Essays on Producer Organizations
Business Models, Social Inclusion and Food Safety

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Chapter 1

General introduction

1.1 Introduction

1.1.1 Drivers of agri-food value chain transformation

Agri-food value chains in developing countries have experienced a rapid transformation as a result of forces on both supply and demand side (Gómez & Ricketts, 2013). First, population and incomes are increasing. Income growth has shifted diets from consumption of traditional food products like cereals to high-value food products like dairy and has increased purchases of processed foods (Tschirley *et al.*, 2015). Second, expanding foreign direct investment has led to a growth in the size of domestic and foreign-owned firms, such as processors, supermarkets, fast food chains, and suppliers of inputs (Reardon *et al.*, 2019). Supermarkets and processors are vertically coordinating value chain activities to meet the increasing food safety demands (Reardon *et al.*, 2009). Third, urbanization is growing rapidly. In the past, supply chains were short since most people lived in rural areas and a large share of agricultural production was for home consumption and selling in nearby markets (Gómez & Ricketts, 2013). With urbanization, supply chains are becoming longer as more food products that are produced in rural areas have to reach consumers in urban areas (Reardon *et al.*, 2019). At the same time, urban areas are attractive food markets because of higher incomes compared to rural areas (Tschirley *et al.*, 2015).

Smallholder farmers are the main producers and suppliers of fresh food in rural and urban markets of developing countries. In Africa for instance, 80 percent of food supplies come from smallholder farmers (Dercon & Gollin, 2014). While the transformation in agri-food value chains provides market opportunities for smallholders, they continue to face asymmetric information when accessing inputs and output markets (Poulton & Lyne, 2009). Further, geographical dispersion, low level of farm production, low literacy of the farmer, and the lack of good information systems contribute to smallholder transaction costs in accessing agri-food value chains (Poulton *et al.*, 2010). Transaction costs and information asymmetry make it difficult for smallholders to meet the growing food demand and further complicates efforts to comply with strict food safety standards (Barrett *et al.*, 2012; Unnevehr & Ronchi, 2014).

1.1.2 Response to transforming agri-food value chains

One way of overcoming the challenges faced by smallholder farmers and to share in the benefits of transforming agri-food value chains is through membership of producer organizations (POs). A PO is a rural business that is generally owned and controlled by small-scale producers and that engages in collective marketing activities (Penrose-Buckley, 2007).

POs alleviate smallholder challenges in agri-food value chains in several ways. First, through horizontal coordination, POs facilitate collective activities such as bulking and joint selling of farm produce, thus creating economies of scale and improving farmers' bargaining power (Markelova *et al.*, 2009). Second, through vertical coordination, POs help in aligning the activities and investments of smallholders with those of other actors in the value chain, thereby reducing transaction costs (Hendrikse & Bijman, 2002). Vertical coordination involves managing complex information exchange between smallholders often in POs with other actors in different stages of the chain such as the buyers of farm produce. For instance,

Bijman *et al.* (2011) show that vertical coordination improves the flow of information related to food safety between smallholder farmers and buyers.

Third, POs support value chain upgrading and strengthening the position of smallholders in the value chain. Value chain upgrading can have economic and social effects. On the one hand, economic upgrading involves increasing competitiveness in value-added processes which allows smallholders to improve their performance and functions (Gereffi *et al.*, 2005). POs enables economic upgrading by taking more functions in the value chain, introducing new products, and improving processes, such as ensuring compliance with food safety requirements. On the other hand, social upgrading is taken as the portion of the benefits from economic upgrading captured by the producers or workers in a given firm or chain (Salido Marcos & Bellhouse, 2016). POs enables smallholders to access and influence decisions of other actors in high value agri-food value chains, thus supporting social upgrading.

Most scholars try to understand social upgrading in value chains through POs by examining social inclusion (Barrientos, 2014; Said-Allsopp & Tallontire, 2015). According to Gupta *et al.* (2015), the concept of social inclusion is defined as the participation of those farmers with few land and livestock resources and those that are vulnerable in terms of age, gender, and location. In developing countries, smallholder inclusion in value chains is a complex issue because farmers are included in value chains often through POs (Fischer & Qaim, 2012b; Mwambi *et al.*, 2016). Inclusion in POs is further complicated as it does not only refer to being a member but also participating in the decision-making process, and benefitting from the services and value generated (Bernard & Spielman, 2009a). Despite the importance of POs, their performance in value chains is challenged by inherent problems including poor management, collective decision-making and lack of finacial capital (Latynskiy & Berger, 2016).

Two knowledge gaps exist in the literature on value chains. First, much research has been done on upgrading taking a chain-wide perspective (Trienekens, 2011; Lee *et al.*, 2012). However, this view ignores the role of specific actors such as POs. It is important to consider the role of POs in value chain upgrading especially in developing countries where smallholder farmers mostly participate in value chains through their POs. For instance, Kilelu *et al.* (2017b) find that economic upgrading through POs enables smallholder farmers to benefit from taking up new activities in the value chain which include new technologies and provision of inputs and services. Second, previous research has focused on economic upgrading but little has been done on social upgrading. There is an ongoing debate as to whether economic upgrading necessarily leads to social upgrading (Kaminski *et al.*, 2020). In this thesis, we contribute to these knowledge gaps by studying the role of POs in value chain coordination and upgrading and assessing the relationship between economic upgrading and social upgrading.

1.1.3 Types of producer organizations and their roles in value chains

Adopting coordination and upgrading strategies in the value chain gives rise to different types of POs. One way to understand the differences is through classification. Classification is a means to describe different organizations based on distinguishing characteristics (Wennink *et al.*, 2007). The literature shows different types of POs that exist in developing countries. POs have been distinguished using the legal form and geographical scope. Common legal forms include cooperatives, self-help groups, and producer companies, while regarding the geographical scope, POs can be primary organizations, secondary organizations (or unions), or federations (Wennink *et al.*, 2007). Primary organizations serve at the village or district level, while secondary organizations are composed of several primary organizations and serve at the regional level. The secondary organizations in turn can form a federation that serves at the national level.

So far, the classification of POs in developing countries is based on organizational characteristics. While this is important, aspects of how POs generate and distribute value are not captured despite that farmers will only join an organization that delivers value to its membership. Bijman *et al.* (2016) attempts to understand PO types using a business perspective and reports two types of POs, namely community-oriented and business-oriented. Community-oriented organizations aim at providing social functions that benefit the community while business-oriented organizations provide economic functions that improve the competitiveness of member farmers in inputs and output markets (Bernard *et al.*, 2008). Still, most classifications fail to capture the value a PO offers to its membership and considers business-oriented POs as homogenous. We contribute to the literature by developing a typology of business-oriented POs using a business model framework. A business model describes a way of producing (value creation) a specific output (value proposition) for the market (customer) that leads to a surplus of revenues over costs (value capture). By using a business model framework, we capture aspects of costs, revenues and value proposition of POs that are key in determining who is included.

This typology will be helpful for policymakers in developing policies targeted to the needs of a specific organization, while smallholders will be able to choose an appropriate type of organization when deciding on membership. Researchers will benefit from the typology in analyzing the dynamics of POs for achieving development outcomes within a given context.

In sum, transformation of agri-food value chains has brought both challenges and opportunities for smallholders. Given this background, the present study aims to gain insights into the role of POs in value chain coordination and upgrading, and assess the relationship between economic upgrading and social upgrading, thus generating information relevant for the development of sustainable value chains.

The remainder of this Introduction is structured as follows. The theoretical framework is presented in section 1.2. Section 1.3 provides the research questions, followed by the context in section 1.4 and data and methods in section 1.5. The outline of the thesis sections is presented in section 1.6.

1.2 Theoretical Framework

To understand the role of POs in value chain coordination and upgrading, we draw on the global value chain theory and the business model framework.

1.2.1 Global value chains

The global value chain concept emerged from the concept of a value-added chain, described as: 'the process by which technology is combined with material and labor inputs, and then processed inputs are assembled, marketed, and distributed (Kogut, 1985). The concept attaches importance to inter-country integration of activities, which are dispersed and integrated on a world-wide basis (Gereffi, 1994; Gereffi *et al.*, 2005). The global value chain concept entails an analysis of the position of the firm in the value chain, and the power relationship dynamics between producers, firms, and other stakeholders of a value chain (Gereffi *et al.*, 2005).

Although the global value chain concept has been developed with a focus on the analysis of value chain performance at a global level, the concept has also gained prominence in understanding local value chains in developing countries (Trienekens, 2011; Kilelu *et al.*, 2017b). Feyaerts *et al.* (2019) note that the development of global value chains has spillover effects on local value chains. For instance, food safety requirements in global value chains are increasingly being adopted in local value chains (Lee *et al.*, 2012; Park & Gachukia, 2020). Additionally, investment and technical spillover also occur and accelerate the development of local value chains. This thesis contributes to the growing body of literature that applies the global value chain concept to local value chains (Lie *et al.*, 2012; Adetoyinbo & Otter, 2019). Two dimensions are usually considered in global value chain analysis, namely governance and upgrading.

1.2.1.1 Governance

Governance describes both how a specific actor (often the lead firm) in the chain exerts control over other actors and how the lead firm appropriates or distributes the value that is created along the chain (Gereffi, 2011). Three main factors determine how transactions between trade partners are being governed, that is asset specificity, supplier capabilities, and the ability to codify the transactions. Governance forms range from spot markets through hybrid to hierarchy (Gereffi *et al.*, 2005). When the need to coordinate transactions in the value chain is low, because of low asset specificity and complexity of transaction, a spot market governance form is most efficient. As the requirements for specific product characteristics increase, the complexity of the transaction increases, and so does the need for investments in specific assets. This will lead to more hierarchical governance forms, which implies that the buying firm exerts more control over its suppliers (Gereffi *et al.*, 2005). Hierarchical governance forms exhibit higher degrees of coordination in the value chain.

When examining the governance role of POs, two forms of coordination have been reported. The first is horizontal coordination among smallholders, thereby creating economies of scale for aggregation and marketing of the farmers' produce (Riisgaard *et al.*, 2008; Adetoyinbo & Otter, 2019). The second is vertical coordination, which is defined as the alignment of activities and decisions among two or more independent players that have a seller-buyer relationship in a supply chain (Hendrikse & Bijman, 2002). Vertical integration is the most extreme form of vertical coordination (Dong *et al.*, 2020). POs can vertically integrate into value-adding processes such as grading, processing, and packing. Vertical integration mostly occurs where the complexity of the transaction is high (for instance in the case of high-value perishable products) and/or the asset specificity of investment is high.

