing farmers, for example, on coffee spacing/planting, when to begin pruning, and how to pick ready cherries. He also works as a village agent for the local government, and he frequently visits the sub-county to bring us coffee seedlings. He introduces us to companies like Bukusu Hillside Company, which buys our coffee at a reasonable price. Steven gave us the authority to buy coffee and resell it to traders in Italy. Jacob taught his IP members how to plant and care for their plants. He has extensive knowledge of coffee farming. He gave us one hundred coffee plants, which we also planted. Perrez is a coffee trader who has assisted farmers with marketing their coffee. He connects coffee farmers to a ready market. He also teaches us how to make high-quality coffee that sells for a high price on the market. Fortunately, all the individuals listed are leaders in their respective IPs. Their services could be incentivized to cover other IPs that they do not own. The key task for IP management at this stage is to narrow down the learning areas and plan and implement the learning.

According to chapter 5, farm family resources are frequently the most useful resource for coffee farmers who participate in transformative learning. Farmers can engage in transformative learning activities aimed at addressing their challenges in a context-specific and socially engaged manner (Leeuwis 2004). Smallholder farms, as a collective and farmer-centered experiential learning context, can serve as a source of inspiration for extension agents as they work to realize the paradigm shift from technology transfer to participatory advisory services. The use of tools such as Participatory Rural Appraisal (Mwongera et al. 2017), which allows for a more extensive gradual, and iterative definition of challenges and solutions in direct exchanges with key stakeholders—farmers—could provide useful insights for potential changes in agricultural extension research and development. Given that farm families rely on guidance to conduct their value chain activities, for example, a possible strategy in the family farm form of agriculture would be to target influential household members for challenges-based learning actions. This comprises experienced mentors giving one-on-one home coaching, with a focus on family assets, value chains, and people. These findings lead to more adaptive transformative and social learning arrangements in which farmers can openly share with EL their previous challenges, knowledge of potential solutions developed and implemented, and other resources. This is especially beneficial in developing nations where rural extension and agricultural information services are still scarce.

Again, family resources have a positive effect on farmer reflection when confronted with challenges, as well as knowledge acquisition through reflection. Coffee farmers who engage in reflection, according to these findings (chapter 5), rely on family members for farming decisions to boost their learning. Second, farm households should create knowledge about the importance of sharing experiences, as well as provide everyone with access to useful material for reflection. As a result of these findings, extension agents should identify important decision-makers (Appendix 9) in farm families (mostly household heads) as a starting point for fostering farmer reflection when faced with challenges, as well as the acquisition of new knowledge through reflection. Because reflection requires seeing, hearing, and talking about the experience (Di Stefano, Pisano, and Staats 2015a); Beard and Wilson (2013), designing learning programs for household decision-makers and sensitizing decision-makers on the importance of equity in coffee-growing activities would improve reflection and knowledge development through reflection.

Family resources have a detrimental impact on farmers' active experimentation when faced with challenges, as well as knowledge acquisition through active experimentation. According to the findings (chapter 5), coffee farmers that actively experiment rely on new knowledge and external networks to expand their learning. As a result of these findings, extension agents should continue to develop learning interventions, such as cooperative experiments involving various farm household members, when faced with challenges. This will coincide with the emphasis on agricultural knowledge production, which corresponds to a broader interest in multi-actor learning networks involving various stakeholders and bringing together and capitalizing on the diverse forms of knowledge possessed by those(Ingram et al. 2018; Moschitz et al. 2015).

6.2.3. Policy implications

In terms of policy, the findings in Chapters 2 & 3 imply that IPs will improve farmers' experiential learning. To avoid repeating the flaws of prior learning approaches such as farmer field schools, policymakers must carefully examine sustainability factors in the design and implementation of learning programs. Because IPs in the research site rely on donor support (Ragasa et al. 2016; Dabire et al. 2017; Schut et al. 2018), policymakers may consider the following lessons when designing and implementing learning programs: To begin, numerous IPs, like Arokwo, Chesiyo, and Bukusu, function as cooperatives, wash stations, coffee processors, and collection centers, in addition to funding their learning activities. Internal income pooling procedures implemented by these IPs include village savings and lending schemes, cooperative initiatives, and so on. The registration of the IP as a cooperative, in which platform members make a small financial contribution to the platform's costs, was identified as a factor that explained its outcome in Ghana. This cooperative balanced members' self-interest and shared interest (Davies et al. 2018). Bubaare IP was initially registered as an association to operate within the district but was re-registered as Bubaare IP Multipurpose Cooperative Society Ltd to not only operate outside of the district but also to obtain legal status. This advice was provided by Kabale District Local Government (KDLG), a major IP stakeholder, through meetings initiated by the District Commercial Office (DCO). Among the many benefits of registration is increased demand for training by SHGs (Dror et al. 2016). It should be noted that registering an IP as a cooperative embeds IPs in private or public mechanisms as well as larger networks, thereby expanding the range of services available to farmers (and other IP members)(Schut et al. 2018). Thus, policymakers could adopt, modify, or apply these lessons to help other IPs. IPs achieve legal status by being registered with local and national authorities. A few farmers, for example, have registered with the Uganda Coffee Development Authority (UCDA) to produce certified coffee seedlings for the community. Even so, these few, ill-equipped farmers are unable to meet the community's seed needs. The challenge of poor seed quality or insufficient seed quantities at the local level is rooted in an interconnected with the challenge at higher levels (e.g., inadequate certification), implying that strategic involvement of policy actors at the national level (e.g., UCDA) is desirable (Schut, van Asten, et al. 2016; Birachi et al. 2013). Having a cooperative take on such seed production tasks would not only increase seed access but also improve farmers' ability to learn on demand. Such services can be obtained by the cooperative on behalf of its members. According to Schut et al. (2018), a successful AIP should be truly demand-driven, participatory, based on collective investment and action, and capable of bringing together committed stakeholders. Having a cooperative take on such seed production tasks would not only increase seed access but also improve farmers' ability to learn on demand. Such services can be obtained by the cooperative on behalf of its members.

Davies et al. (2018) describe how the engagement of an influential representative of a local chamber of agriculture in Burkina Faso developed a basis for gaining support from regional development policy actors, which created an enabling environment for the innovation platform to achieve its objectives. In partnership with the local government, IPs such as Mt. Elgon women in coffee devised and are enforcing bi-laws to control counterfeit inputs and coffee products. Participating in the formulation and implementation of bi-laws is an opportunity that may be seized and used to assist farmers in learning more effectively. For example, the Tanga Dairy Platform successfully lobbied policymakers in Tanga City, Tanzania, to reduce value-added tax on dairy inputs and products and remove restrictions on urban dairy farming (Cadilhon, Pham, and Maass 2016). Bubaare IP members in Uganda mobilized their respective parishes and villages to review and formulate community bi-laws on Natural Resource Management, Agriculture, and Marketing, which were then used to protect gardens and guide marketing procedures (Dror et al. 2016). In essence, value chain IPs necessitate the participation of not only local producers, regional processors, distributors, and retailers, but also national policymakers and certification bodies (Birachi et al. 2013). Recent IP studies show their potential for implementing robust policy strategies (Kilelu, Klerkx, and Leeuwis 2013; Swaans et al. 2014). However, experiences show that the performance and impact of IPs are dependent on a variety of factors, including good organization and facilitation (Rooyen et al., 2013), communication within the IP (Victor et al., 2013), stakeholder representation (Cullen et al., 2013), and institutional embedding (Nederlof, Wongtschowshi, and Van der lee 2011; Schut et al. 2018). The IP should serve as a facilitator in the policy formulation and implementation process. By facilitation, I mean ensuring adequate linkages and participant empowerment, as in the case of Mt. Elgon women in coffee IP. The IP, through its leadership, maintains open communication between the district's local government offices by including government officials in key meetings, introducing visitors to local government offices, and providing regular IP progress updates to the district. This sparked the interest of District officials, including politicians, in ensuring the success of this IP. Finally, the case of Bubaare IP, which was offered a training venue, a store, and security for their products while being guided by the District Community Development office to register as a cooperative, is another example that policymakers can draw on.

Also, most services, such as advisory, are offered by fellow farmers in the IPs. A farmer-to-farmer (F2F) strategy, in which farmers learn from one another both inside and outside of IPs, can be an effective long-term learning mechanism. Aside from being effective, the F2F strategy is more inclusive, low-cost, and provides a broad-reaching alternative for supporting learning (Ssemakula and Mutimba 2011; Wellard et al. 2013). F2F can tap into vast amounts of knowledge that already exist in communities. Farmers are seen experimenting on their farms and sharing knowledge with their neighbors (Takahashi, Mano, and Otsuka 2019). Depending on the context, these individuals may be referred to as 'brokers' (Madzudzo 2011), or 'promotors' (Fichter 2009), for example, farmer promoters in Bangladesh (Islam et al. 2011). Brokers are people who help to catalyze learning by bringing actors together and facilitating interaction (Klerkx, Hall, and Leeuwis 2009). Finally, promoters—are individuals who have knowledge or input into the innovation process. It is important to recognize the incentives associated with information dissemination, which include altruism, access to knowledge/skills, income from extension-related activities, social benefits, and project benefits (BenYishay and Mobarak 2018; Shikuku et al. 2019; Kiptot and Franzel 2015). Consistent with the ideal of incentives, the aspect of embedding is still relevant. Sustainable mechanisms such as government linkages, the formation of lead farmer associations as a means of seeking government services, and the development of viable business services for their clients aided the success of farmer-to-farmer extension programs in Benin, Cameroon, Ghana, Kenya, Malawi, and Uganda (Lukuyu et al. 2012; Moumouni, Vodouhe, and Streiffeler 2009; Wellard et al. 2013).

Besides that, because reflection as a learning activity must be consciously elicited by learning actions (Ajjawi and Boud 2018), policymakers can use the family as a unit to identify practical interventions to local challenges and improve targeted rural agriculture value chains by connecting different stakeholders to farm households at the community level (chapter 5). The family farm is frequently a node in broader learning networks (e.g., Innovation platforms) through which new ideas, techniques, seeds, and other things circulate. Learning activities can assist farmers in identifying practical solutions by engaging in discussions with peers and experts, comparing practices in similar contexts to their own, and participating in hands-on activities throughout the learning process (Adamsone-Fiskovica and Grivins 2022; Ingram et al. 2018; Chancellor, Priebe, and Mkenda 2019). Visualizing a farmer's challenges, for example, might help with concrete experiences, whilst facilitated discussions can help with reflection. Experimenting can be aided by planned joint experimentation activities that extend beyond farm households. Following that, policymakers will be able to incorporate farming households' roles into rural agriculture research and development strategies, recognizing them as critical actors in agricultural knowledge production and dissemination (Dabire et al. 2017; Téno and Cadilhon 2017; Vissoh et al. 2017; Ingram et al. 2020; Moschitz et al. 2015; Tisenkopfs et al. 2015). This includes a better understanding of local, indigenous, technical, and informal knowledge, as well as individual farmers' innovative capacity (Šūmane et al. 2018).

Family resources have a detrimental impact on farmers' active experimentation when faced with challenges, as well as knowledge acquisition through active experimentation. According to the findings (chapter 5), coffee farmers that actively experiment rely on new knowledge and external networks to expand their learning. As a result of these findings, policymakers should continue to develop learning interventions, such as cooperative experiments involving various farm household members. These experiments should be carried out in a household that is central to the target households. The responsibility for managing such experiments should fall on the host household members, with assistance from everyone else who is learning from the site. Extended stakeholders attend periodic learning sessions at the site. Because respective household members engage in the process, the likelihood is that they will be eager to learn from their site. This will coincide with the emphasis on agricultural knowledge production, which corresponds to a broader interest in multi-actor learning networks involving various stakeholders and bringing together and capitalizing on the diverse forms of knowledge possessed by those (Ingram et al. 2020; Moschitz et al. 2015).

Because reflection as a learning activity must be elicited consciously by learning actions, policymakers can use the family as a unit to identify practical interventions to local challenges and improve targeted rural agriculture value chains by connecting different stakeholders to farmers at the community level (chapter 5). The family farm is frequently a node in larger learning networks (e.g., Innovation platforms) through whom new ideas, methods, seeds, and other resources circulate. Learning activities can help farmers to identify practical solutions by having discussions with peers and experts, comparing practices in similar contexts to their own, and participating in hands-on activities (Adamsone-Fiskovica and Grivins 2022; Ingram et al. 2018; Chancellor, Priebe, and Mkenda 2019) throughout the learning process. Concrete experiences, for example, can be aided by visualizing a farmer's challenges, whereas reflection can be aided by facilitated discussions. Planned joint experimentation activities beyond farm families can aid experimentation. Subsequently, policymakers will be able to incorporate the role of farming households into rural agriculture research and development strategies, acknowledging them as crucial actors in agricultural knowledge production and dissemination (Dabire et al. 2017; Téno and Cadilhon 2017; Vissoh et al. 2017; Ingram et al. 2020; Moschitz et al. 2015; Tisenkopfs et al. 2015). This also entails a greater appreciation of local, indigenous, technical, and informal knowledge, as well as individual farmers' innovative potential (Šūmane et al. 2018).

6.3. Limitations and directions for future research

Finally, despite these encouraging results, the following questions remain. These are discussed in theoretical and methodological terms.

6.3.1. Theoretical limitations

To start, For starters, I employed Kolb's experiential learning theory, which is widely used in current research to describe how learning occurs (Kolb and Kolb 2017; Matsuo and Nagata 2020; Morris 2020). According to Kolb's model, experiential learning is a cyclical and context-dependent process in which experiences are transformed into experiential knowledge. (Kolb 2015; Kolb and Kolb 2009). To apply Kolb's experiential learning theory to my research, I developed five interconnected concepts: (1) concrete experiences, (2) reflective observations, (3) experiential knowledge, (4) active experimentation, and (5) the context, such as IP governance mechanisms, farmers' role identities, and farm family resources. Let me first reflect on their entire learning process before I look at these concepts individually. In the study, I found that farmers' experiential learning followed two paths. First, when confronted with challenges, farmers reflected on challenges to gain challenges solving knowledge. They tested it out (actively experimented) after acquiring the knowledge to address their challenges. Farmers addressed their challenges by experimenting with the knowledge they had gained. Second, when confronted with a challenge, farmers engaged in two major learning activities: reflection and active experimentation, to gain the knowledge needed to address the challenge. The second path falls out of Kolb’s experiential learning cycle. Another research can explore this further.