By both horizontal coordination and vertical coordination, POs seek to obtain better prices and improved capabilities. While horizontal coordination provides improved bargaining power, vertical coordination facilitates the enhancement of member capabilities, particularly through the provision of farming inputs and technologies. In addition, vertical coordination allows for information sharing about potential markets and buyers, prices, demanded quantity, and safety and quality requirements (Trebbin, 2014).

Once a governance structure has been adopted, it has implications for the choice of the upgrading strategy (Gereffi & Lee, 2014) and thereby for the economic and social outcomes of value chains (Pouw *et al.*, 2019). Thus, the second dimension considered in the global value chain theory is upgrading.

1.2.1.2 Upgrading

Upgrading refers to a move to higher value-added activities in production, through improving technology, knowledge, and skills, which increase the benefits that can be derived from participation in markets (Gereffi *et al.*, 2005). Upgrading therefore is linked to the process of producing better products through improved processes and taking up new functions in the chain (Ponte & Ewert, 2009). Specifically, there are two strategies for upgrading: economic and social (Barrientos *et al.*, 2011).

Economic upgrading involves increasing competitiveness in value-added processes which allows economic actors to improve their performance and functions (Gereffi *et al.*, 2005). Humphrey and Schmitz (2002) have identified four economic upgrading trajectories that we apply for POs in local value chains:

  i.   process upgrading: involves practices that improve productivity, e.g., reduce time to market, increase volume intake, reduce production costs, compliance with food safety requirements;
  ii. product upgrading: involves improving product quality or moving to more sophisticated products (e.g. in processing or packaging);
  iii. functional upgrading: where a PO takes on new functions such as the provision of inputs or services;
  iv. chain upgrading: where a PO takes skills and experiences developed in one value chain to engage productively in another, more rewarding value chain.

Social upgrading is a concept that emerged from the International Labour Organization (ILO) who defines it as the improvements in labor and living conditions and overall social well-being of workers and actors directly or indirectly involved in a value chain (Barrientos *et al.*, 2011). Recently, social upgrading has attracted the attention of scholars in agricultural global value chains where issues of women empowerment, gender equality, and social inclusion are studied (Barrientos, 2014; Said-Allsopp & Tallontire, 2015). In agricultural chains, social upgrading is taken as the portion of the benefits from economic upgrading captured by the producers or workers in a given firm or chain (Salido Marcos & Bellhouse, 2016). The gains could be monetary, improvement in well-being, or empowerment (Islam & Stringer, 2018). In this perspective, social upgrading depends on actors' inclusion in the value chain. In this thesis, we aim to understand the relationship between economic upgrading and social upgrading in local value chains through POs. The concept of social upgrading, in our thesis, captures the issues of the inclusion of poor and vulnerable groups of farmers in POs and who benefits from inclusion.

1.2.2 Economic upgrading and social upgrading: what is the link?

A review of the achievements and limitations of global value chain research by Bair (2005) puts forward concerns of a narrow focus on economic upgrading as a measure of competitiveness while ignoring issues of social upgrading. Similarly, an updated review by Milberg and Winkler (2011) points out that there has been much research on global value chains connecting economic upgrading to competitiveness. To date, social upgrading in value chains remains understudied. Salido Marcos and Bellhouse (2016) and Nadvi (2004) argue that economic upgrading results in increased wages, which reflect social upgrading. This strand of literature assumes that economic upgrading brings both competitiveness of global value chains as well as social upgrading.

In practice, however, the relationship between economic and social upgrading in multifaceted and complex (Barrientos *et al.*, 2011; Milberg & Winkler, 2011; Rossi, 2013), and economic upgrading does not always lead to social upgrading (Lee *et al.*, 2015). Still, economic upgrading is a necessary condition for social upgrading (Salido Marcos & Bellhouse, 2016). There is often a trade-off between economic and social upgrading in the creation and capture of value such that a firm may perform value-added activities leading to economic upgrading, but this may translate into social downgrading. For instance, Dolan and Humphrey (2000) note that the increasing dominance of supermarkets in the fresh vegetable value chain in the United Kingdom pushed out smallholder producers in Kenya and Zimbabwe in favor of large exporters who can more easily upgrade to meet food safety demands. Also, Bellemare and Bloem (2018) and Ton *et al.* (2018) have found exclusion of smallholders from participating in global value chains due to increasing competition. This exclusion highlights the importance of research that focuses on assessing both economic and social upgrading in value chains, an assessment that has largely been ignored (Kaminski *et al.*, 2020). In the developing world context, the issue of inclusion of poor and vulnerable groups in value chains requires attention to generate policies for economic and social progress.

Another limitation of existing studies on upgrading is that they have taken a chain-wide perspective in analyzing smallholder inclusion in value chains. The assumption is that joining a global value chain leads to upgrading. This view is simplistic since joining a global value chain, particularly in developing countries, is complex in two ways. First, the smallholder characteristic of most farmers in developing countries makes it increasingly difficult for them to join global value chains. Second, smallholder farmers do not join value chains as an individual but often as a group such as a PO (Mwambi *et al.*, 2016; Tefera *et al.*, 2019). The intermediary role of POs in including smallholders in global value chains complicates smallholders' access to benefits that may emerge from value chain upgrading. It is plausible that inclusion or exclusion of smallholders in global value chains is dependent on joining a PO and on the effectiveness of that organization. Therefore, studies on value chain upgrading should not only focus on smallholder farmers but also investigate the role and performance of organizations of those farmers. Studying upgrading from the perspective of smallholders and POs will contribute to achieving Sustainable Development Goal (SDG) 10 which strives to promote social and economic inclusion. This thesis improves the understanding of upgrading strategies through POs by applying global value chain analysis.

1.2.3 Producer organizations in value chains

Essentially, POs are rural businesses that perform an economic activity to generate value (Penrose-Buckley, 2007). Contrary to for-profit companies that aim to maximize profit for owners, the PO does not maximize profit but provides value to its members through services such as training, information, transport, and market access (Krivokapic-Skoko, 2002). Additional benefits to members include provision of inputs and financial credit. POs can reduce transaction costs faced by members and this has been highlighted as one of the key factors contributing to competitiveness (Shiferaw *et al.*, 2016). POs can shorten value chains through vertical integration (Trebbin, 2014). Moreover, POs engage in negotiations with buyers and other stakeholders leading to improvements in local infrastructure, which is key to improving their performance in value chains (Vellema, 2016).

However, POs face problems related to investment and decision-making that limit their functioning in value chains. Regarding investment, Olson (1971) notes that the different ages and motives of members entail different preferences for investments. Members will support investments that provide immediate benefit as opposed to long-term investments that will only pay-off in the long run. This is called the horizon problem (Nilsson, 2001). Furthermore, members are reluctant to accept non-member investors because the interest of members and investors are usually not aligned. This means that the equity capital is mostly limited to the amount contributed by members. A lack of capital is a major hindrance to POs' economic upgrading strategies (Latynskiy & Berger, 2016).

Another problem with POs is related to the cost of decision-making. The collective decision-making procedure is slow as members have to deliberate to conclude and POs usually take decisions by consensus. Additionally, the principal-agent problem may be present, as the interests of principals (members) and agents (managers) may divert (Fama & Jensen, 1983). Managers may be more focused on the business, for instance by introducing strict food safety

and quality requirements while members expect the PO to accept all products regardless of quantity and quality. Members have to control and monitor the decisions of managers to ensure that their actions contribute to achieving members' goals. However, members often lack incentives to control and monitor (as the costs are individual while the benefits are for the whole group), which then creates the above-mentioned agency problems (Nilsson, 2001).

POs operate in a competitive business environment implying that members must evaluate their organization from a business perspective. Improving competitiveness and vertical integration can entail four things. First, greater professionalization of management is required (Bijman *et al.*, 2014). Second, increasing membership size may enable organizations to obtain a sufficient amount of capital and bargaining power. On the downside, large organizations are more difficult to control in a democratic process, sometimes leading to a loss of trust and commitment among the members. Third, members can invite external investors to contribute equity capital. But in this case, a problem of conflicting interests arises as investors seek to maximize profits while members seek to receive low-cost services. Fourth, members will be subjected to control mechanisms as the PO seeks to minimize risks and maximize returns (Ménard & Vellema, 2019). These include social control (informal mechanisms such as building trust), process control (through training and farm inspection), and output control (measuring performance through assessment of the product delivered and price incentives) (Hueth *et al.*, 1999).

From the aforementioned, POs choose different strategies to improve competitiveness. This can lead to different models. Kormelinck *et al.* (2019) identify five types of POs in vegetable value chains that differ in activities, which can be social, political, and economic, and in level of integration. The 'rural support association' is least integrated and focuses on social and political activities while 'marketing cooperative with supermarket contract' is vertically integrated with packaging and labeling functions and has high horizontal coordination and professionalization. In between the extreme models are 'marketing cooperative with institutional contract', 'producer network', 'marketing cooperative with own shop'. Trebbin (2014) distinguished POs based on legal form and found three types: cooperatives, self-help groups, and farmer-owned companies. Another way that POs have been distinguished is by geographical scope and membership, which results in primary POs, secondary POs, and unions (Wennink *et al.*, 2007).

While these distinctions are important, they focus on organizational characteristics but fail to capture aspects of value proposition, costs, and revenues (Asikin *et al.*, 2020). Neilson and Pritchard (2011) and Vicol *et al.* (2018) call for a more nuanced approach in analyzing the model of institutions like POs and their role in value chain coordination and upgrading. The basic argument is that, for strengthening their competitiveness, POs need to innovate their business models by introducing new products, services, and knowledge, aiming at creating customer value and satisfying buyer requirements. The integration of smallholders in value chains through POs requires an understanding of what value farmers get from PO membership. In this regard, we introduce a business model framework to further elaborate on the types of POs.

1.2.4 The business model framework of producer organizations

The definition of the term business model is still a debate in business model literature (DaSilva & Trkman, 2014). According to Teece (2010), a business model is defined as how the enterprise creates and delivers value to customers, and then converts payments received into profits. Osterwalder and Pigneur (2010) suggest that a business model is a way of producing (value creation) a specific output (value proposition) for the market (customer) that leads to a surplus of revenues over costs (value capture). For this thesis, we adopt the latter definition as it captures the key elements of a business.

Applying the business model framework to POs, Mazzarol *et al.* (2018) show that the following components are important: key activities, key resources, members, governance structure, cost structure, revenue stream, customer segments, value proposition, and legal form. A few studies have attempted to classify POs using a business perspective leading to two models namely community-oriented or business-oriented (Bijman *et al.*, 2016; Wassie *et al.*, 2019). These studies do not refer to the business model framework, albeit the focus is on the business strategy of POs. More so, business-oriented POs are considered homogenous. Yet, POs differ in the way they are organized and in their choice of upgrading strategies in the value chain, which leads to different business models. The business model of POs remains poorly understood and this topic has been neglected within the business and management literature (Mazzarol *et al.*, 2018). Understanding business models of POs will lead to policies that are specific to the upgrading needs of an organization. In this thesis, we develop and use a typology derived from the business model framework to evaluate the impact of POs on social upgrading.

1.2.5 Smallholder inclusion in value chains through producer organizations

As a first condition for social upgrading, we argue that POs have to be inclusive, that is, to integrate smallholders into more remunerative value chains (Helmsing & Vellema, 2011). In this case, POs have to represent "inclusive business models" (Ménard & Vellema, 2019). Inclusion of smallholders in POs is a complex process that not only involves membership but also participation in decision-making and benefitting from services and value created (Bernard & Spielman, 2009b). According to Bijman and Wijers (2019), inclusion/exclusion of smallholders in POs raises three dilemmas: (1) community-orientation versus market-orientation; (2) open versus closed membership; and (3) the level of representation of members in the governance of the PO.

The first challenge is related to inclusion versus efficiency. Literature argues that inclusiveness differs with the objective of the PO. When providing public goods is the main objective, POs tend to be more inclusive than when the objective is marketing of members' produce (Lutz & Tadesse, 2017; Bijman & Wijers, 2019). Supporting this argument, Wassie *et al.* (2019) examine inclusiveness and efficiency of agricultural cooperatives in Ethiopia and find that business-oriented cooperatives are less inclusive of poor and illiterate farmers. These studies make a distinction between community-oriented and business-oriented POs. However, when it comes to business orientation, POs are further heterogeneous. In this thesis, we make a distinction between a less business-oriented model, and a more business-oriented model.

On the second challenge, POs struggle with inclusion while adopting economic upgrading strategies. In a less business-oriented PO, economic upgrading is limited to one activity in the value chain (e.g., functional upgrading). On the other hand, a more business-oriented PO adopts more economic upgrading strategies, which may include food safety control (process upgrading) as well as additional activities along the value chain (functional upgrading). To keep up with the upgrading strategies, farmers need to adopt food safety measures and technologies and invest in specific assets. Higher levels of vertical coordination and compliance with food safety standards become necessary, but are achieved at the expense of inclusion─ farmers that cannot meet these requirements are excluded, hence they do not benefit from the economic upgrading.

Focusing on the third challenge on representation of members in governance, in a democratic organization like a PO, it is expected that the interests of all members, including poor and vulnerable groups, are equally represented in the governance (Borda-Rodriguez *et al.*, 2016). However, literature shows that this is often not the case. Women and youth are excluded from decision-making (Meier zu Selhausen, 2015). Depending on the type of PO, smallholders can be excluded. In a less business-oriented PO, smallholders control the decisions of the organization and run day to day activities. In a more business-oriented PO, which are mostly unions, there is a separation of decision rights between members and managers. A more business-oriented PO has several levels of representation, where members elect regional representatives that elect the board of directors. Separation of decision rights leads to lower involvement of members, reduced trust, and therefore lower commitment.

The relationship between the key concepts of the thesis is presented in Figure 1.1.
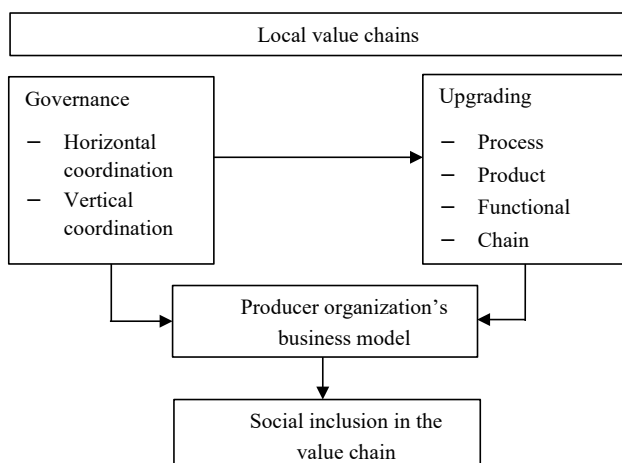
Figure 1.1: Conceptual framework

1.3 Research questions

The main aim of this thesis is to examine the role of POs in value chain coordination and upgrading and assess the relationship between economic upgrading and social upgrading. This general aim is answered using four research questions. In this section, we discuss the gaps leading to our research questions focusing on the typology of POs, social inclusion, and food safety issues.

1.3.1 A typology of producer organizations

POs adopt different strategies to improve coordination and upgrading in value chains in a specific context. This leads to different PO models. Previous studies show that POs differ by functions and geographical coverage (Wanyama, 2009) as well as the level of integration (Kormelinck *et al.* (2019). This view of classifying POs is limited and does not offer information on the business aspect of POs. Bijman and Wijers (2019) try to fill this gap by distinguishing between community-oriented and business-oriented POs. Still, issues on costs, revenues, and value generated are not captured. Yet, POs will attract farmers if the costs incurred in membership and participation are lower than the benefits derived. More so, costs and revenue affect the performance of the organizations in value chain coordination and upgrading. Given this understanding, it is critical to evaluate the PO from a business and a global value chain perspective.

The global value chain theory indicates that POs adopt different upgrading and coordination strategies to remain competitive. The strategies adopted will affect the business model of the organization. The business model framework provides a holistic approach that can be used to examine POs. Precisely, the business model framework provides an integrated perspective and a system-level framework, which looks at linkages between characteristics, for explaining how organizations create and capture value (Zott *et al.*, 2011). In the business model framework, the characteristics of organizations are referred to as components and include key activities, value proposition, key resources, legal forms, customer segments, cost structure and revenue streams, governance structure, and membership relations (Dilger *et al.*, 2017; Mazzarol *et al.*, 2018). The implicit assumption behind most development policies and practices is that business-oriented POs follow the same business model. Such an assumption creates a challenge for the effectiveness of policies and practices.

RQ1: *What are the business model components of POs and what typology of PO business models can be derived?*

1.3.2 Producer organizations and inclusiveness

Promoting social inclusion is at the center of development projects (IFPRI, 2020). The 2030 Agenda for The United Nations Sustainable Development Goals "leave no one behind" underscores the growing attention to social inclusion (UNDP, 2018). The main idea is to ensure that people have equal opportunities to participate in and benefit from development progress. Social inclusion, therefore, is a powerful strategy to improve the participation of poor and vulnerable groups in development.

This thesis examines social inclusion in agricultural value chains. Three dimensions are examined as proposed by Bernard and Spielman (2009b): i) membership of an organization, ii) participation in decision-making of the organization (including attending meetings and serving on the board), and iii) benefiting from the organization. In this section, we discuss the first two dimensions of social inclusion in terms of who is included in membership and decision-making in POs. The next section discusses the third dimension by looking at how POs contribute to empowering women.

To address the first two dimensions, the thesis examines membership and participation in the decision-making processes of those farmers with few land and livestock resources and those that are vulnerable in terms of age, gender, and location (Gupta *et al.*, 2015). We use the cost/benefit framework proposed by Fischer and Qaim (2014), which suggests that a rational individual will weigh the costs and benefits of membership in deciding whether to join or not. Once they are members, farmers choose how to participate in the decision-making process. Costs of membership include membership fees, share contribution, and specific investments in producing according to the safety and quality requirements of the PO and its' customers. Benefits are access to resources, markets, and services. The costs of participation involve time and money to attend meetings. In return, farmers benefit from representing their interests in the PO. The type of PO and farmer characteristics like age, gender, and asset ownership have been shown to influence the costs and benefits of membership and participation (Weinberger & Jütting, 2001; UNDP, 2018).

Despite the growing interest of social inclusion and POs in academia, the subject of membership is under-researched in developing countries except for a few studies in Ethiopia (Bernard & Taffesse, 2012; Lutz & Tadesse, 2017). These studies highlight the tension between social and business objectives of POs; pursuing social functions encourages the entry of all members of the community, some of whom are not necessarily interested in marketing while organizations that adopt a business approach have to exclude farmers that are not efficient in producing for the PO. Lutz and Tadesse (2017) show that business-oriented POs exclude farmers that cannot contribute to the financial needs of the organization.

Membership alone provides limited evidence on social inclusion because being a member does not mean that a farmer actively participates and that his/her interests are captured. A few studies have analyzed farmers' participation in decision-making. Fischer and Qaim (2012b) in their study on farmers participation in banana groups show that high costs hinder participation of poor farmers. For women, these costs arise because of limited time to attend meetings and trainings (Lyon *et al.*, 2016). With this thesis, we contribute to the literature by examining social inclusion using both membership and decision-making criteria. Understanding which farmers are included in membership and decision-making in POs is crucial for policymakers in creating targeted policies for rural development.

Further, we note that previous studies have treated business-oriented POs as homogenous models in examining inclusion of farmers. This thesis goes further to analyze inclusion across different business-oriented POs. We argue that less business-oriented organizations are more inclusive of poor farmers because of the low cost of membership. POs that adopt a more business-oriented strategy require a higher member contribution to investment. Moreover, more business-oriented POs may focus on accessing modern markets that require compliance with strict food safety requirements, which leads to the exclusion of farmers that do not meet the minimum product safety standards. Distinguishing inclusion by PO type is helpful for PO managers and farmers in choosing an appropriate business model.