6.3.1.1.Concrete experiences

While I captured both positive and negative key informant interviews, I had to leave out the positive experiences during the FGD tool training and pre-testing. The reason for this is that it did not elicit the learning activities and outcomes required to build a solid knowledge base. As a result, I resorted to all other EL studies, e.g. Manolis et al. (2013); Miettinen (2000); (Morris 2020); Matsuo and Nagata (2020) by focusing on resolving challenging experiences; other studies could incorporate pleasant/positive experiences.

Moreover, Kolb (2015)'s EL theory views concrete experiences as experiences that occur in "all situations and arenas of life". However, because of the type of respondents I was dealing with (farmers), I had to specify the time for recall purposes. I asked respondents to consider their challenges over the last five years along the coffee value chain. This is consistent with the fact that knowledge is situated in context, with a focus on place (Smith and Segbers 2018; Pipitone 2018; Harper 2018) and Time (Coker et al. 2017; Blair 2016). This is outside of Kolbs' experiential learning theory and should be researched further.

Following Matsuo and Nagata (2020) suggestions based on Kolbs' experiential learning theory, I attempted to capture both expected and unexpected experiences (challenges) at the focus group stage. This distinction was later dropped during the follow-up interviews and survey. The reason for this is that most farmer challenges were unexpected. For example, no farmer anticipated pest and disease infestation. There are numerous unnoticed root causes for pest and disease attacks. Other studies may attempt to categorize farmers' experiences as expected or unexpected.

Then, both Morris (2020); Matsuo and Nagata (2020) (both from higher education/classroom settings) propose that emotions associated with unpleasant experiences be incorporated into Kolb's EL theory. I followed this advice at the beginning of the study, but it didn't produce any results that I could analyze further. For example, if a farmer describes how their entire garden of 100 coffee plants dried up and they harvested no cherries due to coffee lead rust or coffee berry borer, do you still go ahead and ask how they felt about it? In a nutshell, I saw no way to analyze such data meaningfully and incorporate the findings into the thesis. Other studies, on the other hand, can include emotions in their research. The reason for this is that, according to (Larsen 2017), experiential learning is frequently an emotionally intense experience as metacognitive awareness of self is gained.

6.3.1.2.Reflection observation

According to Asfeldt, Hvenegaard, and Purc-Stephenson (2018), reflection is essential for making sense of experience and plays a central role in the learning process. According to Di Stefano, Pisano, and Staats (2015b); Beard and Wilson (2013), reflection observation entails seeing, hearing, and discussing the experience—what happened, how it happened, and why it happened. Schön (1987)'s reflection theory divides reflection into two parts: reflection in action (Cajiao and Burke 2016) and reflection on action (Ajjawi and Boud 2018). "Reflection in action" refers to decisions made while in the scenario, or "how teachers think on their feet", p. 12 (Farrell 2012). Reflection-in-action is almost entirely concerned with the problem-solving process. Reflection on action, on the other hand, occurs after the activity has been completed (Schön 1987). In other words, reflection-on-action is the act of looking back to assess what has happened (Ajjawi and Boud 2018). The third type of reflection is critical reflection. The complex nature of problem-solving in experiential learning necessitates higher-order thinking (Collins, Sibthorp, and Gookin 2016). Hence, experiential learning fosters critical thinking abilities (Scogin et al. 2017; James and Williams 2017). Reflection for my respondents mostly revolved around identifying challenges, determining root causes, and exploring viable solutions as part of the process (Miller and Maellaro 2016). Other studies in the farmer setting could attempt to investigate all three types of reflection.

6.3.1.3.Knowledge (Abstract conceptualization)

While it is possible to limit farmers' knowledge to that generated by reflecting on their experiences, my qualitative study (key informant, focus group, and follow-up interviews) produced important learning outcomes as well. Farmers learn about new farming methods and networks. New roles, personal weaknesses, and strengths, and so on. Other scholars, particularly those in formal education, could try this and see what happens. It could have an impact on how we define experiential learning.

6.3.1.4. Active experimentation.

As previously stated, farmers' experiences (value chain challenges in my case) and experiential knowledge gained through active experimentation fall outside of Kolb's experiential learning theory. Other studies can go down this road.

6.3.1.5. The context

The context is not specified in Kolb's theory of experiential learning. I suppose this is still fine for a theory to allow for different points of view. Based on the study site's limited resources and the nature of the experiential learning I anticipate, I concluded that this context is social. Deringer (2017) emphasizes the importance of community engagement in the EL process., Learners themselves are central to the context (Burns and Danyluk 2017). According to Blair (2016), the nature of knowledge construction is a social process. In line with previous research on IP and learning (Lamers et al. 2017), the empirical findings highlight how farmers learn through social interactions. I consider the IP to be the first coffee farmer context. This entailed incorporating the IP theory (an operationalization of the value chain/system) into Kolb's EL theory. However, the least studied aspect of IPs is governance and its impact on farmer learning.

This meant that I had to incorporate the governance theory into the study once more. Because existing qualitative studies do not link governance mechanisms to specific learning outcomes or, more importantly, the learning process, I decided to abandon the idea of delving deeply into governance theories. Once again, learning in the IP is role-based. While it is true that learning in the IP context is role-based, there has been little research into this, which is why I chose to investigate the effect of farmer role identity on their EL process. This required me to incorporate the identity theory into Kolb's EL theory. Then, according to existing IP literature, family members are an important resource for farmer learning. Family members provide the necessary resources for farmers to learn how to solve their IP challenges, but this has not been thoroughly researched. Building on these, I investigate the impact of farm family resources on the EL process of farmers.

As previously stated, I used Kolb's EL theory in conjunction with other theories. One of the toughest tasks I encountered was a lack of clear adoption of the EL theory outside of the classroom setting. Many existing studies that attempt to apply Kolb's theory in the context next to mine are qualitative. While they may exist, I have not come across any studies that attempted to incorporate more than one theory into Kolb's EL theory. Consequently, I had to conduct extensive qualitative research to obtain some measurable concepts and operationalize the study concepts. Coupled with this, the subsequent steps, namely analysis, and discussion of the survey results were difficult because there was no basis to discuss text other than the qualitative findings. Unfortunately, there is for now no better theory to guide the EL process than Kolb's EL. There, I encouraged more researchers to expand on the concepts developed in this thesis to gain a better understanding of the phenomenon.
undertaken.

6.3.2. Methodological limitations

Some limitations of my research methodology are acknowledged in this section, and then directions for future research are proposed. The first limitation of this study is the sample selection. The cases chosen were all from the VIP4FS project area. This is not Uganda's only coffee-growing region. One could argue that this is indeed limited because it is unknown whether the results would differ if the study was conducted in central, West Nile, or southwestern Uganda. Of course, this is correct, but it can be addressed in future research. What's more, only the Innovation platform participating in the VIP4FS project was chosen. Under these conditions, the sample may be biased and may not include all specifics of EL and relevant social factors in the coffee value chains. This, however, is not true given that all of the VIP4FS have previously participated in other project interventions such as FFS, Cooperative movement, and so on. Nonetheless, future research could address this limitation by broadening the scope of the study to include other coffee-growing areas and looking beyond individual project initiated/supported IPs. Besides that, because the data is from a single country (3 regional districts), the findings may be context and country-specific. As a result, replication of the studies in different contexts is required to strengthen the contribution and broad applicability of these findings. In the end, the generalizability of this thesis' findings may benefit from future research in EL and the effect of context factors such as IP governance, role identities, and family resources.

Second, because there was little information available on the study aspects, I used a mixed-methods sequential-embedded approach, with phase 1 exploratory interviews with farmers inspiring the development of a phase 2 questionnaire (Creswell and Clark 2017; Harrison, Reilly, and Creswell 2020). This approach was chosen because it would allow the first round of data collection and analysis to inform the content of a subsequent survey (Farmer et al. 2014). Hence, future research should be conducted to replicate this approach using similar study aspects in other areas, the same area at a different time, or a comparable population.

Third, the results were attained using the partial least squares structural equation modeling (PLS-SEM) technique (Hair, Risher, et al. 2019). PLS-SEM is a well-liked technique for researching intricate relationships between observable and latent variables in a variety of fields, including psychology and agricultural science (Willaby et al. 2015). For more information, see Hair, Risher, et al. (2019). PLS-SEM has benefits when working with complex models, non-normal data, and small samples, and it is particularly well suited to models with higher-order components (Hair Jr et al. 2017). Most PLS-SEM studies frame their methodology as confirmatory, which means they first conduct a literature review, then create formal hypotheses, and finally estimate models (Henseler 2018). The current study, which is interdisciplinary and applied, is designed more for exploratory purposes than for confirmatory ones. As a result, given that this study is exploratory rather than confirmatory, mediating or moderating variables should not have been taken into account because the models are still in the early stages of development. This contradicts the views of (Hair, Hult, et al. 2019), who believe that a solid theoretical or conceptual foundation is required before investigating significant mediation or moderation effects. Other researchers' replication or validation of this study would be more beneficial.

Finally, while this study examined IP governance from the perspective of farmers, future research may examine it from different (or multiple) perspectives. Other studies would run the PLS analysis separately for the IPs with the most respondents to see if there were any differences.

7

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8

Appendices

Appendix 1: Key informant interview (KII) tools

KII Checklist 1a. Research Assistant under the VIP4FS project

BACKGROUND INFORMATION	
Name	
Education level	
Role in IP	

1. What challenges do IPs seek to address?
2. How do the IPs help farmers to address the above challenges?
3. What are some of the key attributes of the VIP4FS project formed IPS? Please describe an active IP
4. What was the farmer learning (challenges-learning activities-knowledge) situation before IPs?
5. What is the farmer learning (challenges-learning activities-knowledge) situation after IP formation?
6. What do you see as the future of farmers' farmer learning (challenges-learning activities-knowledge) in these IPs?

KII Checklist 1b.Follow-up interviews with the district focal persons working with IPs

BACKGROUND INFORMATION	
Name	
Sex	
Age	
Education level	
Name of IP	
Role in IP	
Marital status	
Household headship	

1. The list of organizations working closely with the IPs in the district
2. Which ones have helped farmer address their value chain challenges and how?

3. Which ones have hindered farmers to address their value chain challenges and how?
4. What can be done?

KII Checklist 1c. Innovation platform facilitators

BACKGROUND INFORMATION	
Name	
Sex	
Age	
Education level	
Name of IP	
Role in IP	
Marital status	
Household headship	

Section A: Experiential learning process

Farmer's responsibility in learning- 3 P model clustering	**Cross-reference Kolb's (2015) model as well as reviews by(Matsuo and Nagata 2020; Morris 2020)**	**Key informant interviews**
Experiences	-Expected experiences arise from practical active experimentation -Unexpected experiences	**A1: Coffee farmers expected and unexpected past challenging experiences** 1. What challenges did farmers in your IP face in coffee production, harvesting, post-harvest handling, coffee processing, and marketing in the past five years (2014-2018) a. challenges at production b. challenges at harvesting, post-harvest handling, and coffee processing c. challenges at marketing

Learning activities	Reflective analysis and active experimentation	**A1.2. Reflective analysis of both expected and unexpected challenging experiences.** Reflecting on the challenges above, 2a what major learning activities did they carry out to address such challenges after joining IPs? a. Learning activities at production b. Learning activities at harvesting, post-harvest handling, and coffee processing c. Learning activities in marketing 2b Did anybody in the IP and/or through the IP give any insights on how to address such challenges? 2c. Who gave in the IP and/or through the IP gave insights? (Organization and Individuals) 2d. How they (2a and b) helped in performing activities related to solving challenges?
Learning outcomes	Abstract conceptualization	**A3: Learning outcomes-context specific abstract conceptualization and drawing conclusions (experiential knowledge) from the above learning activities** Through engaging in the learning activities mentioned in 2 above, 3a. which people and organizations have they gotten to know (Include both new and existing) 3b. What is the role of the above(3a) in farmer learning to address their harvest, postharvest handling, processing, and marketing challenges 3c. What new production, harvest, postharvest handling, processing, and marketing practices have farmers known about? 3d. What personal strengths and weaknesses have farmers realized at production, harvest, postharvest handling, processing, and marketing stages?

Section B: Farmer identities

1(a) How would you define your IP members?

(b) Have their traditional identities(production) changed since the year 2014?

(c) If yes, through which process?

2. According to you, what do they like about the new roles?

3a. Who helped to develop their new identities? 3b. How?

Section C: How is your or their IP organized i.e., goals, membership criteria, values, resource pooling, and coordination tasks

Appendix 2: Focus group discussion and follow-up interview checklists

Section A: Experiential learning process

Farmer's responsibility in learning- 3 P model clustering	**Cross-reference Kolb's (2015) model as well as reviews by (Matsuo and Nagata 2020; Morris 2020)**	**Questions asked**	
		Focus Group discussions	**Individual interviews**
Experiences	-Expected experiences arise from practical active experimentation -Unexpected experiences	1a. What challenges did you face in coffee production, harvesting, post-harvest handling, coffee processing, and marketing in the past five years (2014-2018) 1b: What happened before 2014? 1c: What were your expectations?	1. What challenges did you face in coffee production, harvesting, post-harvest handling, coffee processing, and marketing in the past- five years (2014-2018)
Learning activities	Reflective analysis and active experimentation	Reflecting on the challenges above, 2a. What major learning activities did you carry out to address such challenges before organizing yourself into innovation platforms? 2b. What major learning activities did you carry out to address such challenges after	Reflecting on the challenges above, 2a. What major learning activities did you carry out to address such challenges after joining the IP? 2b. Did anybody in the IP and/or through the IP give you any insights about how to address such challenges?

		organizing yourself into innovation platforms? 2c. Did anybody in the IP and/or through the IP give you insights about how to address such challenges? 2d. Who in the IP and/or through the IP gave you insights? How?	2c. Who in the IP and/or through the IP gave you insights and, 2d.how?
Learning outcomes	Abstract conceptualization	Through engaging in the learning activities mentioned in 2 above, 3a. which people and organizations have you gotten to know (Include both new and existing) 3b. What is the role of the above(3a) in your learning to address their harvest, postharvest handling, processing, and marketing challenges 3c. What new production, harvest, postharvest handling, processing, and marketing practices have you known about? 3d. What personal strengths and weaknesses have you realized at the production, harvest,	Through engaging in the learning activities mentioned in 2 above, 3a. which people and organizations have you gotten to know (Include both new and existing) 3b. What is the role of the above(3a) in your learning to address their harvest, postharvest handling, processing, and marketing challenges 3c. What new production, harvest, postharvest handling, processing, and marketing practices have you known about? 3d. What personal strengths and weaknesses have you realized at the

	postharvest handling, processing, and marketing stages?	production, harvest, postharvest handling, processing, and marketing stages?