RQ2*: What factors determine farmers' membership and their participation in decision-making in POs?*

1.3.3 Producer organizations and women empowerment

Under the third dimension of social inclusion, we assess the impact of membership in POs on women empowerment. Achieving women empowerment and gender equality is vital for reaching the following SDGs: eliminating poverty (SDG1), achieving zero hunger and malnutrition (SDG2), ensuring good health and well-being for women and children (SDG3), and gender equality (SDG5).

While the term empowerment is subject to various conceptualizations and interpretations, we define it as the process by which an individual acquires the capacity for self-determination (Kabeer, 1999; Galiè *et al.*, 2018). Several measures have been discussed for measuring empowerment (Narayan, 2005; Alsop *et al.*, 2006; Ibrahim & Alkire, 2007). For women specifically, the Women Empowerment in Livestock Index (WELI) is one of the strategies for measuring women empowerment in the livestock sector (Galiè *et al.*, 2018). The dimensions of empowerment in the WELI include (1) decisions about agricultural production; (2) decisions related to nutrition; (3) access to and control over resources; (4) control over and use of income; (5) access to and control over opportunities; and (6) workload. WELI is an appropriate tool for our study because it is directly related to issues of women empowerment

in livestock value chains and the tool is adapted to the East African context including Kenya, which is our area of study.

Women often face challenges in participating in the development processes because of gender differences in accessing resources and carrying out responsibilities (World-Bank, 2012b). POs can address women's constraints related to agricultural production and marketing. When women join POs, they get better access to agricultural inputs, markets, credit, and information that can help improve production and thereby food security for themselves and their families (Sraboni *et al.*, 2014; Malapit *et al.*, 2015; Sharaunga *et al.*, 2016). A study in Uganda shows that women that are exposed to trainings and participatory projects in POs improve their confidence, negotiating skills, ability to be of service to their communities through transferring skills to non-members, and their ability to take control of household decisions (Ferguson & Kepe, 2011). The intriguing question is what type of business models of POs support women empowerment?

A few studies have assessed the effect of membership on women empowerment while considering the type of PO, which can be single-sex i.e., women or men PO, or mixed-sex (men and women) and the type of a member, which can be household (either man or woman in the household is a member) or woman (Dohmwirth & Hanisch, 2017).

Ferguson and Kepe (2011)'s study involving Manyakabi Area Cooperative Enterprise in Uganda, which is majorly composed of women, show that membership increases women's independence, social status, leadership, and business skills. Similarly, membership in groundnut women groups in Zambia increases women's control over groundnut income (Orr et al., 2016). In contrast, members of women dairy cooperatives in India perceive themselves as having less control over dairy income and productive decisions compared to non-member women (Dohmwirth & Hanisch, 2017). When a woman is a member of a mixed PO, empowerment or disempowerment can the outcome. In Mozambique, women members did not benefit from receiving cows following a project that donated cows through POs (Quisumbing *et al.*, 2015). Instead, men remained the ultimate decisionmakers on most dairy production issues with regards to inputs use, production practices, and technologies. In Kenya, women's membership and leadership in dairy POs enabled women to gain control over some milk (Basu *et al.*, 2019).

We contribute to this literature by distinguishing the effect of membership by PO business models. In addition, we examine the effect of the type of membership, that is, household and woman membership in different PO business models, on women empowerment. Membership in a more business-oriented PO may improve women empowerment because of the wide number of services and resources available for members as compared to a less-business oriented organization that has minimal services. Knowing the contribution of POs in women empowerment will be beneficial to the government and development practitioners in implementing specific PO interventions for empowerment.

RQ3*: What is the effect of household and woman membership in POs on women empowerment?*

1.3.4 The role of producer organizations in food safety

Major developments in agri-food markets are pushing for structural changes in the agricultural sector, particularly affecting smallholders. The modernization of domestic markets and globalization have led to strict food safety standards (Reardon *et al.*, 2019). Further, the demand for safe food has increased because of rising outbreaks of food-borne diseases that, according to a World Health Organization report, caused 91 million cases of foodborne diseases and 137,000 deaths in Africa in 2010 (WHO, 2015). Increasing food safety demands put small farmers at a disadvantage compared to large farmers because smallholders face higher production and marketing costs, are less able to access financial services, and face high risks in investing in producing for modern domestic and international markets (Wedig & Wiegratz, 2018). Consequently, smallholders may be excluded from agri-food value chains.

One of the upgrading strategies of POs that can help smallholders to access agri-food value chains is by ensuring members' compliance with food safety standards. The role of POs in influencing smallholders' adoption of food safety can be explained using social, process, and output control measures (Zhou *et al.*, 2019). Social control refers to the social mechanisms in an organization, for instance, trust, that directly or indirectly influence members' adoption behavior. Process control is the monitoring of food safety measures at the farm and provision of inputs and services that contribute to the production and marketing of safe food. POs provide technical assistance to their members, storage, transportation, and processing facilities for perishable products, and access to credit (Meador *et al.*, 2016; Mutonyi, 2019). Output control involves price incentives and the direct assessment of product safety which is done using laboratory equipment (Hueth *et al.*, 1999).

One of the most relevant questions is what business model of POs supports members' compliance with food safety requirements. One way to measure member compliance is by examining the adoption of food safety measures (Kumar *et al.*, 2017). A less business-oriented PO may not have the capacity to offer access to technical training, inputs, or financial resources that are key in supporting members' adoption of food safety. As a PO becomes more business-oriented, food safety requirements of the final customers become more important, and therefore strict food safety control measures are likely to be implemented. If strict strategies for compliance are employed in POs, trust of the members increases (Cechin *et al.*, 2013). Trust in turn enhances commitment to food safety. Besides, tight vertical coordination in more business-oriented POs through contractual relationships between the organization and its members improves members' adoption of food safety measures (Mugwagwa *et al.*, 2019). More business-oriented POs also employ professional staff and

qualified technical staff who offer assistance to members and thereby support the adoption of food safety measures.

RQ4*: What is the effect of household membership in POs on the adoption of food safety measures?*

1.4 The context

This thesis is one of the results of the research program "Local and International business collaboration for productivity and Quality Improvement in Dairy chains in Southeast Asia and East Africa (LIQUID)." The program is a collaboration between Wageningen University and Research, The Netherlands, Royal FrieslandCampina, The Netherlands, Agriterra, The Netherlands, Egerton University, Kenya, International Livestock Research Institute (ILRI), Tanzania, and Sokoine University of Agriculture, Tanzania. The LIQUID program seeks to understand how different business models contribute to inclusiveness and quality improvement in dairy value chains. The research program is funded by the Netherlands Organisation for Scientific Research's (NWO) Science for Global Development department (WOTRO) through the Food and Business Global Challenges Programme (GCP). Within the LIQUID framework, the present study focuses on understanding the business models of dairy producer organizations (POs) and the role of these POs in value chain development.

This thesis focuses on POs in the dairy value chain in Kenya. Dairy farming is the single largest sub-sector of agriculture in the country and contributes 12% of the agricultural gross domestic product (KDB, 2016). The dairy sub-sector includes about 700,000 smallholders, each owning 1-4 acres of land, 1-3 cows, and account for 80% of the milk produced (Makoni *et al.*, 2014). Kenya's dairy sub-sector is growing in importance, evidenced by an increase in domestic milk production. Milk production has been rising since 2010 up to 2016 before dropping in 2017 due to drought (USAID, 2018). Figure 1.2 depicts the trend in milk production in tons and the number of milking cows from 2010 to 2018. Besides increasing production, the dairy processing capacity and annual per capita milk consumption in the country are increasing at an average rate of 7% and 5.8% per year, respectively (KDB, 2017). These factors point to a pro-poor agricultural sub-sector that can play a big role in improving the livelihoods of smallholder farmers.
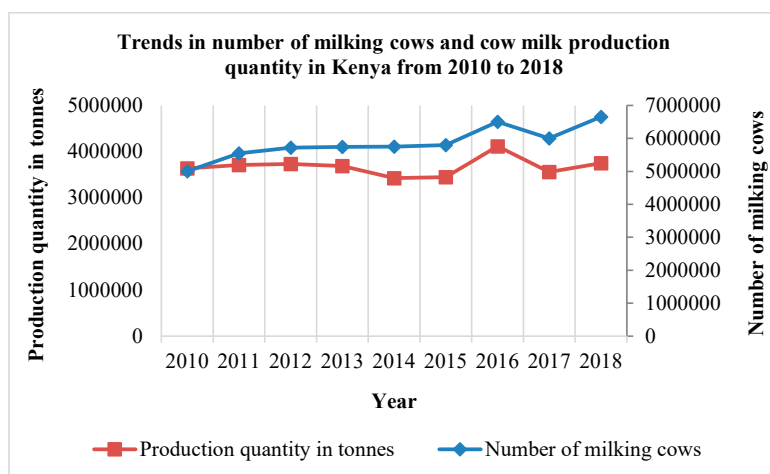
Figure 1.2: Trends in number of milking cows and cow milk production quantity (in tons) in Kenya from 2010 to 2018 (FAOSTAT, 2019)

The expanding dairy sub-sector is characterized by an increasingly sophisticated marketing structure. Some smallholders sell milk to traders through the informal value chain which handles raw unchilled milk and is less compliant with food safety standards (Alonso *et al.*, 2018). The informal chain, accounting for 80% of the milk reaching the market, is composed of producers and traders distributing milk to mainly milk bars and shops (USAID, 2018). In this chain, farmers receive payment mostly in cash but have low bargaining power and low access to production and marketing related services. However, farmers benefit from reduced transaction costs as traders collect milk from the farm and transport it to buyers in nearby towns and cities.

Other smallholders organize themselves in POs to bulk and sell their milk collectively. POs mainly operate in the formal value chain handling about 20 percent of the marketed milk in the country (USAID, 2018). The formal value chain is defined by licensed operators and by strict food safety monitoring and control (Alonso *et al.*, 2018). The cow milk intake in this chain is growing at an average of 7% per year (Rademaker *et al.*, 2016a), which indicates the growing importance of the formal value chain.

POs are important in dairy for coordination of milk collection, cooling, marketing, and sometimes processing activities. Efficient coordination is necessary because of the highly perishable nature of milk which requires that it be consumed, boiled, or cooled immediately after the cows are milked. In Kenya, most smallholders do not have refrigeration facilities at home, but these are available in some organizations. Also, since most smallholders are located in rural areas where road infrastructure is poor, POs offer milk collection services that reduce transaction costs. Services such as access to inputs, credit, training, veterinary and artificial insemination can be provided and other services for food safety control such as farm

inspection and product testing may be available. Most POs offer check-off services to members where a portion of members' earnings from milk is automatically sent to pay liabilities such as school fees, loan repayments, and insurance payments (Savoie, 2018).

Dairy POs in Kenya show several variations. The legal forms of the POs include cooperatives, self-help groups, and producer companies (Mutinda *et al.*, 2015). Some POs are organized in tiers. The first tier is composed of primary POs that bulk and cool raw milk and have individual farmers as members. In some cases, several primary POs form a union which is the second tier. The union does processing and the members (i.e., primary cooperatives) collectively own the processing facility. The primary POs are organized at the village level while the second tier POs are organized at the county level. Primary POs can choose to partner with a private investor and invest in processing joint venture. Jointly, the members of the primary PO are co-owners of the processing facility.

Dairy POs continue being traditional in ownership and control rights; they are member-owned and member-controlled enterprises. POs have an open membership and are democratic, that is, voting is on a one-member-one-vote basis. Economic benefits are distributed according to the members' level of economic activity in the PO, not according to their capital contribution. Two or three levels of decision-making exist. The first level is the members who exercise decision-making power on investments by the PO. The second level is composed of the leaders who represent the members; they are the management committee (also referred to as the board of directors). The management committee establishes policy and oversees business affairs. In case a PO has processing activities, professional staff can be hired, which adds a third level of decision-making. In this case, the management committee is not involved in the day-to-day operations, they only supervise the professional staff.

Young people and women are sometimes underrepresented in membership in Kenyan dairy POs because of a lack of access to resources such as land, finances, and skills. The participation of youth and women in leadership positions is also low (Katothya, 2017).

Traditionally in Kenya, women play a predominant role in milking, watering, cleaning out the pens, and feeding the animals while men have a larger role in activities related to animal health. Cow ownership is associated with men. Women exercise greater control over milk and also do the marketing of milk and other dairy products in the informal market but this trend is changing because of the formalization of dairy value chains (Gallina, 2016). Selling to the formal value chain is linked to increased milk production and commercialization (Wilkes *et al.*, 2020). Men are likely to take control over product marketing when yields are higher (Wilkes *et al.*, 2020).

The government recognizes dairy POs to be a major contributor to national development and it has emphasized policies that regulate and support the establishment of these organizations (GoK, 2013). The main objective of these policies is to strengthen the market position of farmers in the value chain and to promote business-oriented strategies in the organizations.

Although we focus on dairy POs in Kenya, the contribution of this study may apply to other sub-Saharan countries for reasons explained in the following section.

1.5 POs in the Kenyan context in relation to POs in the sub-Saharan African context

Kenya is a representative country for understanding the characteristics and impact of POs in sub-Saharan African contexts. Kenya and other sub-Saharan countries are similar in terms of the development phases experienced by POs, the role of POs in the economies, and the changing marketing structures. Regarding the development phases, like in other sub-Saharan African countries, POs in Kenya have gone through two phases evolving into many forms and structures (Wanyama, 2009).

The first phase is the state control phase during the pre-colonial, colonial, and independence periods. The pre-colonial period had informal organizations represented by the 'self-help' groups, where farmers help each other out, for example at peak labor periods (Wennink *et al.*, 2007). Self-help groups still exist today but have adopted business strategies like selling members' produce collectively and are formally registered with the Ministry of Gender, Children, and Social Development. The colonial period witnessed the introduction of certain forms of POs to promote the production and marketing of cash crops by peasant farmers (Develtere *et al.*, 2008). Such organizations adopted the legal forms based on the western cooperative model and were managed and controlled by the colonial administration. In the post-independence period, the Kenyan government and other sub-Saharan countries' governments alike, introduced their types of POs to promote the organizations as potential institutions for smallholders' access to markets, credit, and inputs and to implement state policies (Wanyama *et al.*, 2009). Independent cooperative unions were created and managed under the government directives. However, government interference led to a declining performance as POs were engulfed in state politics.

The liberalization phase is considered the second phase which began in the 1980s in Kenya and other sub-Saharan countries. Liberalization coupled with the withdrawal of the state from the provision of services, privatization, democratization, international dynamics, and the influence of donors on national policy-making led to reforms of state-controlled POs and cooperatives (Wanyama *et al.*, 2009). POs were made responsible for their management. Increasing private-sector involvement in the agricultural sector led to the creation of other forms of POs such as producer companies (Mutinda *et al.*, 2015). Farmers also created their organizations (e.g., federations) to lobby for and defend their interests at national and regional

levels (Wennink *et al.*, 2007). In Kenya and many sub-Saharan countries, these farmer-led initiatives for new types of POs are supported by international donors.

POs play an important role in the Kenyan economy as they do in other Sub-Saharan economies. Currently, Kenya's agriculture sector has more than 5,000 societies and unions, mainly involved in coffee, dairy, pyrethrum, cereals, and cotton production and marketing (GoK, 2019). Agricultural cooperatives contribute significantly to social and economic development in the country (GoK, 2018). About 63 percent of the Kenyan population participate directly or indirectly in cooperative societies in general, accounting for about 31 percent of Kenya's national gross domestic product (GoK, 2019). In other sub-Saharan African countries, cooperatives play a major role in development too (Ortmann & King, 2007; Verhofstadt & Maertens, 2014).

The market structure where POs operate has been changing in Kenya and the sub-Saharan region at large. Competitive marketing has led to the involvement of organizations in buying, collecting, processing, and marketing farm produce, which is also the case for POs in the sub-Saharan region (Ragasa & Golan, 2014; Latynskiy & Berger, 2016; Tefera *et al.*, 2017). Kenya's agricultural value chains are changing because of growing urbanization, internationalization, supermarkets, and demand for safe food. These changes are reflected in other African countries and have implications for the contribution of POs to value chain development.

1.6 Data and Methods

This study was carried out in two counties in Kenya namely Meru and Nyandarua, which are among the main dairy producing hubs in the country (USAID, 2015). The counties have a high number of dairy POs and an active non-PO marketing chain.

Nyandarua county is located in the central region of Kenya, about 100km from Nairobi. According to the unpublished report given by the county officer, there are about 154,125 cows in the county producing an average of 6 to 10kg of milk per cow per day. In 2015, a total of about 224 thousand kg of milk was produced which earned Nyandarua a revenue of US$ 84 million making dairy the economic mainstay of the county. Due to its proximity to Nairobi, Nakuru, Naivasha, and Nyahururu towns, Nyandarua enjoys a high demand for milk from the urban population, processors, and traders (Van der Lee *et al.*, 2018). An unpublished county report further shows that the county has 27 POs located in its five sub-counties namely Ndaragwa, Ol'jororok, Olkalou, Kipipiri, and Kinangop. Olkalou and Kinangop have active dairy production and marketing activities (both individual and collective) and were therefore chosen for this study.

Meru county is found in the eastern region of Kenya, about 225km northeast of Nairobi. According to the county livestock director, Meru has about 180,000 cows producing an average of 8-9kg of milk per day per cow. As of 2019, the county recorded production of 200 million liters per year of milk valued at US$99 million. Meru is not within the immediate reach of traders and processors from Nairobi but enjoys local demand for milk. The county boasts of having a total of 60 POs located in its 9 sub-counties namely Imenti North, Imenti South, Imenti Central, Buuri, Igembe Central, Igembe South, Tigania East, Tigania Central, and Tigania West. Imenti South and Imenti North sub-counties were selected for this study because they have active dairy production and marketing activities and have a variation of POs in terms of their functions.

Figure 1.3 shows the map of Kenya and the locations of Meru and Nyandarua counties.
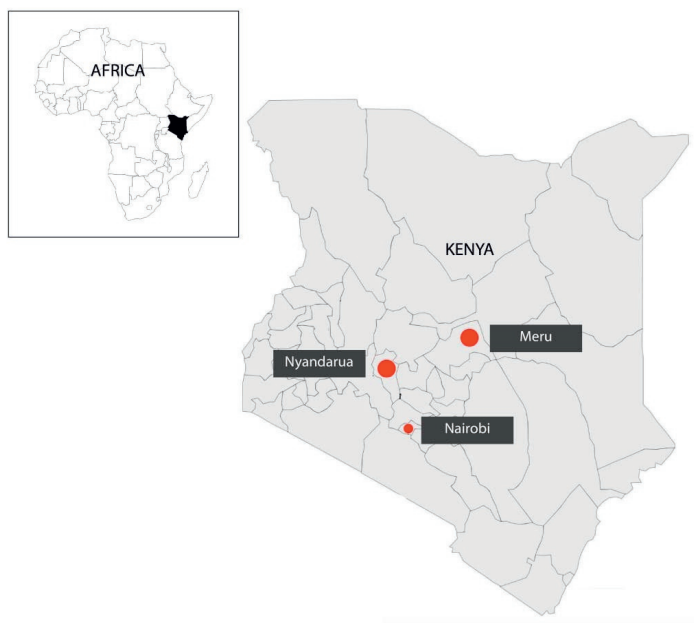
Figure 1.3 Kenya map showing the location of Meru and Nyandarua counties

Both qualitative and quantitative data were used in this thesis. In research question 1, the business model components and the typology of POs based on these components were examined using the business model framework. The data collection took place in October 2017 and involved identification of organizations in consultation with dairy experts from the county government and non-governmental organizations like Heifer International and

Agriterra, to gather information on the variation of POs in Kenya. Judgmental sampling was used to select POs based on their functions which included milk collection, bulking, cooling, and processing. It was noted that the selection of POs based on functions would lead to POs with different business model characteristics. For instance, POs that process are mainly cooperative unions covering the county and have a large membership while POs that have collection and bargaining activities only are mainly self-help groups covering the village and have a small membership. A total of 13 POs were selected in Meru County and 9 POs from Nyandarua county.

We then conducted key-informant interviews with the managers or the chairpersons of the organizations. For triangulation purposes, an additional 15 qualitative interviews were done with experts from government, non-governmental organizations and processing companies and 9 observational instances conducted including attending PO meetings, plant tours, and member farm visits to clarify and validate the primary interview data. Interviews covered questions on membership, resources, functions, governance structure, and marketing strategies of the organizations. For analysis, the audio recorded interviews were transcribed and underwent a qualitative content analysis using ATLAS.ti software.