Section B: Farmer identities

1(a) In terms of the division of roles in coffee farming, how would you define yourself?

(b) Have you changed your traditional identity (production) since 2014?

(c) If so, which processes did you go through to learn the new identity? and

2. (d) How has the shift in your identity helped you learn new ways to address your farming challenges?

3a. Who helped to develop your new identities? 3b. How?

Appendix 3: Survey questionnaire

Name of Respondent (Optional): ____________________District: _____________ Sub county:______________ Parish:________________Village: __________________

SECTION A: BACKGROUND INFORMATION

1. The following question relates to your background information. *Please fill in the following blank spaces provided.*

a) Sex **Codes A:** 0. Female 1. Male	b) Marital status **Codes B:** 1. Married 2. Not married	c) Age (years)	d) Highest Formal Education attained	e) Years of growing coffee	f) Average number of household members who helped with coffee work between 2015-2019	g) Average number of IP members who helped with coffee work between 2015-2019	h) Average number of organizations including local government and research institutions who help with coffee work between 2015-2019

Codes C: 0. None, 1. Primary, 2. Secondary Ordinary, 3. Secondary Advanced, 4. Diploma / College, 5. University

SECTION B: EXPERIENTIAL LEARNING PROCESS

SECTION B1: CHALLENGES

Qn.1: Please indicate by ticking the appropriate box how often you faced challenges in the last 5 years (2015-now) in						
a: production		*1* never	*2* rarely	*3* sometimes	*4* often	*5* *always*
i.	pests and disease infestation	☐	☐	☐	☐	☐
ii.	production inputs (e.g., pesticides, fertilizers, pruning saws, labor etc.)	☐	☐	☐	☐	☐
iii.	Extreme weather changes i.e., sometimes too hot, or too much rain.	☐	☐	☐	☐	☐

iv.	knowledge about coffee agronomic practices e.g., weeding, spraying against pests and diseases, fertilizer application, etc.	☐	☐	☐	☐	☐
b: harvesting						
i.	skilled coffee-picking labor	☐	☐	☐	☐	☐
ii.	thieves	☐	☐	☐	☐	☐
iii.	knowledge about coffee picking	☐	☐	☐	☐	☐
c. post-harvest handling and processing,						
i.	knowledge about coffee sorting, washing, fermenting, drying, storage, etc.	☐	☐	☐	☐	☐
ii.	coffee pulping labor	☐	☐	☐	☐	☐
iii.	equipment (e.g., pulping machines, drying materials, etc.)	☐	☐	☐	☐	☐
iv.	too much rain slowing down the coffee drying process	☐	☐	☐	☐	☐
v.	storage (e.g., space, materials-bags)	☐	☐	☐	☐	☐
vi.	knowledge of proper coffee storage	☐	☐	☐	☐	☐
d: marketing						
i.	coffee buyers (e.g., few, unreliable, untrustworthy)	☐	☐	☐	☐	☐
ii.	coffee prices	☐	☐	☐	☐	☐
iii.	fluctuating coffee prices	☐	☐	☐	☐	☐
iv.	transport challenges	☐	☐	☐	☐	☐
v.	finances to run the coffee business	☐	☐	☐	☐	☐
vi.	coffee prices information	☐	☐	☐	☐	☐

SECTION B2: THE TRANSFORMATION PROCESS (Active experimentation, Reflective analysis)

Qn.2a1: How often- in the last 5 years - have you used the knowledge obtained through relationships to tackle production and harvesting challenges compared to other IP members? (Active experimentation)					
I used...	*1* never	*2* rarely	*3* sometimes	*4* often	*5* *always*
a) Operation Wealth Creation (OWC)/NAADS,	☐	☐	☐	☐	☐
b) National Agriculture Research Organization-Buginyanya	☐	☐	☐	☐	☐
c) Uganda Coffee Development Authority (UCDA)	☐	☐	☐	☐	☐
d) NUCAFE	☐	☐	☐	☐	☐
e) Makerere University	☐	☐	☐	☐	☐
f) Kyagalanyi	☐	☐	☐	☐	☐
g) Kawacom	☐	☐	☐	☐	☐
h) Great lakes Ltd	☐	☐	☐	☐	☐
i) Coffee A Cup	☐	☐	☐	☐	☐
j) Gumutindo	☐	☐	☐	☐	☐
k) Innovation Platform	☐	☐	☐	☐	☐
l) Cooperative union (e.g., Kabeywa, Bukusu, Arokwo, etc.)	☐	☐	☐	☐	☐
m) farmer group	☐	☐	☐	☐	☐
n) contact/model/influential farmers	☐	☐	☐	☐	☐
o) Local leaders e.g., politicians, clans, local council	☐	☐	☐	☐	☐
p) other, namely...					

2a2. Compared to other IP members, I use my knowledge about coffee:						
i.	Production					
ii.	harvesting					
iii.	Post-harvest handling and processing					
iv.	Marketing					
Qn.2b1: How often- in the last 5 years - have you reflected on your interactions with existing relationships to tackle post-harvest and marketing challenges, compared to other IP members? (Reflective analysis)						
I used...		*1* never	*2* rarely	*3* sometimes	*4* often	*5* *always*
a)	Operation Wealth Creation (OWC)/NAADS,					
b)	National Agriculture Research Organization-Buginyanya					
c)	Uganda Coffee Development Authority					
d)	NUCAFE					
e)	Makerere University					
f)	Kyagalanyi					
g)	Kawacom					
h)	Great lakes Ltd					
i)	Coffee A Cup					
j)	Gumutindo					
k)	Innovation Platforms					
l)	Cooperative union (e.g., Kabeywa, Bukusu, Arokwo, etc.)					
m)	farmer groups					
n)	contact/model/influential farmers					
o)	Local leaders e.g., politicians, clans, local council					

p)	Other, namely...					
2b2. Compared to other IP members, I ...						
v.	question the way other coffee farmers production methods and try to think of a better way	☐	☐	☐	☐	☐
vi.	like to think over my coffee harvesting methods and consider alternative ways of doing it.	☐	☐	☐	☐	☐
vii.	re-appraise my coffee post-harvest handling and processing so I can learn from it and improve for my next performance	☐	☐	☐	☐	☐
viii.	reflect on my coffee marketing sells to see whether I could have improved on what I did.	☐	☐	☐	☐	☐

SECTION B3: EXPERIENTIAL KNOWLEDGE

Qn.3.Please indicate how much knowledge you have - compared to your IP colleagues - in the following domains:

	1 Very low knowledge	2 Low knowledge	3 Moderate knowledge	4 High knowledge	5 Very High knowledge
beneficial network relationships for coffee					
a) production	☐	☐	☐	☐	☐
b) harvesting	☐	☐	☐	☐	☐
c) post-harvest handling and processing	☐	☐	☐	☐	☐
d) marketing	☐	☐	☐	☐	☐
Knowledge about methods to					

e) increase my coffee production(yield)	☐	☐	☐	☐	☐
f) improve my coffee harvesting methods	☐	☐	☐	☐	☐
g) improve on post-harvest handling and processing methods	☐	☐	☐	☐	☐
h) market coffee	☐	☐	☐	☐	☐

SECTION C: FACTORS MODERATING CHALLENGES TO EXPERIENTIAL KNOWLEDGE TRANSFORMATION

SECTION C1: FARMER ROLE IDENTITIES

Qn.4. Please indicate by ticking the appropriate box. To what extent do you agree with the following statements?					
	1 Strongly disagree	2 Somewhat disagree	3 Neither agree nor disagree	4 Somewhat agree	5 Strongly agree
1. I am an input dealer	☐	☐	☐	☐	☐
2. I am a coffee producer	☐	☐	☐	☐	☐
3. I am a coffee seedling nursery operator	☐	☐	☐	☐	☐
4. I am a coffee picker	☐	☐	☐	☐	☐
5. I am a coffee processor	☐	☐	☐	☐	☐
6. I am a coffee transporter	☐	☐	☐	☐	☐
7. I am a coffee trader	☐	☐	☐	☐	☐
8. I am a savings and lending group member	☐	☐	☐	☐	☐

9. I am an advisory service provider	☐	☐	☐	☐	☐
10. I am a manager (specify what you manage):	☐	☐	☐	☐	☐

Codes for 10; 1. Welfare/treasurer, 2. Opinion leader/local leader, 3. Publicity, 4. Mobilizer, 5. Recorder/Secretary,6. IP facilitator,7. Security

SECTION C2: FARM FAMILY RESOURCES

Qn.5. Please indicate whether the support from your family members helped you address challenges in coffee production, harvesting, post-harvest handling, and marketing -in the following domains:					
	1 Strongly disagree	2 Disagree	3 Somewhat agree	4 Agree	5 Strongly agree
a) I obtain advice from my family members on:	☐	☐	☐	☐	☐
a. coffee production	☐	☐	☐	☐	☐
b. coffee harvesting	☐	☐	☐	☐	☐
c. post-harvest handling and processing	☐	☐	☐	☐	☐
d. coffee marketing	☐	☐	☐	☐	☐
b) My family members offer coffee					
a. production labor	☐	☐	☐	☐	☐
b. harvesting labor	☐	☐	☐	☐	☐
c. post-harvest handling and processing labor	☐	☐	☐	☐	☐
d. marketing support-transporting, negotiating coffee prices, etc.	☐	☐	☐	☐	☐
c) My family members are involved in decision-making at					
a. production	☐	☐	☐	☐	☐

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b. harvesting	☐	☐	☐	☐	☐
c. post-harvest handling and processing	☐	☐	☐	☐	☐
d. marketing	☐	☐	☐	☐	☐
d) My family members offer me					
a. production inputs-pruning saws	☐	☐	☐	☐	☐
b. Production inputs-land	☐	☐	☐	☐	☐
c. post-harvest handling and processing activities-pulping machines	☐	☐	☐	☐	☐
e) My family members mentor me in coffee production activities	☐	☐	☐	☐	☐
f) My family offers me emotional support during coffee production activities	☐	☐	☐	☐	☐
g) I have no restriction from my family on whether to attend training on coffee farming	☐	☐	☐	☐	☐
h) My family members are a source of inspiration for my coffee production activities	☐	☐	☐	☐	☐
i) My family paid for my school fees until my current education level	☐	☐	☐	☐	☐
j) I have access to farming contacts through my family members	☐	☐	☐	☐	☐
k) My family members do finance my coffee farming operations	☐	☐	☐	☐	☐
l) My family members act as collateral for me to access finances for my coffee farming activities	☐	☐	☐	☐	☐

SECTION C3: INNOVATION PLATFORM(IP) GOVERNANCE MECHANISMS

Qn.6. Please indicate by ticking the most appropriate box the contribution of IP governance mechanisms to your farming activities.

		1 Strongly disagree	2 Disagree	3 Somewhat agree	4 Agree	5 Strongly agree
Representation	In my IP relevant stakeholders are represented					
	Members in my IP are selected in a transparent manner					
	My IP is inclusive of a diversity of actors					
Participation & equity	Every participating member is sufficiently heard during IP discussions					
	Within my IP any member can influence decision making					
	My IP creates a feeling of ownership for members					
Accountability & transparency	In my IP, members hold each other accountable for their actions					
	In my IP, members have access to diverse sources of coffee value chain information					
	In my IP, decision-making is in a transparent manner					
Leadership	I trust my IP's leadership					
	The selection process of my IP's leadership is in a transparent manner					