Analysis of qualitative data revealed that there are four types of business models of POs in Kenya namely bargaining, cooling, hub, and processing. We proceeded with this classification in identifying POs and farmers for the quantitative data collection of research questions 2, 3, and 4. Because of time and financial constraints we proceeded with two POs using the bargaining and processing business models, which we refer here as baragining and processing POs. The bargaining organization focuses on collecting, bulking, and selling milk. The processing organization processes milk into various dairy products, sells these products, and provides a wide range of services to its members such as access to inputs and training. Bargaining and processing POs vary widely in their business models, and selecting the two distinct models minimizes the overlap that could arise in the organizations' functional and organizational characteristics. The selection procedure for POs and households sampled for answering research questions 2, 3, and 4 is detailed in the following paragraphs.

A cross-sectional survey was conducted between October and December 2018 using a one-on-one interview with dairy farming households. At the sub-county level, we used stratified sampling with three strata: bargaining POs, processing POs, and non-members. Two processing POs and one bargaining PO in the Imenti-South sub-county in Meru were chosen. One processing PO operating in the Kinangop and Ol-Kalou sub-counties in Nyandarua was selected as it was the only one available; it had members in both sub-counties. We selected one bargaining PO in Ol-Kalou sub-county in Nyandarua. We purposively selected the POs based on accessibility, the receptiveness of the PO staff, and representativeness of either bargaining or processing POs in the counties. We used reports from the Kenya Dairy Board, Agriterra (Kagathi, 2014), and from a joint study by Wageningen University and Research

and the Food and Agricultural Organization (Ton *et al.*, 2016) as well as journal articles (O'Brien & Cook, 2016) to verify the representativeness of selected POs.

We could not identify members from the PO register because the contact details of the members were either missing or not updated. To ensure a random sample, we obtained a list of milk collection routes from the POs. Seven enumerators followed a different route every morning. The first enumerator started to identify households at the start of the collection route. Along the same route, the next enumerator started to identify households at least four km from where the previous enumerator was left. We used the following technique to identify households belonging to the targeted PO: when the first household was identified, enumerators were required to skip five households to pick the next household.

For the selection of non-members, we first identified areas in which traders were operating. In regions with POs, trader activities were minimal. Thus, we also sampled non-members from areas in which POs were not active. Trader-dominated areas had similar geographical characteristics as areas with active POs. We first identified the village from which traders were collecting milk. Then enumerators converged in the village center and followed a particular milk-collection route followed by traders. A similar identification procedure as that of PO members was used. We sampled 375 PO members (112 in the bargaining POs and 263 in the processing POs), and 220 non-members. Data were collected using one-on-one interviews.

Research question 2, which aimed at examining the factors of membership and participation in decision-making in bargaining and processing POs was answered using logit models. Our empirical approach to examining membership was modeled as a choice, given the households' social and economic characteristics. A household had three choices; to supply to a trader, to a bargaining PO, or a processing PO. However, the choices could not be ordered, and a household could select only one of the available choices. A multinomial logit model that is used in dealing with the multiple choices that are not ordered was chosen for this analysis.

Once a farmer joins a PO, he/she is expected to participate in decision-making. In modeling farmers' participation decisions, several alternative modeling techniques such as ordered, multinomial and nested logit models could be considered, but these were not appropriate for our dataset. For example, the multinomial and nested logit models do not account for the ordering of the decision-making process. In our case, the participation decisions were not only ordered but also sequential. Attending the annual general meeting (passive) is conditional on being a member (nominal), speaking up in the annual general meeting (active) is conditional to attending the annual general meeting (passive), and serving on the board (pro-active) is conditional on speaking up in the annual general meeting (active). We adopted a sequential logit model as proposed by Fullerton (2009) to explore the association between household characteristics and the PO type on the decision to move from one stage to the next.

Both research questions 3 and 4, which examined respectively the effect of membership on women empowerment and the adoption of food safety measures, employed an impact evaluation approach. In this approach, membership in a PO was our treatment. The evaluation approach required constructing a counterfactual, that is, the outcome for those being treated had they not been treated. Given the non-experimental nature of our data, our counterfactual was missing. We could only observe the difference in outcomes between members and non-members – the problem known as selection bias (Heckman & Hotz, 1989). Most non-experimental methods tackle this issue building on the assumption of "selection-on-observables", that is, conditional on observable characteristics the difference between treated and non-treated is due to the treatment (Heckman & Robb, 1985). We used the propensity score matching (PSM) and entropy balancing methods for research questions 3 and 4, respectively to minimize observable selection bias by matching members and non-members with similar observed time-invariant characteristics.

After matching, the average treatment effects on the treated were calculated for research question 3 to give the effect of PO membership on women empowerment indicators such as control over resources, decision-making, and access to markets. Similarly, the average treatment effects on the treated were calculated to answer research question 4 which measured the effect of PO membership on the adoption of food safety measures.

1.7 Outline of the thesis

The outline of the thesis is presented in Figure 1.4. Chapter Two uses the global value chain theory and the business model framework to explore the business model of POs in the dairy value chain in Kenya. A typology of the business model of POs is derived and the link between the business model and value chain coordination and upgrading assessed. Chapter Two uses qualitative data collected from managers and chairpersons of the management committee of POs. Using the identified business models of POs, Chapters Three, Four, and Five go further to assess the role of different POs in social inclusion and improving food safety. Chapter Three examines inclusiveness by analyzing smallholders' membership and their participation in decision-making in POs. In Chapter Four, we extend our analysis on inclusiveness by assessing the impact of household and woman membership in POs on women empowerment. Chapter Five evaluates the effect of household membership in POs on the adoption of food safety measures. The results of Chapters Two, Three, Four, and Five are discussed in Chapter Six, which also provides the main conclusions, highlights the contributions to the literature, and the implication for policies and management.
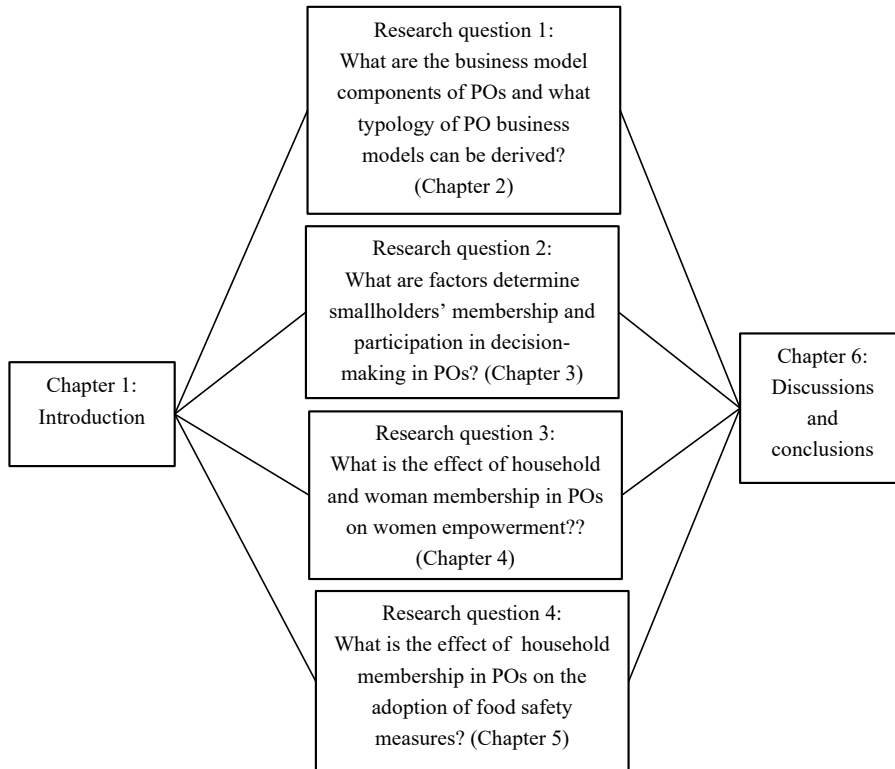
Figure 1.4 Thesis outline

Chapter 2

Understanding the business models of producer organizations

Abstract

Producer organizations (POs) in developing countries are adopting diverse business models to remain competitive in the modern agri-food value chains. However, not much is known about the characteristics and types of these POs. This study employs business model framework to assess the business model components of POs and derive a typology based on these components. Further, the global value chain theory is used to draw implications of a PO business model for value chain coordination and upgrading. The Kenya dairy value chain is used as a case study. The paper finds that POs use a mix of business model components including membership, governance structure, legal form, key activities, value proposition, key resources, customer segment, revenue streams, and cost structure. Further, the study develops a typology consisting of bargaining, cooling, hub, and processing business models, which POs adopt. Findings indicate responsiveness of POs to coordination and upgrading in value chains. Specifically, increasing coordination and upgrading entails a shift from a bargaining business model to a processing business model. This, in turn has implications for investment, which can threaten social inclusion and hence rural development.

Keywords: Business models; producer organizations; cooperatives; value chain upgrading; value chain coordination

2.1 Introduction

Agri-food value chains in developing countries have experienced rapid transformations as a result of forces on both supply and demand side (Gómez & Ricketts, 2013). Major reasons for transformations include increasing population, incomes, and urbanization, and growth of supermarkets and processors, leading to increased demand for food and tighter food safety requirements (Tschirley *et al.*, 2015). While the transformations provide market opportunities for smallholders who are the main supplies of fresh food in agri-food markets, these farmers continue to face asymmetric information when accessing inputs and output markets (Poulton & Lyne, 2009). Further, geographical dispersion, low level of farm production, low literacy of the farmer, and the lack of good information systems contribute to smallholder's transaction costs hindering their participation in value chains (Poulton *et al.*, 2010). Transaction costs and information asymmetry make it difficult for smallholders to meet the growing food demand and further complicates efforts to comply with strict food safety standards (Barrett *et al.*, 2012; Unnevehr & Ronchi, 2014).