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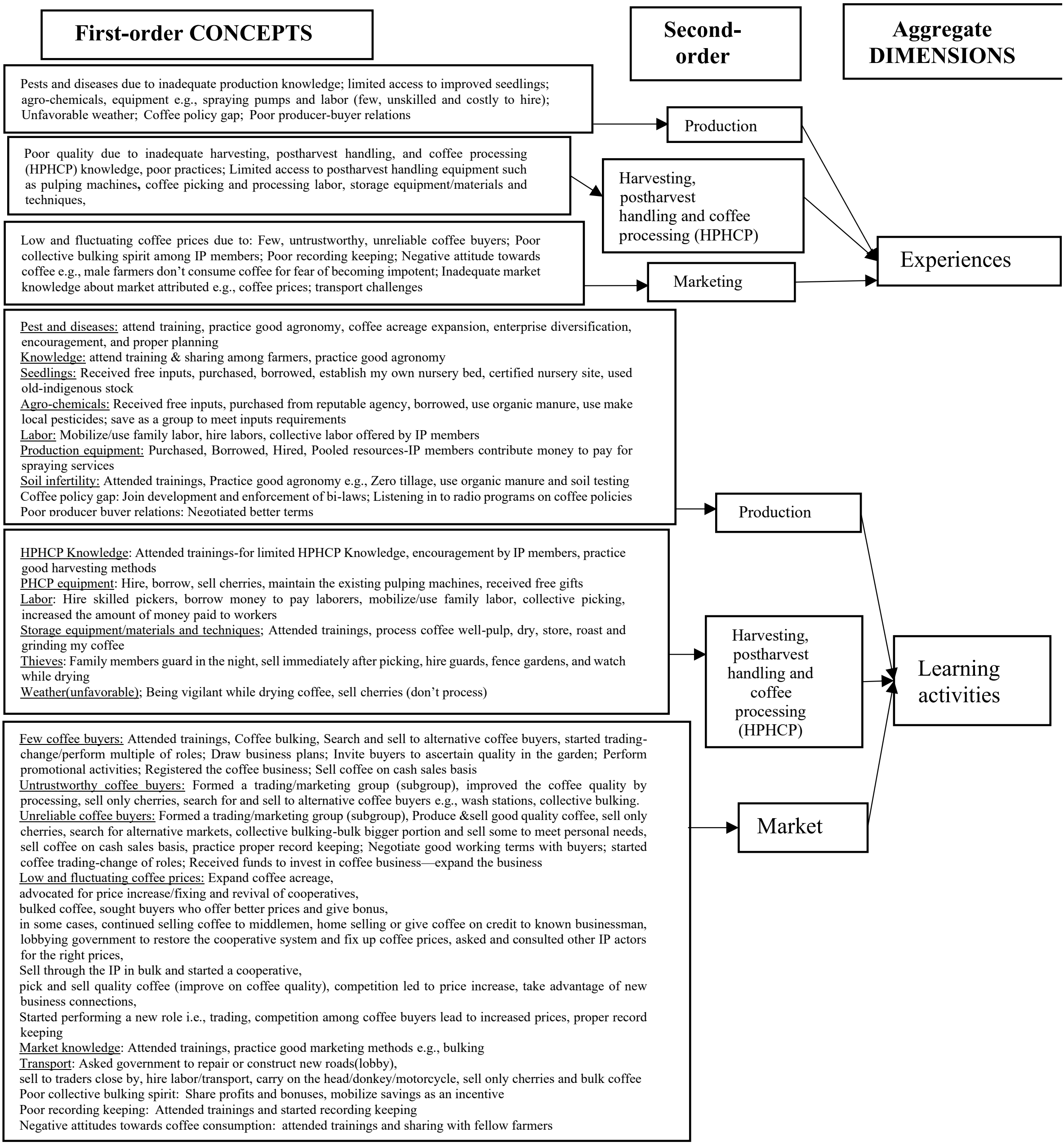
	The rules in my IP are flexible allowing me to stay a member or cease being at will	☐	☐	☐	☐	☐
Facilitation and communication	The IP is effective in organizing meetings	☐	☐	☐	☐	☐
	Coffee value chain information is widely shared among my IP members	☐	☐	☐	☐	☐
	The IP is effective in mobilizing members for agreed actions	☐	☐	☐	☐	☐
Trust	As an IP member, I feel comfortable sharing information with fellow IP members	☐	☐	☐	☐	☐
	My IP members feel encouraged to contribute to the betterment of the IP	☐	☐	☐	☐	☐
	My IP creates trust among a diversity of actors	☐	☐	☐	☐	☐
Commitment	My IP members are committed to sharing knowledge freely	☐	☐	☐	☐	☐
	My IP members are willing to let go of their comfort for the sake of others	☐	☐	☐	☐	☐
	My IP members freely take part in coffee IP activities					
Capacities	My IP members offer me advice on coffee value chain activities	☐	☐	☐	☐	☐
	My IP organizes learning tours for me	☐	☐	☐	☐	☐
	My IP facilitates sharing of information between me and other members outside my IP	☐	☐	☐	☐	☐
Resources	My IP facilitates access to finance	☐	☐	☐	☐	☐
	My IP facilitates access to production inputs (e.g., pesticides)	☐	☐	☐	☐	☐

	My IP offers coffee processing equipment (e.g., pulping machines)	☐	☐	☐	☐	☐
	My IP offers transport for my produce to the selling point	☐	☐	☐	☐	☐
	My IP facilitates access to coffee markets	☐	☐	☐	☐	☐
	My IP offers coffee storage space	☐	☐	☐	☐	☐
	As an IP, we have group projects as a strategy to raise money for the IP activities	☐	☐	☐	☐	☐

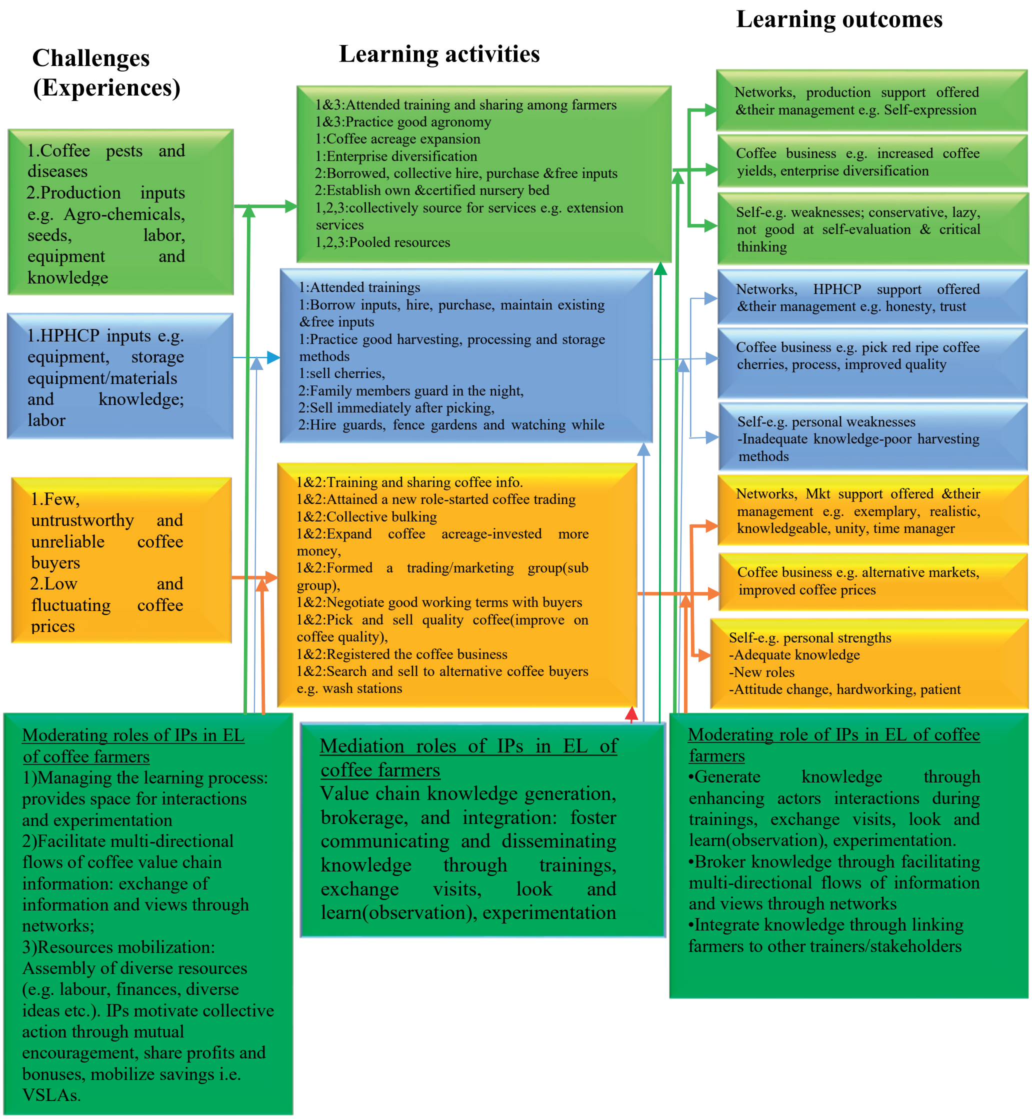
Appendix 4a: Data structure (Chapter 2)



Appendix 4b: Data structure (Chapter 2)

First-order CONCEPTS	Second-order THEMES	Aggregate DIMENSION
A point to lobby coffee buyers to give farmers inputs inform of loans. Emotional support and motivation for undertaking new value chain activities A source of information/training. Act as collateral to access inputs including finance Advertise farmers' coffee on social media especially on Facebook and radio Provide inputs (free or purchase) including finance, markets, and storage for farmers coffee Certify nursery sites/register coffee nursery business Collective bulking-good bargaining power. Collectively provide labor e.g., land preparation, planting, pruning etc. Collectively purchase genuine inputs e.g., agro-chemicals, equipment and in a timely manner Encouraged and supported the development of wash stations, cooperatives, searching for coffee markets,	Networks	Learning outcome
Co-existence, mutual understanding, respect, patience, trust, unity, self-expression, happiness, honesty, common voice and cooperation, task delegation, advocacy for support, team work, being realistic, good time management, being exemplary, effective communication, working together/agreeing with one another keeps the value chain intact, Joint decision making, hard work-not being lazy, being knowledgeable, generate income internally and contribute e.g. sharing ideas, exchange visits/look and learn, demand for trainings, offering collective labor etc.	Managing relationship	Learning outcome
Obtained knowledge of coffee production methods; thus, practice good agronomy; As a result, improved soil fertility due to reduce soil erosion; Expanded coffee acreages; Enterprises (income sources) diversification; Improved coffee yield and sales to the market	Production practices	Learning outcome
Personal weaknesses: Limited knowledge-good agronomy; conservative-need exposure to modern production methods; self-evaluation and critical thinking (easily get discouraged on making loses) and laziness-don't practice good agronomy Personal strengths: Adequate knowledge e.g. how to manage flowers; Proactive-search for information; Appreciate coffee farming- Motivated to put more effort in coffee farming; Mind-set change---now practice good agronomy, attend trainings; Attitude change-persistent and determined coffee farmer; consume own coffee; Proper planning-advance purchase of inputs; Realized that a quick learner after trainings increased on the coffee acreage; Self believe-perform the entire value chain activities; Self-evaluation and critical thinking (easily get discouraged on making loses); Little money to invest in coffee production; Good relations-advanced personal ambitions in many things like purchase of quality pesticides; Diversify income sources-coffee is a long time investment, no need to rush; Reflect on weak points e.g. lack of production inputs such as pesticides so as to devise local methods to that effect.	Production-Self	Learning outcome
Individually, collectively pick, monitor/supervise the picking process, pay picker well thus improved coffee quality Add value- sort it properly, wash, pulp, make coffee powder, properly pack in sucks and on clean surfaces which fetches more money compared to when sold in raw form. Demand for high quality coffee cherries by traders led to quality improvement improved quality	Harvesting, postharvest handling and coffee processing	Learning outcome
Personal weaknesses: Limited knowledge-poor harvesting methods Personal strengths: Attitude change i.e., towards picking; Planning-get own pulping machines, drying material and storage Quality is paramount to success in coffee business and begins from farm care for coffee. Patience-wait for cherries to properly ripen before picking and involved skilled laborers; Mind-set change-shift from traditional ways of picking coffee and processing; New roles-	HPHCP-Self	Learning outcome
The coffee business is good though seasonal and mostly profits those who grow a lot–bigger coffee acreages. The way coffee is handled from the start means a lot to the final user Now understand the business language and relations with trainees and coffee buyers Don't rush to identify partners but choose them after a time of building trust and knowing how realistic they are. Good working relationship with other partners e.g. Great lakes and Kyagalanyi means good profits. Time of selling coffee has changed. Non-value chain actors i.e., coffee buyers do not tell the right coffee market price. Some coffee buyers give bonus-financial incentive Some coffee buying agencies don't have sufficient capital to transact coffee business on cash. Sell only cherries eliminates other transactional costs Keep records Interaction with district officials helped us to learn and understand policies concerning exportation of coffee. New roles/role identity development Better coffee quality-we do value addition as compared to the past when we used to sell cherries or patched coffee. Advocate for revival of cooperatives The demand for high quality coffee cherries has had a positive impact on the coffee quality as most coffee farmers. Competition by various coffee buyers lead to price rise. Unreliable coffee buyers are an opportunity for farmers to develop new identities Create new markets after registering business Collectively market coffee Negotiate better terms with coffee buyers. There is more ready market e.g., IPs, Wash stations, cooperatives, for coffee than before. These markets offer, good prices, bonus, commission	Marketing practices	Learning outcome
Personal weaknesses: Poor saving culture-over spend during harvesting season Personal strengths: Adequate knowledge-supply good quality coffee; New roles-now a trader; Producer-buyer relations(learnt how to treat cheating buyers); Self-encouragement; Working hard equal to more profits; Mind-set(treat coffee as a business); Commitment to be accomplished with good profits; Planning to own transport means, coffee store and advance coffee processing; Self-evaluation and critical thinking-everything begins with an individual; Groups develop the self; Adequate amount of money to trade in coffee; Too many marketing problems==absence of cooperatives; Proper weight estimation-proper weighing of coffee; Patience while waiting for payments after supplying coffee to the cooperative union; Market linkages discovered while sharing information with others	Marketing-Self	Learning outcome

Appendix 5: The role of IPs in EL of coffee farmers



Appendix 6: Network type and support provided to coffee IP farmers (Chapter 2)

Network type	Actors	Support provided
Bonding	Family members e.g., spouses, children, parents, cousins, brother-in-law, grandfather, etc.	-Support in the value chain activities-advice, knowledge, finance, labor (production, harvesting, processing, and marketing), emotional support i.e. encouragement, inspiration, motivation to start or continue coffee farming, training, and business connections -Market information e.g., prices and advice on the coffee quality demanded by coffee buyers (well-dried coffee on a raised platform)
		-Time/grant women permission to attend training meetings,
		the family is a source of network connections
	Friends and peers-fellow farmers, IP/group members, neighbors	-Share experience, training, technical advice across the value chain and business connections
		-Emotional support(encouragement) and motivation for undertaking new value chain activities, starting new businesses
		-Share inputs-farmers borrowed or share agro-inputs amongst themselves as well as hire.
		-Pool resources e.g. labor, funds, and collateral for finances as a group helps in searching for coffee markets,
	Farmworkers mostly coffee pickers	-Provide labor
Bridging	Extension workers, politicians, local council committee members, and contact/model/influential farmers	-Knowledge of new value chain technologies and practices and source of new ideas e.g. market information and potential coffee markets to sell and at what prices.
		-Connections with other agricultural networks and coffee buyers worldwide
		-Serve as an encouragement to grow coffee, market, and work hard
		-sell farmers' coffee
		-A source of business financing, labor, information/training, and business connection.
		-Collective bulking-good bargaining power.

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		-Policy development and advocacy-In conjunction with local government drafted bi-laws to cub down fake agro-inputs in the market along with coffee quality improvement
	CBOS, Local NGOs, Associations, e.g. KOCAFE, KIFANGO, KABUM coffee, BUACE, KFCU, Kayombe coffee corporative-Butilu, Wash stations, etc.	-Trains farmers on working as a team, coffee agronomy, coffee marketing strategies including good prices and other marketing aspects including collective bulking/group selling and liked farmers to other markets
		-Provide inputs(free or purchase) including finance, markets, and storage for farmers' coffee, information, a platform to share and exchange ideas
		-Linkage to external trainers as well as markets
		-Support the performance of new roles e.g. start to a trader in coffee - cater for coffee transport as well as give a commission of 30/= per kg of coffee delivered to them and bonuses of 150/= per kg to all registered members
		-Collective action(and collateral)-purchase genuine inputs and lobby for inputs from other agencies e.g. agrochemicals, equipment (pruning saws, Secutures), finance, and promptly. Joint development and implementation of coffee bi-laws
Linking	Coffee buyers- the private sector, Kawacom, Grate Lakes Limited, Kyagalanyi, Uganda Cooperative Alliance, Private sector Mbale and Mbale farmers' association, Gumutindo, UCDA, Gumutindo	-Provide technical advice on coffee value chain aspects e.g. pest and disease management aspects including spraying, pruning, stumping, and soil amendments e.g. use of organic manure in coffee production, mulching, use of bands, trenches, and agro-forestry. Sponsor study tours, visits, look and learn sessions
		-Encouraged farmers to organize themselves into groups/collective action.
		-Give free inputs e.g. seedlings, agro-chemicals, funding, and material support to farmers across the value chain
		-Encouraged and supported the development of wash stations, cooperatives, purchase farmers' coffee(Seedlings and ready coffee) as well as market linkages
		-Advertise coffee markets on social media, especially on Facebook and radio
		-Certify coffee nurseries.
		-Support in the implementation of value chain investments e.g. establishment of nursery sites

	Banks(Centenary), MFI(BRAC), SACCOS(Chechomiye) and VSLAs	-Funding to undertake production, coffee processing and marketing-purchase inputs, transport coffee, etc.
	Research centres-VIP4FS project (ICRAF, MUK, and Adelaide University), NARO, VECO	-Knowledge of new agricultural technologies and practices
		-Production services (soil analysis)
	Governmental agencies e.g. The District Local Government(DLG) through its arms such as the Sub country extension services, Operation Wealth Creation (OWC)/The National Agricultural Advisory Services (NAADS), Uganda Coffee Development Authority (UCDA), and Community Development Office(CDO)	-Encourage farmers to continue planting coffee in large quantities, offered free coffee seedlings, compliments the private sector as well as allow the private sector to operate in the area. CDO registers farmers' groups
		-Sensitization of coffee policies
		-Certify nursery sites/register coffee nursery business
		-Advertise farmer's coffee products on social media, radio, and the internet

Appendix 7: Innovation Platform Governance mechanisms (Chapter 3)

a) GOALS

- United coffee farmers
- To improve coffee farming among farmers/produce high-quality coffee through
  - collectively maintaining coffee gardens
  - collectively pick coffee
  - Collective coffee marketing to increase household/individual level income
  - monthly member meetings
  - Attend training on coffee aspects e.g. sanitation and hygiene
- Improved coffee farming knowledge exchange across the farming community
- For easy mobilization of farmers of various groups
- For easy management of the farmer groups
- For personal development purposes/change and improvement of livelihoods/ Home support for members we buy cows and goats for members in the group/ Savings and credit/ To fight hunger and poverty in farm households
- Environmental protection
- Member capacity building
- Lobby and advocate for the implementation of policies favorable to coffee farmers

b) VALUES

- Collective action/teamwork
- All farmers should have well-managed coffee trees in their gardens
- Freely share their knowledge and experiences among members. The rules and regulations of the IPs allow free interaction of members.
- Value for money
- Innovative and creative
- Transparency/Honesty
- Accountability
- Time management
- Trust
- Hard work

c) MEMBERSHIP CRITERIA

- Anyone willing coffee farmer above 18 years though there are some exceptions-those who can provide a service that no other group members can e.g., transporters
- Must be an active and hardworking person
- Must be committed to attending IP meetings
- Must come from a farmer/primary group in their community

- Six members are chosen from every group as representatives in the I.P
- An annual subscription fee of 50, 000 per year must be paid by every member.
- Buy an IP t-shirt having the association name.
- Free entry and exit

d) RESOURCE POOLING

- Save as a group during weekly and monthly meetings to generate income to handle value chain tasks e.g., buy coffee as well as provide credit to members in case one needs it. The savings as in form of merry go round and Village Savings and Loans Associations (VSLAs)
- Registration fee of 5000/=
- Annual membership fees of 20,000/=
- A monthly contribution of 5000/= from each farmer/primary group
- I.P. Members always monitor the activities of primary group members.
- 1000/= from every member for lunch during meetings
- At times contribute labor for picking coffee for fellow group members. This is because some of the people they ask to pick their coffee normally pick unripe cherries and this negatively impacts the quality of the coffee.
- Support from well-wishers like the area member of parliament. For instance, Mt. Elgon women in coffee IP receive 500,000/= from our area member of parliament to support IP activities.

e) COORDINATION TASKS

- Meet every month to discuss their farming challenges and solutions.
- IP activities are coordinated by a steering committee as follows:

Position	Roles and responsibilities
Chairperson	- The chairperson handles general coordination with the organization and disseminates information to members. Coordinates I.P. activities, such as holding meetings, mobilizing members for meetings, and farming. The chairperson chooses representatives for workshops.
Facilitator	-Provides translation when visitors arrive. -During training, sends information/invitation to group members via their chairpersons. The chairpersons of separate organizations then notify members of their respective groups. The group consists of ten pickers, two members, and one chairperson. -Facilitates the training and distributes training materials to the participants. -Manages meetings, mobilizes members for resource pooling, and networks
Secretary	Take notes during meetings and keep meeting minutes.

Treasurer/Welfare	Manages funds for the group and ensures the well-being of its members
Time Keeper	Keeps time
IP members	2 primary group members to observe what is going on in the group and take reports to their respective members

Appendix 8: Farmer role identities (Chapter 4)

8a: Farmer role identities (Key informant interviews)

Proportion	Farmer role identities
100%	Coffee farmer-Coffee picker-processor-Contact farmer,
75%	Coffee farmer-Coffee buyer-Coffee IP or group leader-Coffee transporter-Input stockiest-Opinion leader
25%	Coffee farmer-Trainer

8b:Farmer role identities(Focus group discussion and Follow up interviews combined)

Frequency(Percentage)	Farmer role identity	Farmer role identity breakdown
23 (25%)	Coffee farmer	Coffee farmer (Non-traditional/modern coffee farmer)
31 (34%)	Coffee farmer-trader	Coffee farmer, nursery operator, coffee picker, trader (+sometimes processor)
9 (10%)	Coffee farmer-trader-leader	Coffee farmer, trader (+sometimes processor), IP facilitator (sometimes local leader, opinion leader), recorder/secretary
2 (2%)	Coffee farmer-trader-Adviser	Coffee farmer, trader (+sometimes processor), Extension worker
16 (18%)	Coffee farmer-leader	Coffee farmer, Group Chairperson, IP Facilitator/IP supervisor, recorder/secretary, publicity/ mobilizer, treasurer
10 (11%)	Coffee farmer-leader-Adviser	Coffee farmer, IP facilitator, contact farmer/trainer, leader (opinion leader, an elder)

Note. Figures in brackets are percentages i.e. responses to a certain role identity/total*100%

8c: Farmer role identities (Focus group interviews)

Frequency (Proportions)	Farmer role bundle	Roles bundle breakdown
18(42%)	Farmer-modern coffee farmer	Farmer(Non-traditional/modern coffee farmer)
10(23%)	Farmer-trader	Farmer, nursery operator, trader
3(7%)	Farmer-trader-farmer group leader	Farmer, trader(+sometimes processor), IP facilitator
2(5%)	Farmer-trader-Adviser	Farmer, trader(+sometimes processor), Extension worker
4(9%)	Farmer-trader-farmer group leader	Farmer, trader(processor), Recorder/Secretary
4(9%)	Farmer-farmer group leader	Farmer, Group Chairperson, IP Facilitator/IP supervisor
2(5%)	Farmer-farmer group leader-Adviser	Farmer, IP Facilitator, contact farmer

8d: Farmer role identities (Follow-up interviews)

Frequency (Proportions)	Farmer role identity	Farmer role identity breakdown
5(10%)	Farmer-modern coffee farmer	Farmer(Non-traditional/modern coffee farmer)
21(44%)	Coffee farmer-trader	Farmer, Trader(+sometimes processor), coffee picker Nursery bed operator
2(4%)	Coffee farmer-trader-farmer group leader	Farmer, trader, IP facilitator(+ sometimes local leader, opinion leader)
12(25%)	Coffee farmer-farmer group leader	Farmer, Group Chairperson, IP Facilitator, Recorder/Secretary, publicity/ mobilizer, treasurer
4(8%)	Coffee farmer-non farmer group leader-farmer advisor	Farmer, Opinion leader, Contact farmer, an elder
4(8%)	Coffee farmer-farmer advisor	Farmer, trainer

Appendix 9: Farmer role identity components description (Chapter 4)

Farmer role identities		Farmers' descriptions of their role categories
Coffee farmer	Non-traditional/Modern coffee farmer	Non-traditional/modern coffee farmer (uses improved methods to increase farm production and productivity), harvests their coffee or for other farmers but not for money and coffee cherry supplier (Change in the production methods and in-charge of the coffee supply activities unlike in the past when the cooperative)
Coffee trader	A coffee trader at production-Coffee Nursery operator	Coffee farmer, picker and cherry supplier, nursery bed operator-often supplies seedlings to or via Uganda Coffee Development Authority (UCDA) to other farmers(trader)
	Coffee trader postproduction-Coffee picker	Coffee farmer, trained to pick coffee and does so for money (living), as well as coffee cherry supplier
	Coffee trader postproduction-Coffee buyer/trader/Businessperso n/Output dealer/Exporter	Coffee farmer, picker and cherry supplier, trader (harvests own, buys from other farmers, processes and/or parchment to re-sell), and/or buyer on behalf of a bigger buyer, more networked, knowledgeable, advises other farmers and also a channel for inputs access, offers training venues, may invite trainers, most hold leaderships positions e.g. as a group/IP leader, political position or former employee in either public or private sector and, finally, has relatedly higher income than others
	Processor	Coffee farmer, picker, cherry supplier, trader (harvests own, buys from other farmers, processes coffee to parchment for resale), has a processing unit, purchases mostly coffee cherries from at least 10 producer groups of 25 members, sells coffee parchment and post parchment products, more networked, experienced, advises other farmer and also a channel for inputs access, offers training venues, can invite trainers, most hold leaderships positions e.g. as a group/IP leader, political position or former employee in either public or private sector and, finally, has relatedly higher income as a result.

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Coffee farmer advisor	Contact person/model farmers/prominent farmers/extension agent/trainer	Coffee farmer, picker and cherry supplier, trader, informed about the entire coffee value chain aspects (trains/guides/demonstrates/shares experiences/larger coffee acreage and exemplary coffee, larger network size-both value chain and non-value actors, connect with other training opportunities), encourager/motivator, village agent or contact person for local government and private sector, most times well educated-tertiary institution level and holds a leadership position e.g. IP Facilitator, Recorder/Secretary.
Farmer leader	Opinion leader	Coffee farmer, nursery operator, current or former extension worker, group/collective/association/IP leader-both coffee and non-farming e.g. Church, local council (political), informed about the entire coffee value chain aspects (trains/guides/demonstrates/shares experiences/bigger coffee acreage and exemplary coffee, larger network size-both value chain and non-value actors, connections with other training opportunities or a training agent affiliated to private or public sector) and an encourager/motivator, at the very least able to read and write
	Recorder/Secretary	Organize meetings, mobilize members for resource pooling and networking
	Mobilizer/Publicity	Inform and mobilize members about IP events. In terms of coffee management, sensitizing and communicating with many people in the group.
	IP Facilitator	Both intra and inter-IP level learning activities are coordinated by the IP facilitator.
	IP Supervisor	Provide supervision in the IP, such as assisting the IP leadership in carrying out their responsibilities.
	Primary group leader/Subgroup leader i.e., chairperson, production, bulking, marketing	Subgroup leader oversees the respective group activities e.g., coffee sales
	Treasurer	Custodian for IP-level funds from various sources such as membership, annual subscriptions, fines, etc. Avails such funds to execute IP-level activities as well as offer periodic accountabilities to members.

Appendix 10: The role of IPs in identity development (Chapter 4)

Frequency (Proportions)	How organizations and people helped to develop farmer role identity
85 (93%)	Kyagalanyi Co Ltd, Kawacom, Kapchorwa District Landcare Chapter (KADLAC), ICRAF, Makerere University (MUK), and Adelaide University-trained farmers on the entire value chain through Innovation Platforms/ Farmer Field Schools (FFSs)/groups, soil conservation techniques, and how to tap new coffee business opportunities. Through these, some farmers became professional coffee pickers, processors, traders, etc. In addition to training, Bugisu Cooperative Union (BCU) gave farmers free seedlings. Uganda Cooperative Alliance (UCA)–trained farmers on working together along with other coffee value chain aspects. Interactions and sharing of information amongst trainees. Local Government extension service providers trained farmers in coffee management techniques as well as registration farmer groups at the sub-country and district Again, Bukusu Area Cooperative Enterprise, IPs e.g., Kabeywa, Arokwo, Chema, etc have helped to develop their identities as traders by buying farmers' coffee at good prices. Likewise, Great Lakes Ltd, Kyagalanyi purchased farmers' coffee at good prices and built wash stations. Finally, the BRAC Magale branch & UWA lent/gave farmers money to buy coffee.
68 (75%)	Fellow group members, friends, and neighbors are a source of encouragement, inspiration, advice, and knowledge on the marketing of coffee, business idea, and the skill of doing coffee business, advertising farmers/traders in the communities as trusted buyers of coffee, conflict resolutions, capital to buy more coffee and labor. Extension workers trained farmers on the coffee value chain aspects, encouragement, advice, and linkages to other trainers. Also, group chairpersons/leadership offered encouragement to perform extra roles apart from farming, joining the coffee group/IP, teamwork, and linkage to other organizations for training on the coffee value chains. Equally, business or coffee traders

	purchase coffee, offer business loans, coffee business information, and training on saving and loaning thus inspired to start the loaning scheme. Similarly, connections to other trainers and other coffee buyers. Finally, financial support.
17 (18%)	*Relations e.g.,* husbands offered start-up capital, encouragement, and advice on how to start up buying coffee/trading as well as allow their wives more time outside the home to attend workshops and for business purposes. Similarly, husbands offer labor for coffee-related tasks including picking and transporting coffee to the selling point. Likewise, sons are a source of encouragement and financing for the coffee business. Also, some daughters helped their parents to draw business plans along with associated budgets. Other relations e.g., brothers, aunties, and fathers who double as group members and model farmers are a source of encouragement to start growing coffee including nursery bed establishment, offering free seedlings, advice to not only grow coffee but also buy coffee from other farmers, and labor.