To overcome these challenges, smallholders organize themselves in producer organizations (POs). A PO is a rural business that is generally owned and controlled by small-scale producers and that engages in collective marketing activities (Penrose-Buckley, 2007). POs are viewed as organizational structures that can promote smallholders access to agri-food value chains. First, through horizontal coordination among smallholders, POs perform collective activities of bulking and selling farm produce, thus creating economies of scale and improving the bargaining power (Markelova *et al.*, 2009). Second, through vertical coordination, which is defined as the alignment of activities and decisions among two or more independent players that have a seller-buyer relationship in the suppy chain, POs help in reducing transaction costs (Hendrikse & Bijman, 2002). Third, POs contribute to upgrading, defined as a move to higher value-added activities in production, through improving technology, knowledge, and skills, which increase the benefits that can be derived from participation in markets (Gereffi *et al.*, 2005). Upgrading in value chains through POs is achieved when the organizations take more functions, introduce new products, and improve processes, such as ensuring compliance with food safety requirements, thus strengthening the position of smallholders in the chain.

However, in some cases POs are inefficient because of the problems related to investment and decision-making (Latynskiy & Berger, 2016). For instance, members are reluctant to accept non-member investors because the interest of members and investors are usually not aligned. This means that the equity capital is mostly limited to the amount contributed by members. A lack of capital is a major hindrance to improving PO competitiveness (Latynskiy & Berger, 2016). Another problem with POs is related to the cost of decision-making. The collective decision-making procedure in POs is slow as members have to deliberate to conclude and POs usually take decisions by consensus. Additionally, the principal-agent problem may be present, as the interests of principals (members) and agents (managers) may divert (Fama & Jensen, 1983). These challenges point to the difficulty in improving value chain development in a particular context.

We argue that POs have to overcome these inherent problems to improve their efficiency in value chain coordination and upgrading. In particular, members must evaluate their organization from a business perspective. Improving competitiveness and coordination can entail three things. First, greater professionalization of management is required (Bijman *et al.*, 2014). Second, increasing membership size may enable organizations to obtain a sufficient amount of capital and bargaining power. On the downside, large organizations are more difficult to control in a democratic process, sometimes leading to a loss of trust and commitment among the members. Third, members can invite external investors to contribute equity capital. But in this case, a problem of conflicting interests arises as investors seek to maximize profits while members seek to receive low-cost services.

From the aforementioned, it is clear that POs make choices of how to run the organization to improve coordiantion and upgrading in the value chain. This leads to different types of POs. Kormelinck *et al.* (2019) identify five types of POs in vegetable value chains that differ in activities, which can be social, political, and economic, and in level of integration. The 'rural support association' is least integrated and focuses on social and political activities while 'marketing cooperative with supermarket contract' is vertically integrated with packaging and labeling functions and has high horizontal coordination and professionalization. In between the extreme models are 'marketing cooperative with institutional contract', 'producer network', 'marketing cooperative with own shop'. Trebbin (2014) distinguishes POs based on legal form and found three types: cooperatives, self-help groups, and farmer-owned companies. Another way that POs have been distinguished is by geographical scope and membership, which results in primary, secondary, and unions (Wennink *et al.*, 2007). While these distinctions are important, they fail to capture business aspects of value proposition, costs, and revenues (Asikin *et al.*, 2020), which are key in determining the success of POs in competitive value chains.

A few studies have attempted to classify POs using a business perspective leading to two models namely community-oriented or business-oriented (Bijman *et al.*, 2016; Wassie *et al.*, 2019). Still, these studies fail to consider the costs, revenue, and value proposition aspects, albeit the focus is on the business strategy of POs. In this regard, we introduce a business model framework to further elaborate on model of business-oriented POs. More so, in previous studies, business-oriented POs are considered homogenous. Yet, POs differ in the way they are organized and in their choice of functioning in the value chain, which leads to different business models. The business model of POs remains poorly understood and this topic has been neglected within the business and management literature (Mazzarol *et al.*, 2018).

The objective of this paper is to identify the business model components of business-oriented POs and to derive a typology of the POs based on these components. The study uses qualitative data from the dairy value chain in Kenya involving key informant interviews with managers and directors of 22 dairy POs, 15 expert interviews, and 9 PO observational instances. Understanding the business model of POs is timely given that these organizations are under constant pressure to focus on business strategies to increase competitiveness and performance (FAO, 2012; IFAD, 2016). Also, non-governmental organizations are shifting

from community aid objectives to providing business-oriented services to POs (Agriterra, 2016). Understanding business models of POs will lead to policies that are specific to the needs of an organization. For researchers, a typology can help to design an impact assessment that considers the specificities of the business models of different POs.

2.2 Value chains and POs

To understand the business models of POs, we draw on the global value chain theory and business model framework.

2.2.1 Global value chains

The global value chain concept emerged from the concept of a value-added chain, described as: 'the process by which technology is combined with material and labor inputs, and then processed inputs are assembled, marketed, and distributed (Kogut, 1985). The concept attaches importance to inter-country integration of activities, which are dispersed and integrated on a world-wide basis (Gereffi, 1994; Gereffi *et al.*, 2005). The global value chain concept entails an analysis of the position of the firm in the value chain, and the power relationship dynamics between producers, firms, and other stakeholders of a value chain (Gereffi *et al.*, 2005).

Although the global value chain concept has been developed with a focus on the analysis of value chain performance at a global level, the concept has also gained prominence in understanding local value chains in developing countries (Trienekens, 2011; Kilelu *et al.*, 2017b). Feyaerts *et al.* (2019) note that the development of global value chains has spillover effects on local value chains. For instance, food safety requirements in global value chains are increasingly being adopted in local value chains (Lee *et al.*, 2012; Park & Gachukia, 2020). Additionally, investment and technical spillover also occur and accelerate the development of local value chains. This thesis contributes to the growing body of literature that applies the global value chain concept to local value chains (Lie *et al.*, 2012; Adetoyinbo & Otter, 2019). Two dimensions are usually considered in global value chain analysis, namely governance and upgrading.

2.2.1.1 Governance

Governance describes both how a specific actor (often the lead firm) in the chain exerts control over other actors and how the lead firm appropriates or distributes the value that is created along the chain (Gereffi, 2011). Three main factors determine how transactions between trade partners are being governed, that is asset specificity, supplier capabilities, and the ability to codify the transactions. Governance forms range from spot markets through hybrid to hierarchy (Gereffi *et al.*, 2005). When the need to coordinate transactions in the value chain is low, because of low asset specificity and complexity of transaction, a spot market governance form is most efficient. As the requirements for specific product characteristics increase, the complexity of the transaction increases, and so does the need for investments in specific assets. This will lead to more hierarchical governance forms, which

implies that the buying firm exerts more control over its suppliers (Gereffi *et al.*, 2005). Hierarchical governance forms exhibit higher degrees of coordination in the value chain.

When examining the governance role of POs, two forms of coordination have been reported. The first is horizontal coordination among smallholders, thereby creating economies of scale for aggregation and marketing of the farmers' produce (Riisgaard *et al.*, 2008; Adetoyinbo & Otter, 2019). The second is vertical coordination, which is defined as the alignment of activities and decisions among two or more independent players that have a seller-buyer relationship in a supply chain (Hendrikse & Bijman, 2002). Vertical integration is the most extreme form of vertical coordination (Dong *et al.*, 2020). POs can vertically integrate into value-adding processes such as grading, processing, and packing. Vertical integration mostly occurs where the complexity of the transaction is high (for instance in the case of high-value perishable products) and/or the asset specificity of investment is high.

By both horizontal coordination and vertical coordination, POs seek to obtain better prices and improved capabilities. While horizontal coordination provides improved bargaining power, vertical coordination facilitates the enhancement of member capabilities, particularly through the provision of farming inputs and technologies. In addition, vertical coordination allows for information sharing about potential markets and buyers, prices, demanded quantity, and safety and quality requirements (Trebbin, 2014).

Once a governance structure has been adopted, it has implications for the choice of the upgrading strategy (Gereffi & Lee, 2014). Thus, the second dimension considered in the global value chain theory is upgrading.

2.2.1.2 Upgrading

Upgrading refers to a move to higher value-added activities in production, through improving technology, knowledge, and skills, which increase the benefits that can be derived from participation in markets (Gereffi *et al.*, 2005). Upgrading therefore is linked to the process of producing better products through improved processes and taking up new functions in the chain (Ponte & Ewert, 2009). Specifically, there are two strategies for upgrading: economic and social (Barrientos *et al.*, 2011). In this chapter, we focus on the economic upgrading aspect.

Economic upgrading involves increasing competitiveness in value-added processes which allows economic actors to improve their performance and functions (Gereffi *et al.*, 2005). Humphrey and Schmitz (2002) have identified four economic upgrading trajectories that we apply for POs in local value chains:

    i.   process upgrading: involves practices that improve productivity, e.g., reduce time to market, increase volume intake, reduce production costs, comply with food safety requirements;

    ii.   product upgrading: involves improving product quality or moving to more sophisticated products (e.g. in processing or packaging);

iii.   functional upgrading: where a PO takes on new functions such as the provision of inputs or services;

iv.   chain upgrading: where a PO takes skills and experiences developed in one value chain to engage productively in another, more rewarding value chain.

Scholarly attention for the role of POs in value chain coordination and upgrading is scarce. Zylberberg (2013) has examined functional, process, and product upgrading trajectories with POs in flower value chains where the organizations provide information on markets, access to irrigation equipment, improved varieties, and a channel for farmers to voice complaints and concerns to the buyer. This study, however, does not explain the costs, revenue and value proposition to members in POs, yet costs and benefits are important understanding differences in POs. Neilson and Pritchard (2011) and Vicol *et al.* (2018) call for a more nuanced approach in analyzing POs. The basic argument is that, for strengthening their competitiveness, POs need to innovate their business models by introducing new products, services, and knowledge, aiming at creating member and customer value. Enhancing products and knowledge entails different ways of doing business. In this regard, we adopt the business model framework to explore differences in POs.

2.2.2 The business model framework of producer organizations

The definition of the term business model is still a debate in business model literature (DaSilva & Trkman, 2014). According to Teece (2010), a business model is defined as how the enterprise creates and delivers value to customers, and then converts payments received into profits. Osterwalder and Pigneur (2010) suggest that a business model is a way of producing (value creation) a specific output (value proposition) for the market (customer) that leads to a surplus of revenues over costs (value capture). For this thesis, we adopt the latter definition as it captures the key elements of a business. Applying the business model framework to POs, Dilger *et al.* (2017) and Mazzarol *et al.* (2018) show that the following components are important: key activities, key resources, members, governance structure, cost structure, revenue stream, customer segments, value proposition, and legal form.