Note. Figures in brackets are percentages i.e., responses to a certain parameter/total*100%

Appendix 11: Variable measurement and item loading (Chapters 3, 4 & 5)

Variable	Operationalization	Question asked	Questionnaire item	Chapter 3 (Appendix A)		Chapter 4 (Appendix E)		Chapter 5 (Appendix C)	
				Outer loading at first PLS Algorithm rum	Outer loading at PLS Algorithm re-run	Outer loading at first PLS Algorithm rum	Outer loading at PLS Algorithm re-run	Outer loading at first PLS Algorithm rum	Outer loading at PLS Algorithm re-run
Challenges	Matsuo and Nagata (2020) portrayed experiences as both expected and unexpected, drawing on Kolb's experiential theory. Morris (2020) defined experiences as context-specific challenges. Using the above literature as well as existing coffee value chain literature, such as (Cerda et al. 2017; Pimenta, Angélico, and Chalfoun 2018; Hameed et al. 2018; Kidist, Zerihun, and Biniam 2019); Ochago et al. (2021), this study identifies four interrelated elements to define farmers' challenges: challenges during production, harvesting, postharvest handling, and marketing.	Please indicate by ticking the appropriate box how often you faced challenges in the last 5 years (2015-now) in Challenges at production, harvest, postharvest handling, processing and storage, and marketing (on a 5-point scale as *never* (1) and *always* (5)	Pest and disease infestation	.297	Low loading	.287	Low loading	.298	
			Production inputs (e.g.pesticides, fertilizers, pruning saws, labor, etc	.261	Low loading	.249	Low loading	.225	
			Extreme weather changes (e.g.sometimes too hot or too much rain	.271	Low loading	.259	Low loading	.254	
			Knowledge about coffee agronomic practices (e.g.weeding, spraying against pests and diseases, fertilizer application, etc.)	.369	Low loading	.371	Low loading	.384	
			Harvesting skilled coffee-picking labor	.393	Low loading	.385	Low loading	.399	
			Thieves	.481	Low loading	.478	Low loading	.485	
			Knowledge about coffee picking (CE1)	.584	.536***	.577	.537	.587	
			post-harvest handling and processing knowledge about coffee sorting, washing, fermenting, drying, storage, etc.	.444	Low loading	.439	Low loading	.444	

			post-harvest handling and processing coffee pulping labor	.424	Low loading	.426	Low loading	.445
			post-harvest handling and processing equipment (e.g., pulping machines, drying materials, etc.)	.492	Low loading	.485	Low loading	.479
			post-harvest handling and processing too much rain slow down the coffee drying process	-.189	Low loading	-.192	Low loading	-.204
			Post-harvest handling and processing storage (e.g., space, materials-bags) (CE2)	.630	.649***	.640	.649***	.632
			post-harvest handling and processing knowledge of proper coffee storage	.479	Low loading	.468	Low loading	.453
			Market coffee buyers (e.g., few, unreliable, untrustworthy)	.326	Low loading	.322	Low loading	.334
			Market coffee prices (CE3)	.504	.716***	.509	.715***	.504
			Market fluctuating coffee prices (CE4)	.600	.767***	.606	.767***	.603
			Market transport challenges (CE5)	.486	.576***	.492	.575***	.489
			Market finances to run the coffee business	.449	Low loading	.452		.447
			Market coffee prices information (CE6)	.678	.695***	.682	.695***	.654
Experiential knowledge	Matsuo and Nagata (2020) defined experiential knowledge as a learning outcome based on Kolb's experiential theory. According to these authors, Ochago et al. (2021) used agricultural value chain literature,	Please indicate how much knowledge you have - compared to other IP members - in the following domains: Know about new value chain						
			Beneficial network relationships for coffee production (EK1)	.705	.747***	.693	.734***	.681
			Beneficial network relationships for coffee harvesting (EK2)	.707	.707***	.714	.721***	.720
			Beneficial network relationships for coffee post-harvest handling and processing (EK3)	.691	.671***	.678	.659***	.681

	such as (Kabambe et al. 2012; Thiele et al. 2011), to define experiential knowledge as knowing about new value chain networks, farming methods, and technologies, agricultural activities-farming methods, and technology, as well as self-personal strengths and weaknesses. Following extant research, this study employs two interconnected parts: knowing new value chain actors, and farming methods to define farmers' experiential knowledge.	networks, and farming methods on 5 points scale as *strongly disagree* (1) to *strongly agree* (5)	Beneficial network relationships for coffee marketing	.419	Low loading	.418	Low loading	.420
			Knowledge about methods to increase my coffee production (yield) (EK4)	.740	.784***	.728	.778***	.722
			Knowledge about methods to improve my coffee harvesting (EK5)	.713	.680***	.738	.710***	.754
			Knowledge about methods to improve post-harvest handling and processing methods	.468	Low loading	.493	Low loading	.475
			Knowledge about methods to market coffee	.293	Low loading	.301	Low loading	.360
Reflection	According to Matsuo and Nagata (2020), Kolb's experiential learning cycle should include reflective analysis instead of reflective observation. This is because reflection entails identifying challenges, determining root causes, and considering viable remedies. Moreover, challenge-solving involves reflecting on past challenge-solving strategies as well as sharing practical ideas with others and joint challenge solving making social interactions critical. Thus, using value chain literature (Kabambe et al. 2012; Thiele et al. 2011; Ochago et al. 2021), this	How often- in the last 5 years - have you reflected on your interactions with existing relationships to tackle post-harvest and marketing challenges, compared to other IP members? I reflect on interactions with..., a) Operation Wealth Creation (OWC)/NAADS, b) National Agriculture Research Organization-Buginyanya	National Agricultural Research Organization (NARO)	.206	Low loading	.171	Low loading	.139
			Uganda Coffee Development Authority (UCDA)	.176	Low loading	.175	Low loading	.174
			Makerere University	.407	Low loading	.142	Low loading	.397
			Kyagalanyi Coffee Limited (RA1)	.646	.683***	.370	.687***	.644
			Kawacom Uganda Limited (RA2)	.549	.599***	.645	.625***	.558
			Great lakes Ltd	.339	Low loading	.583	Low loading	.256
			Coffee A Cup	.273	Low loading	.351	Low loading	.193
			Gumutindo	.297	Low loading	.262	Low loading	.205
			Farmer groups	-.162	Low loading	.254	Low loading	-.191

study defined the first component of reflection as a farmers' reflection on interactions with other value chain actors	c)Uganda Coffee Development Authority (UCDA) d)NUCAFE e) Makerere University f) etc. on a 5-point scale as *never* (1) and *always* (5)	Innovation Platforms	-.059	Low loading	-.121	Low loading	-.041
		National Union of Coffee Agribusinesses and Farm Enterprises Ltd (NUCAFE)	.202	Low loading	.051	Low loading	.211
		Cooperative union (e.g., Kabeywa, Bukusu, Arokwo, etc.)	-.072	Low loading	-.032	Low loading	-.134
		Contact/model/influential farmers	-.213	Low loading	-.186	Low loading	-.301
		Politicians, gatekeepers	.052	Low loading	-.259	Low loading	-.034
Kember et al. (2000) used four items to assess reflection. These items are as follows: *(1) I occasionally question how others do something and try to come up with a better way, (2) I enjoy thinking about what I've been doing and considering alternative solutions, (3) I frequently reflect on my actions to see if I could have done better, and (3) I frequently re-appraise my experience to learn from it and improve for my next performance*. According to these authors, the second component of reflection was defined as a farmer reflecting on their current knowledge to solve coffee value chain challenges.	Compared to other IP members, I .... (i) question the way other coffee farmers' production methods and try to think of a better way on a 5-point scale a 5-point scale as never (1) and always (5)	question the way other coffee farmers production methods and try to think of a better way (RA3)	.640	.685***	.631	.680***	.628
	(ii) like to think over my coffee harvesting methods and consider alternative ways of doing it.	like to think over my coffee harvesting methods and consider alternative ways of doing it (RA4)	.633	.679***	.719	.660***	.647
	(iii) re-appraise my coffee post-harvest handling and processing so I can learn from it and improve for my next performance	re-appraise my coffee post-harvest handling and processing so I can learn from it and improve for my next performance (RA5)	.686	.724***	.611	.732***	.665

		(iv) reflect on my coffee marketing sales to see whether I could have improved on what I did.	reflect on my coffee marketing sales to see whether I could have improved on what I did (RA6)	.612	.607***	.638	.613***	.597
Active experimentation	Matsuo and Nagata (2020) define active experimentation as "doing or putting to use current knowledge". The most prevalent definitions of active experimentation are "I learn by doing" (Alice Y Kolb et al., 2015) and "I prefer to be doing things" (Wang et al. 2020). With the socially engaged aspect of learning in the rural value chain context (Ochago et al. 2021), active experimentation was described using two sub-components as follows: (i) having used existing value chain actors; (ii) using existing coffee farming knowledge to solve coffee value chain challenges.	How often- in the last 5 years - have you used the knowledge obtained through relationships to tackle production and harvesting challenges compared to other IP members? I used knowledge from..., a) Operation Wealth Creation (OWC)/NAADS, b) National Agriculture Research Organization-Buginyanya c)Uganda Coffee Development Authority (UCDA) d)NUCAFE e) Makerere University f) etc. on a 5-point scale as never (1) and *always* (5)	Operation Wealth Creation (OWC)/NAADS	-.035	Low loading	-.045	Low loading	-.076
			National Agricultural Research Organization (NARO) (AE1)	.716	.782***	.710	.791***	.742
			Uganda Coffee Development Authority (UCDA) (AE2)	.570	.621***	.565	.623***	.605
			Makerere University	.126	Low loading	.125	Low loading	.120
			Kyagalanyi Coffee Limited	.225	Low loading	.231	Low loading	.186
			Kawacom Uganda Limited (AE3)	.610	.706***	.604	.688***	.684
			Great lakes Ltd	.080	Low loading	.093	Low loading	.066
			Coffee A Cup	.300	Low loading	.308	Low loading	.250
			Gumutindo	.262	Low loading	.250	Low loading	.227
			Farmer groups	.339	Low loading	.335	Low loading	.219
			Innovation Platforms	.061	Low loading	.117	Low loading	.068
			National Union of Coffee Agribusinesses and Farm Enterprises Ltd (NUCAFE)	.189	Low loading	.204	Low loading	.657
			Cooperative union (e.g., Kabeywa, Bukusu, Arokwo, etc.)	-.005	Low loading	.017	Low loading	-.017
			Contact/model/influential farmers	.018	Low loading	.016	Low loading	.072

			Politicians, gatekeepers	.003	Low loading	.029	Low loading	.056
		Compared to other IP members, I use my knowledge about coffee: on a 5-point scale as never (1) and *always* (5) (i) Production	use my knowledge about coffee production (AE4)	.722	.727***	.724	.737***	.721
		(ii) harvesting	use my knowledge about harvesting (AE5)	.722	.748***	.727	.760***	.750
		(iii)post-harvest handling and processing	use my knowledge about post-harvest handling and processing use my (AE6)	.717	.703***	.726	.702***	.712
		(iv)Marketing	use my knowledge about marketing (AE7)	.703	.729***	.676	.718***	.676
IP governance mechanisms	Using IP evaluation literature (Audouin et al. 2021; Davies et al. 2018; Lamers et al. 2017; Schut et al. 2017; Lukurugu et al. 2021; Miningou et al. 2021; Sako et al. 2021), the following items and question were developed:	Please indicate by ticking the most appropriate box the contribution of IP governance mechanisms to your farming activities. [on 5 points scale where (1) ''strongly disagree'' to (5) ''strongly agree''] (i) In my IP relevant stakeholders	**IP members' commitment and trust include a trust for other actors, commitment, IP leadership, and facilitation (IPGM1)**					
			As an IP member, I feel comfortable sharing information with fellow IP members (Trust1)	.663	.699***			
			My IP members feel encouraged to contribute to the betterment of the IP (Trust2)	.665	.704***			
			My IP creates trust among a diversity of actors (Trust3)	.649	.660***			
			I trust my IP's leadership (Leadership1)	.633	Low loading			
			The selection process of my IP's leadership is in a transparent manner (Leadership2)	.734	.734***			

are represented (ii) Members in my IP are selected in a transparent manner (iii) My IP is inclusive of a diversity of actors (iv) Every participating member is sufficiently heard during IP discussions	The rules in my IP are flexible allowing me to stay a member or cease being at will (Leadership3)	.546	Low loading
	The IP is effective in organizing meetings (Facilitation1)	.637	Low loading
	Coffee value chain information is widely shared among my IP members (Facilitation2)	.691	.689***
	The IP is effective in mobilizing members for agreed actions (Facilitation3)	.680	.708***
	My IP members are committed to sharing knowledge freely (Commitment1)	.650	.677***
	My IP members are willing to let go of their comfort for the sake of others (Commitment2)	.646	.636***
	My IP members freely take part in coffee IP activities (Commitment3)	.702	.755***
	My IP members offer me advice on coffee value chain activities (Capacities1)	.602	Low loading
	My IP organizes learning activities for me (Capacities2)	.531	Low loading
	My IP facilitates sharing of information between me and other members outside my IP(Capacities3)	.561	Low loading
	IP members' involvement includes accountability, equitable participation, and the recruitment process. **(IPGM2)**		

	In my IP, members hold each other accountable for their actions (Accountability1)	.625	.663***
	In my IP, members have access to diverse sources of coffee value chain information (Accountability2)	.740	.773***
	In my IP, decision-making is in a transparent manner (Accountability3)	.735	.780***
	Every participating member is sufficiently heard during IP discussions (Participation_Equity1)	.682	.679***
	Within my IP any member can influence decision-making (Participation_Equity2)	.630	.662***
	My IP creates a feeling of ownership for members (Participation_Equity3)	.569	.617***
	In my IP relevant stakeholders are represented (Representation1)	.508	low loading
	Members in my IP are selected in a transparent manner (Representation2)	.804	.793***
	My IP is inclusive of a diversity of actors (Representation3)	.603	Low loading
	member access to IP resources (IPGM3)		
	finance (Resources1)	.758	.759***
	production inputs (e.g., pesticides) (Resources2)	.739	.722***
	coffee processing equipment (e.g., pulping machines) (Resources3)	.691	.703***

			transport services for coffee to the selling point (Resources4)	.745	.752***		
			coffee markets (Resources5)	.587	.573***		
			coffee storage space (Resources6)	.712	.721***		
			As an IP, we have group projects as a strategy to raise money for the IP activities (Resources7)	.600	.606***		
Farmer's role identity (FRI). I further split the 8 items included in the paper based on their loading, reliability, and validity issues as follows: Coffee input dealer-processor-transporter-manager/leader loaded first and therefore I grouped this as my FRI while the remainder acted as Control FRI	Most earlier studies that examined the multiple and shifting farmer identities allowed respondents to choose only one term that described them and their activities on the farm (Bokemeier and Garkovich 1987). In contrast, drawing on studies by Bokemeier and Garkovich 1987; Brandth 2002; Sachs, 1996, in a survey Brasier et al. (2014) allowed respondents to identify with any of the seven farm-related roles drawn from relevant literature: farmer-operator, farm entrepreneur, farm business partner, farm worker-apprentice, farm bookkeeper, farm wife–domestic partner, worker-professional. Other scholars define farmers as productivists (Burton and Wilson 2006), good farmers (McGuire, Morton, and Cast 2013; Riley 2016; Burton et al. 2020), and stewards (Comito, Wolseth, and Morton 2013) though used differently means that same-	Please indicate by ticking the appropriate box. To what extent do you agree with the following statements? on 5 points scale as *strongly disagree* (1) to *strongly agree* (5) 1. I am an input dealer 2. I am a coffee producer 3. I am a coffee seedling nursery operator etc	**Farmer's role identity (FRI)**				
			I am an input dealer (FRI1)			-.078	.483***
			I am a coffee transporter (FRI2)			-.071	.799***
			I am a coffee processor (FRI3)			-.137	.680***
			I am a manager (FR4)			.118	.840***
			Control FRI				
			I am a coffee picker (FRI5)			-.533	.864***
			I am a coffee trader (FRI6)			-.283	.448***
			I am an advisory service provider (FRI7)			-.242	.518***
			I am a savings and lending group member (FRI8)			-.537	.648***
			I am a coffee producer			.572	All respondents are coffee producers, this item is redundant
			I am a coffee seedling nursery operator			-.077	Low loading

	farmer. The authors (Brasier et al.2014) also assessed each of these identities using two seven-point semantic differential measures, ranging from "does not describe me" to "describes me," and from "not central to who I am" to "central to who I am" (Burton and Wilson 2006). Using the aforementioned text and qualitative study findings, the role identity of coffee IP farmers was described as...I am a coffee farmer,....etc.			
Farmer's family resources (FMR). Note: The 11 items in the paper are further divided into two groups based on loading, reliability, and validity issues, as follows: FMR1 to FMR5 loaded first and thus acted as FMRa, while the remainder acted as FMRb.	-advice, information, or knowledge (e.g., on the coffee quality demanded by coffee buyers) -labor (production, harvesting, processing, and marketing) -emotional support i.e., encouragement, inspiration, motivation to start or continue coffee farming, and attending training -Time/grant a spouse permission to attend training meetings, family members connect other family members to training avenues, financing stakeholders, etc. -farmers borrow or share agro-inputs e.g., pulping machines	Please indicate whether the support from your family members helped you solve challenges at coffee production, harvesting, post-harvest handling, and marketing -in the following domains: production, harvest, postharvest handling, processing and storage, and marketing (on a 5-point scale where 1 = "never" and 5 = "always)	I obtain advice from my family members on coffee production (FMR1)	.642
			I obtain advice from my family members on harvesting	.061
			I obtain advice from my family members on post-harvest handling and processing	-.026
			I obtain advice from my family members on marketing	-.203
			My relatives encouraged me to e.g., start coffee farming (FMR2)	.731
			My family members mentor me in coffee farming activities (FMR3)	.346
			My family offers me emotional support during coffee production activities (FMR4)	.576
			My family members are knowledgeable about coffee, and I	.602

	-Financing coffee farming activities e.g. providing funds, and collateral for accessing finances as a group are a few of the resources accessed by farmers through their families across the coffee value chain (Ochago et al. 2021)(Ochago et al., 2021)	have learned a lot from them (FMR5)	
		I have no restriction from my family on whether to attend training on coffee farming	.358
		My family members are a source of inspiration for my coffee farming activities (FMR6)	.509
		My family paid for my school fees until my current education level	.074
		My family members are involved in decision-making at the production stage (FMR7)	.726
		My family members are involved in decision-making at harvesting (FMR8)	.562
		My family members are involved in decision-making at post-harvest handling and processing (FMR9)	.599
		My family members are involved in decision-making in marketing	.143
		The trust my family members have in me motivated me to start up coffee farming (FMR10)	.565
		My family members offer coffee production labor (FMR11)	.543
		My family members offer coffee harvesting labor	.048

	My family members offer coffee post-harvest handling and processing labor	.040
	My family members offer coffee marketing support-transporting, negotiating coffee prices, etc.	.083
	My family members offer me production inputs-land	.333
	My family members offer me production inputs-pruning saws	.151
	My family members offer me post-harvest handling and processing activities-pulping machines	-.017
	I have access to business contacts through my family members	.246
	My family members do finance my coffee farming operations	.148
	My family members act as collateral for me to access finances for my coffee farming activities	.217

Note. Items to include in the model are chosen using outer loadings, reliability, and validity measures. The initial run of the PLS algorithm revealed that some items had low outer loadings. After removing and rerunning the PLS algorithm, the results were satisfactory.

Appendix 12: Pearson correlations between decision-making and farmer's family resources (chapter 5)

	My family members are involved in decision-making at:			
	production	harvesting	post-harvest handling and processing	Marketing
I obtain advice from my family members on coffee production methods	$.389^{**}$	$.230^{**}$	$.249^{**}$	$.151^{*}$
My family members are knowledgeable about coffee, and I have learned a lot from them	$.400^{**}$	$.253^{**}$	$.245^{**}$	$.157^{*}$
My relatives encouraged me to e.g. start coffee farming	$.414^{**}$	$.334^{**}$	$.374^{**}$	$.296^{**}$
My family offers me emotional support during coffee production activities	$.327^{**}$	$.159^{*}$	$.201^{**}$	$.343^{**}$
The trust my family members have in me motivated me to start up coffee farming	$.293^{**}$	$.277^{**}$	$.350^{**}$	$.448^{**}$
My family members offer coffee production labor	$.238^{**}$	$.236^{**}$	$.297^{**}$	$.311^{**}$
My family members offer me production inputs-land	$.191^{**}$	-	-	$.183^{**}$

Note. significant at ***p<0.01; **p<0.05 level (2-tailed)

8

Summary

Summary

The coffee value chains in Africa depend on smallholder farmers, who face several challenges in their farming process i.e., production, harvest, postharvest handling, and marketing. Insect pests and diseases, for example, cause coffee output loss as well as low quality, which leads to low and fluctuating coffee market prices. This is an example of a complex coffee farming challenge that require several solutions. Complex farming challenges have several dimensions, are entrenched in interactions across various organizational and social settings and include a large number of people. As a result, a variety of actors (for example, researchers, donors, policymakers, and practitioners) have adopted the coffee value chain concept as a solution to farmers' challenges.

In underdeveloped countries, innovation platforms (IPs) are the most common operationalization of coffee value chains, and they have been utilized to aid farmers in learning how to address their challenges. IPs can take many forms, but in the context of this study, an IP is defined as structured interfaces among farmers where they can learn how to address their farming challenges by tapping into the capacities of diverse actors (e.g., processors, traders, transporters, input suppliers, traders, policymakers, extension agents, and researchers). International research and development (R&D) organizations are at the forefront of inventing and applying IP techniques. However, some unanswered questions remain in the existing literature regarding how farmers learn to solve their challenges and the role of innovation platforms in improving such learning. This Ph.D. thesis aims to 1) explain coffee farmers' experiential learning process in Innovation platforms, and 2) determine the role of farmer role identities, farm family resources, and Innovation platform governance mechanisms in their experiential learning process. Using Ugandan coffee Innovation platforms as the empirical backdrop for this study, I attempted to contextualize farmers' experiential processes by answering the following research questions (RQs):

Research question one (Chapter two): How are the challenges (experiences) of coffee farmers transformed into experiential knowledge? In this work (Chapter 2), I explored qualitatively the mechanism by which coffee growers' knowledge development results from performing tasks when confronted with challenges. This question is the cornerstone for the entire Ph.D. thesis and is divided into two sub-questions/components: (1) illustrates that farmers' knowledge to address their challenges is a result of engaging in activities that result in challenges, (2)

Building on the notion that IPs mean to provide a safe environment for actors to experiment and explore solutions to their shared challenges, the second sub-question sought to determine how IP processes influence the process of farmers' knowledge development as a result of performing activities when confronted with challenges. By interviewing ninety-one coffee IP farmers, this paper provides answers to the above question. I used content analysis to establish overarching themes for farmers' experiences, learning activities, and outcomes. The findings show that farmers' engagement in IP learning activities increases their understanding of how to deal with coffee value chain challenges. Farmers' making sense of challenges and developing new solutions, in particular, represent an iteration between individual critical reflection and experimentation with value chain activities. By mobilizing essential resources, IPs encouraged multidirectional information exchanges among farmers. This article expands on the concept of experiential learning in the context of IPs. This chapter advances experiential theory in the context of agriculture by proposing a model for how IPs can expedite farmers' experiential learning processes based on challenges encountered. Farmers are increasingly relying on IPs whose processes drive members' learning, commitment, and endeavors, while many African governments are unable to provide adequate extension support. However, governments can use these insights to customize the design and implementation of IPs to farmers' experiential learning processes.

Research question two (chapter three): What effects do IP governance mechanisms have on the process of farmers' knowledge development as a result of performing activities when confronted with challenges? In this study, I argue that indirect relationships between farmers' value chain challenges and experiential knowledge generated through learning activities may be conditional on-IP governance mechanisms. To answer this research question, I analyzed survey data from 214 coffee IP farmers using smartPLS-a structured equation modeling software. In responding to these concerns, I found that when farmers attempt to address their challenges, IP governance mechanisms have both positive and negative effects on the acquisition of experiential knowledge through reflection and active experimentation. This study contributes to existing research on problem-based learning, experiential theory, and practice, as well as IP governance, agricultural value chains, and farmer institutional contexts. In three ways, it adds to current research on governance and EL in IPs. To begin, each IP must create means for routinely assessing and executing its governance procedures in collaboration with local entities. Furthermore, IP leadership should create awareness about the need of sharing experiences, reflection, and the role of external sources, while also providing vital information to each member for reflective analysis and experimentation following the collective goals. Still, the findings suggest that coffee farmers who participate in learning activities should rely on other IP actors and show dedication and involvement in IPs to increase their learning. Second, by bringing together numerous stakeholders and farmers at the community level, policymakers may use the IP as a unit to identify practical solutions to local challenges and strengthen targeted rural agriculture value chains. Third, this study employs the IP(Systems) theory to investigate farmers' experiential learning processes in the context of rural coffee value chains.

Research question three (chapter four): What are the effects of farmers' role identities on the process of their knowledge development because of performing activities when confronted with challenges? Based on the findings of paper 1 (qualitative study), which observed that farmers learn experientially and that this process is role-based, this question seeks to better understand the effect of farmer role identities on their experiential learning process (chapter 3) using a combination of qualitative and quantitative methodologies to analyze data. Following a mixed-methods sequential-embedded approach, I used key informant interview findings to inductively analyze data from 91 semi-structured interviews (focus groups and follow-up discussions) using Atlas ti software to define farmers' role identities and how these influence farmers' experiential learning (EL) processes. Informed by the qualitative study, I developed a structured survey questionnaire to evaluate the emerging framework on how farmers' role identities shape processes of farmers' EL. To address this research question, I analyzed data from 214 coffee IP farmers using smartPLS-a structured equation modeling software. The findings show that farmers' identity as coffee farmers influences what, how, and when they learn from value chain challenges. Farmers' production role identity encourages them to reflect on prior challenges and experiment to improve their challenge-solving knowledge. This research adds to the existing theory and practice of problem-based learning, as well as farmers' role identities, agricultural value chains, and farmer institutional environments. This chapter demonstrates that farmers have many identities, that the coffee farmer identity acts as a springboard, and that identity building is a social learning activity that changes their EL process by integrating the farmer identity and experiential learning theories. These findings imply that practitioners should understand farmers' identities and how they influence their learning to choose the aims and developments of their value chain training programs.

Research question four (chapter five): What are the effects of farmers' farm family resources on their knowledge development process because of performing activities when faced with challenges? Based on the findings of paper 1 (qualitative study), which revealed that farmers learn experientially and that this process is influenced by farmers' access to farm-family resources, this question is designed to better understand the impact of farm-family resources on their experiential learning process using a survey. Following the concept of social embeddedness, resources acquired through ongoing personal relationships (i.e., embedded) may moderate the mediating influence of learning activities on the difficult experiences to experiential knowledge relationship. Over this, more challenged farmers demand more family resources to engage in a variety of learning activities that result in high levels of experiential knowledge. To solve the research question, I analyzed data from 214 coffee IP farmers using smartPLS-a structured equation modeling software. The chapter shows how the availability of family resource support can potentially increase experiential learning by integrating the family embeddedness perspective—a nuanced lens of the social embeddedness perspective that focuses on embeddedness within the specific context of family ties and experiential learning theorization. In this way, the chapter contributes to agricultural experiential theory by providing a model of how rural family support might operate as a resource to improve the mechanisms underlying farmers' experiential learning. Smallholder farms, as a collective and farmer-centered experiential learning context, can serve as a source of inspiration for extension agents as they work to make the paradigm shift from technology transfer to participatory advisory services a reality.

Acknowledgments

Acknowledgments

I'd like to convey my heartfelt gratitude to the following individuals and organizations for actualizing and making my Ph.D. a reality: First and foremost, I would like to express my gratitude to my supervisors, Prof Jacques Trienekens, Prof Domenico Dentoni, and Dr. Maral Mahdad, for actively leading me through the course of this Ph.D.

Jacques, I am deeply grateful that you provided me with a doctoral position, which above all enabled me to pursue my Ph.D. study. Studying for my Ph.D. in an international environment was my dream, Domenico, and you opened a window of opportunity for me to realize it. I will never forget your thoughtful, inspirational, insightful, Mature, Calm, and scientific guidance throughout the research and writing of this thesis. I received crucial support from you when I needed it the most. Without your help, this thesis would not exist. Thank you for the out-of-office interactions such as our Friday lunch walks-this kept me going. These interactions made me learn one among many important things-you wanted me to complete my Ph.D. and you worked hard to make sure I earned it. Thank you, Professor Jacques!

My sincere gratitude to you, Domenico, for your invaluable insights and suggestions. It was a great pleasure to work with you on my Ph.D. thesis. You have lived the entire journey of my Ph.D. trajectory, and you have experienced the excitement and the consequences perhaps even more thoroughly than I have. I have learned from you not only academic but skills such as multitasking, creativity, constructive feedback, patience, thoughtfulness, empathy, and humility. Your availability and friendliness made the Ph.D. journey enjoyable even when it was challenging. Thank you very much for your encouragement when I was worried, and your incredible insights and guidance when I was confused. Thank you for your daily guidance, crucial follow-up, and support, for which I am forever grateful. Thank you very much for picking me up from Schipol Airport the very first time I got to the Netherlands. This meant a lot to me and later on shaped the rest of my Ph.D. journey.

Maral, even though you only joined the supervisory team in my last year, I appreciate your critical reviews and edits.

I would like to thank the brain behind this study. Dr.Thomas Lans I would like to thank you so much for initial engagement which led to this study. Your idea about experiential learning and later understanding the context (IPs) gave rise to this study. Even though you left the supervisor team due to the job shift I am so grateful for the inspiration. You have a very good command of the subject-learning, are sociable and exhibit a mature attitude in handling students or situations involving students.

I'd like to thank the members of my thesis committee, Prof. dr. P.J. den Brok, Dr S.M. Pedersen, Dr T. Kakeeto-Aelen, and Dr Ir J.M. van Paassen for reviewing my work. 'Highly esteemed opponents,' it would be an honor to discuss my thesis with you on June 7th, 2023. Matthew Ayamga and Rottier Marlous, my amazing paranymphs, thank you for sharing my special day with me. It means a great deal to me!

Doing a Ph.D. is accompanied by lots of administrative and logistical arrangements. I benefited a lot from the support and assistance of Ina, Linette, Liesbeth, Marloes, and Brigit. Thank you all for the endless support you have provided throughout my Ph.D. journey. Simona Marini, Ineke van Driel, and Nalini Gangabisoensingh, from Phd services Liason office, thank you so much for your support and assistance in contractual issues and my travels in and out of the Netherlands.

Throughout writing this thesis, I received advice, moral and technical support from my Ph.D. colleagues and Post Docs at the MST (now Business Management and Organization) Group, specifically Precious Senyolo, Sophia, Carlos, Francisco, Timothy, Daniel, Mercy, Jilde, Matthew, Blandine, and Rob. Thank you for all the brainstorming sessions, academic and social charts, and words of encouragement. I learned a lot from our varied points of view and civilizations.

Mr. and Mrs. Kagwa, as well as the entire Ugandan community at Wageningen University and Research, thank you for providing vital moral support during my time in Wageningen. Thank you for the get-togethers, dinners, travels, advice, and inspiration.

Thank you for your love, moral support, and prayers, members of the Amazing Grace Parish in Wageningen. Pastors Farai and Busi Maphosa, Gilbert thank you for your prayers, encouragement, and support throughout my Ph.D. Thank you, Pastors Farai and Busi Maphosa, for the beautiful new bible you gave me; I still read it.

The input of my fieldwork team is critical to the success of this project. Thank you for your diligence in conducting the data gathering exercise, Eva Tereka, Victor Chepsikor, Martin Masha, Emmanuel Wabuteya, David Mugonyi, Alice Sumbatala, Dison Wesonga, Micheal F.Wekalawo, Micheal Kashake, Grace Limo, Ivan Wanambma, Chemutai Deborah, Kiplimo Abraham, Tim Banan, Docus Chebet, Faiza Chepkwurui, Martin Cheboryot, Anthony Wandabwa, Ivan Masete, Hillary Sadia Kisaka, Atright Mayuba, and Deogratious Soita. I would like to thank the VIP4FS project team (Dr. Prossy Isubikalu, Innocent Tuhaise, Leonard Ekoot and Dr. Clement Okia. Dr. Prossy, thank you for recommending me for PhD funding through Wageningen University and Research, as well as for introducing me to project sites and providing guidance during my data collection exercise. Thank you so much for the project documents and insights, Innocent Tuhaise and Leonard Ekoot. Thank you for having me as a student on your project, Dr. Clement Okia. During the project's mid and end-of-term evaluations, I enjoyed the field work. Thank you for the brainstorming exercises about my potential study area in the car while in the field during the mid-project review, professor Randy. District VIP4FS project coordinators (Simon Nyangas, Wesonga Dison, and Wandawa John Bosco), IP leaders and facilitators, and IP members were responsible for coordinating field data collection.

Dr.Peter Tamas (Wur), Prof.Margaret Najjingo Mangheni (Mak), and Dr.Haroon Sseguya (IITA) are among those who indirectly contributed to this thesis. Peter, you are one of the instructors who guided me through three critical research methodology courses, including topic to proposal, systematic approaches to reviewing literature, and qualitative data analysis with Atlas ti. I really appreciated your vast experience virtually answering every student question from around the world. You have greatly inspired me with your knowledge of every field and context around the world, as well as your ability to interact with your students on an individual basis. How do you go about it? Anyway, the bond formed aided me so much in my thesis writing process that whenever I had a stack, I imagined asking you a question and an idea would come to me. Prof.Margaret Najjingo Mangheni, this thesis is in part due to my involvement with you at the master's level. The opportunity you provided for me to pursue my master's degree through the GGT-IPM Innovation Lab (a USAID-funded project) exposed me to broader networks, which led to research opportunities. Specifically, two words you frequently told me kept me going: Robert educate yourself and am I communicating? To me, Robert educate yourself meant that I needed to learn more on my own rather than relying solely on my supervisors. These two words lingered in my mind throughout my Ph.D., and it has paid off—the thesis speaks for itself. Finally, the prayer you said the first time we went to the field with Dr. Richard Miiro was the beginning of my journey. Dr. Haroon, you unknowingly inspired me to pursue a PhD outside of the country. It was your wish that I study outside of Uganda, specifically at a University other than Makerere University, where I already had two degrees. You wanted me to learn more and expand my network. This is accomplished. Dr. Haroon, thank you very much.

Finally, I'd like to thank my wonderful wife and children. I'm at a loss for words to describe how much you mean to me. You paid a higher price in more ways for this Ph.D. to become a reality. You may not realize it, but the notion of you is what helped me get through the final stretch of my Ph.D. trip. Thank you for your patience, and understanding, and for providing me with a reason to keep going. As a gesture of gratitude, I dedicate this work to you all.

Robert Ochago,
07 June 2023
Wageningen, Netherlands

About the author

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About the author

As a highly qualified and skilled agricultural extension officer, I have great communication abilities gained from experience in agriculture extension, management, research, and teaching which have allowed me to assist farmers in making decisions and ensuring that proper knowledge is implemented to achieve the best results in terms of sustainable production and overall rural development. I have successfully managed several projects, and I have an exceptional capacity to supervise, manage, and inspire other team members. Moreover, I have experience in data analysis, interpretation, and presentation. Finally, I have a background working with students at the certificate, diploma, and bachelor levels. In 2005, I graduated from Bukalasa Agricultural College with Uganda government-funded National Diploma in Animal Husbandry. Following graduation, I worked as an Agriculture Extensionist with the Food and Nutrition Security Project (FNS). A German Technical Cooperation (GTZ) funded the project, which was implemented by the German Development Service (ded)-African Development Initiative. At the same time, I worked as a private service provider for the Government of the Republic of Uganda's National Agricultural Advisory Services. Due to my continuous interest in agricultural research and development, I resigned from my Agricultural Extensionist employment with GTZ's Food and Nutrition Security Project (FNS) under the German Development Service (*ded*)/African Development Initiative in 2007 to pursue a bachelor's degree. As a student, I worked as a research assistant and data management clerk for German Development Services (*ded*), World Food Program (WFP), and Food and Agriculture Organization (FAO), as well as Makerere University in conjunction with RUFORUM. After finishing my first degree in 2010, I enrolled in a Master of Science in Agricultural Extension Education the following year. As a master's student, I also worked as a research assistant for the IPM CRSP's Gender Global theme in the Eastern African Region, which was funded by USAID, and I taught undergraduate students as part of the graduate-level capacity development program. I worked on several projects for Makerere University in partnership with MEAS, the Universities of Florida (USA), Reading (UK), and Economics (Paris). I also served as a teaching assistant at Busitema University's crop production and management department. In the same year, I enrolled in Makerere University's Master of

Science in Agricultural Extension Education program, which I finished in 2014. I enrolled in Makerere University's Ph.D. program in agricultural and rural innovation in 2016, but because of financial constraints, I dropped out after one year of coursework. I then enrolled in a Ph.D. program at Wageningen University and conducted research after receiving funding from the Australian Centre for International Agricultural Research (ACIAR) as part of the program Value Chain Innovation Platforms for Food Security (VIP4FS), which collaborated with the World Agroforestry Centre (ICRAF), the University of Adelaide (Australia), and Wageningen University in the Netherlands. My Ph.D. research focused on the design, management, and implementation of learning methodologies to tackle complex challenges in the food and agriculture sector.

Peer reviewed publications

Robert Ochago, Domenico Dentoni and Jacques H. Trienekens (2023): "Unraveling the connection between coffee farmers' value chain challenges and experiential knowledge: The role of farm family resources." The Journal of Agricultural Education and Extension. https://doi.org/10.1080/1389224X.2023.2169479

Robert Ochago, Domenico Dentoni, Thomas Lans & Jacques Trienekens (2021): Disentangling the experiential learning process of coffee farmers in Uganda's innovation platforms, The Journal of Agricultural Education and Extension, https://doi.org/10.1080/1389224X.2021.1977664

Dione, M. M., Ochago, R., Ouma, E. A., Lule, P. M., Kakinda, M. J., Nyapendi, R., ... & Pyburn, R. (2020). Gendered perceptions of biosecurity and the gender division of labor in pig farming in Uganda. *Journal of Gender, Agriculture and Food Security*.

Ochago, R. (2018). Gender and pest management: constraints to integrated pest management uptake among smallholder coffee farmers in Uganda. *Cogent Food & Agriculture*, *4*(1), 1540093.

Ochago, R. (2017). Barriers to women's participation in coffee pest management learning groups in Mt Elgon Region, Uganda. *Cogent Food & Agriculture*, *3*(1), 1358338.

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Ochago, R., Mangheni, M. N., & Miiro, R. F. (2017). EVIDENCE FROM COFFEE PEST MANAGEMENT LEARNING GROUPS IN BUGISU SUB REGION, UGANDA. *International Journal of Agricultural Extension*, *5* (1), 23-38.

Ochago, R., Mangheni, M. N., & Miiro, R. F. (2016). Gender and social economic factors affecting IPM knowledge acquisition and application: A case study of coffee farmer group members in bugisu, Uganda. *Asian Journal of Agriculture and Rural Development*, *6*(9), 175-187.

Under review

Robert Ochago, Domenico Dentoni and Maral Mahdad. The effect of Ugandan coffee farmers' role identity on their experiential learning. Second round of review with the *Journal of Experiential Education.*

Robert Ochago, Domenico Dentoni, Jacques Trienekens and Maral Mahdad. " Governance of agricultural value chains: How Innovation Platforms govern the experiential learning process of coffee farmers' in Uganda." Second round of review with the *International Food and Agribusiness Management Review (IFAMR).*

Robert Ochago
Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
A1 Managing a research project			
WASS Introduction Course	WASS	2018	1
Writing research Proposal	WUR	2018	6
The Essentials of Scientific Writing and Presenting	Wageningen in'to Languages	2018	1.2
'Embedded entrepreneurship: Entrepreneurial learning processes in Ugandan coffee value chains'	13th Wageningen International Conference on Chain and Network Management, Ancona, Italy	2018	1
Scientific Writing	Wageningen in'to Languages	2018	1.8
A2 Integrating research in the corresponding discipline			
Research Methodology: From topic to proposal	WASS	2018	4
Systematic approaches to reviewing literature	WASS	2020	4
Qualitative Data Analysis: Procedures and Strategies, MAT 50806	WUR	2020	6
B) General research related competences			
B1 Placing research in a broader scientific context			
Entrepreneurship in emerging economies	WASS	2018	2
Academic Publication and Presentation in the Social Sciences	WASS	2018	4
B2 Placing research in a societal context			
'Embedded entrepreneurship: Disentangling rural entrepreneurial learning processes in Ugandan coffee value chains'	1st workshop on Entrepreneurship: Culture and Institutions, Warsaw, Poland	2018	1
C) Career related competences/personal development			
C1 Employing transferable skills in different domains/careers			
Project and Time Management	WGS	2018	1.5
Reviewing a Scientific Manuscript	WGS	2020	0.1
Total			**33.6**

*One credit according to ECTS is on average equivalent to 28 hours of study load
WUR = Wageningen University and Research, WASS = Wageningen School of Social Science, WGS = Wageningen Graduate School

The research described in this thesis was financially supported by the Australian Centre for International Agricultural Research (ACIAR) as part of the program "Value chain Innovation Platforms for Food Security" (VIP4FS) partnering with the World Agroforestry Centre (ICRAF), University of Adelaide (Australia) and Wageningen University, The Netherlands.

Any findings, recommendations, or opinions expressed herein do not necessarily reflect/express the views of any of these sponsors.

Printed by ProefschriftMaken.nl
Cover Design by Fenna Schaap in consultation with the author of this PhD thesis

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Farmers’ value chain challenges

Experiental knowledge

Active experimentation

Reflection

IP governance machanisms

Farmer role identity

Family resources