The first component of the PO business model framework is *key activities* in the value chain, which include collection of farm produce and bulking. Additional activities like storage, cooling, transportation, processing, marketing, and providing technical advice and inputs may be available (Tefera *et al.*, 2017). These activities aim at improving competitiveness of a PO in value chains. Carrying out different functions entails investing in *key resources*. Human, physical and financial resources are required to deliver value and achieve functions in the organization (Mazzarol *et al.*, 2018).

Members forms another business model component. It is important to know the type of members and the potential reward expectations to enhance member satisfaction and commitment (Dilger *et al.*, 2017). This commitment can be to supplying produce to POs and meeting food safety requirements of buyers. Members are patrons (supply produce), investors (provide financial capital for investment or to secure membership), and owners (control

decisions) of the PO (Barton, 1989). These three roles borne by members affect POs strategy to invest in value chains. The role of members as owners and decision-makers on how the enterprise is governed and managed is captured as *governance structure* (Birchall & Simmons, 2004). Here, the focus is on the allocation of decision rights among members, the management committee (board), and the professional staff (Bijman *et al.*, 2014). Decision rights concern all rights regarding the deployment and use of assets. Two types of decision rights are distinguished; decision control (ratification and monitoring) and decision management (initiation and implementation) (Fama & Jensen, 1983). A good business model entails efficient allocation of decision rights to keep all actors motivated to improving the performance of the organization (Bijman *et al.*, 2013).

The activities of POs are linked to *cost structure* and *revenue streams* (Dilger *et al.*, 2017). POs have two revenue streams: one from providing services and inputs to the members and the other from selling farm products to the customers. Additional revenue can be obtained from membership fee, share, and capital contribution. The revenue accounts for costs related to administration and technical operations. An important decision to be made is the distribution of profits. POs retain their profits for reinvestment into the business and sometimes provide patronage refunds.

The *customer segment* details the type of customers served by a PO while the *value proposition* component captures the value offered by the organization. Here, we distinguish between member value proposition and customer value proposition (Dilger *et al.*, 2017; Mazzarol *et al.*, 2018). Krivokapic-Skoko (2002) identifies benefits for members to include market access, enhanced prices, and access to information. The value should not only attract farmers but also be sustainably delivered over time. For customers, the organization delivers value proposition by improving product quality and safety, reducing transaction costs, and sometimes low price. A value proposition that offers a economic benefits attracts and retains members (Francesconi & Wouterse, 2017).

The *legal form* of an organization is important although the business and management literature has not recognized this component yet. Whether a PO is a self-help group, a cooperative or a producer company has implications for its development (Mutinda *et al.*, 2015). For instance, the self-help groups are independent organizational forms established to help farmers cope with market liberalization (Kalra *et al.*, 2013). Producer companies are hybrids between private companies and cooperative societies that combine both the efficiency of a company with the membership and participation structures of traditional cooperatives (Trebbin & Hassler, 2012).

A summary of the business model components of POs is presented in Table 2.1.

Table 2.1: Business model components of POs

Business model components	Description
Key activities	Activities required for the business to function successfully
Key resources	Physical, financial or human resources essential to function successfully
Members	Types of members, member relationships: owners, patrons, and investors
Governance structure	Allocation of decision rights among governing bodies in the organization
Cost structure and revenue stream	Main costs and revenues
Customer segment	Different types of targeted customers
Value proposition	Embedded value in the product/service offered to members and customers
Legal form	The legal form of an organization

Sources: Framework based on Osterwalder *et al.* (2005); Dilger *et al.* (2017); Mazzarol *et al.* (2018)

2.3 Methods

This study was carried out in Meru and Nyandarua counties, which are among the main dairy producing hubs in Kenya with collective action marketing structures (USAID, 2015). We purposively selected sub-counties with a high level of collective action activities and depending on visible variations, which were mostly in terms of the PO function and legal form. This way we were assured of having diverse models. At the sub-county, we purposively selected POs in consultation with the sub-county officers, considering organizations that are active, accessible, and receptive to research activities.

Nyandarua county is located in the central region of Kenya, about 100km from Nairobi. The county has five sub-counties namely Ndaragwa, Ol'jororok, Olkalou, Kipipiri, and Kinangop, all of which are active dairy production zones. According to the unpublished report given by the county officer, there are about 154, 125 cows in the county producing an average of 6 to 10 Kgs of milk per cow per day. In 2015, a total of about 224 thousand kgs of milk was produced which earned a revenue of KES. 9 billion to the county. Olkalou and Kinangop sub-counties have the highest number of POs, 8 in each sub-county, and have the highest variation in terms of functions from collection to processing. This is followed by Ol'jororok and Ndaragwa sub-counties with 4 POs each and Kipipiri with 3. Olkalou and Kinangop sub-counties were selected and 4 POs purposively selected from Kinangop and 5 from Olkalou.

Meru County is found in the eastern region of Kenya, about 225 kilometers northeast of Nairobi. According to the county livestock director, Meru has about 180,000 cows producing an average of 8-9 kgs of milk per day per cow. The county boasts of having a total of 60 POs located in its 9 sub-counties namely Imenti North, Imenti South, Imenti Central, Buuri,

Igembe Central, Igembe South, Tigania East, Tigania Central, and Tigania West. A total of 20 POs originate from Imenti South sub-county making it the main host of POs followed by Imenti Central with 14 POs and Imenti North which has 7 POs. The rest of the sub-counties have less than 5 POs per sub-county. Two sub-counties were selected in Meru; Imenti North and Imenti South because they exhibit more variation of POs in terms of activities and legal form compared to other sub-counties. A total of 13 POs were selected in Meru County. The list of the 22 POs selected is presented in Appendix A.1.

We conducted key-informant interviews with the managers or the chairpersons of the POs (the interview protocol is in Appendix A.2). All interviews were recorded, with each interview lasting for 45 to 120 minutes. For triangulation purposes, an additional 15 qualitative interviews were done with diverse stakeholders in the dairy industry (Appendix A.3). Further, observations were done which served to clarify and validate the primary interview data. In total 9 observational instances were conducted including attending meetings organized by POs, plant tours, and member farm visits (Appendix A.4). As advised by Yin (2009), the data collection procedure for observations required the researchers to record the location, the participants that were present, and a summary of the behaviors observed.

For analysis, the audio recorded interviews were transcribed and underwent a qualitative content analysis using ATLAS.ti software. During the analysis we developed a set of categories to explain the business model components of POs. Categories included concepts such as "functions in the value chain", "customers", "revenue streams" and "resources" among others. These categories were consistent with the literature on business models.

2.4 Empirical results

In this section, we present the results of our study. We identify the business model components of 22 POs using the business model framework discussed in section 2.2. From these components, we derive four business models existing in the dairy value chain in Kenya (Table 2.2). The first is a ***bargaining business model***. POs using a bargaining business model perform minimum activities in the value chain, mainly collection and bulking of produce and coordinating the selling of members' produce. Storage facilities are not provided in these organizations meaning that after collection, milk is bulked in milk cans at the roadside collection centers before it is picked by customers. Members are individual farmers, the membership size runs from tens to hundreds and the daily milk intake ranges between 200 and 15,000kg.

Two main governing bodies: the general meeting and the management committee, are present in POs using a bargaining business model. The general meeting exercises its decision rights during the PO's annual general meeting whereby members elect the management committee, approve budgets, and are informed by the management committee on the progress of their organization. The management committee is made up of two parts: 1) the executive, and 2)

the ordinary members. The executive is composed of three to five members and its role is to propose investment ideas. Ordinary members vary depending on the number of the milk collection routes and their role is to support the executive. The management committee volunteers to run the day to day activities of the POs. In rare cases, professional staff is hired to manage the business.

In terms of decision rights, the executive proposes and discusses ideas regarding investment options. The idea is then tabled to the entire management committee. Once an agreement is reached, the management committee consults the general meeting who approves or disapproves of the idea. Thus, in the bargaining business model, decision control rights reside with the general meeting, and decision management rights reside with the management committee.

POs using a bargaining business model have few revenue sources mainly from membership fees and collective selling of farm produce. Main costs are administrative. In most cases, there is no profit. More relevant to this business model is the customer segment where POs mostly sell to a single customer, that is, a processor. Customers obtain value through reduced transaction costs of collecting milk from individual smallholders while members mainly benefit from collective marketing activities, access to a reliable market, and sometimes better price particularly if the customer of the organization is a processing cooperative union. POs of the bargaining business model mostly use the self-help group legal form.

The *cooling business model* forms our second model. Unlike POs using a bargaining business model that focus on milk collection and bulking, POs using a cooling business model engage in collection, bulking, transportation, cooling, and marketing. Additional services such as credit, artificial insemination, technical training, and inputs may be available. The resources of this business model are much more than those of the bargaining business model. Physical resources are mainly land, buildings, and cooling facilities of a capacity averaging at 1,500 kg. The milk intake ranges from 600 to 17,000kg per day. Skilled employees hired in short-term contracts provide the required human resource. In some POs, information, and technology resources are made available by the use of computers, internet, and phones to enhance communication and record-keeping.

Members of POs using a cooling business model are individual farmers ranging from 3,000 to 10,000. The governance structure in this model is different from that of the bargaining business model in that two additional governing bodies called the supervisory committee and the professional staff are involved. The supervisory committee comprises three members: a chairperson, a secretary, and a member. Its main duty, as mentioned by our interviewees, is to act as a watchdog for the members by monitoring the activities of the management committee. The decision control rights are held by the general meeting while decision management rights are held jointly by the management committee and the professional staff.

Table 2.2: A typology of dairy PO business models

Business model component	Description of the component	PO business model			
		Bargaining	Cooling	Hub	Processing
Key activities	Value chain function	Collection, bulking, transportation	Collection, bulking, transportation, cooling	Collection, bulking, transportation, cooling	Collection, bulking, transportation, cooling, processing
	Services to members	Very narrow	Narrow to medium	Broad	Very broad
Members	Membership size	Very small	Small to medium	Large	Very large
	Membership type	Individuals	Individuals	Individuals	Individuals, primary cooperatives
	Suppliers of milk	Members	Members	Members, non-members	Members, non-members
Member value proposition	Value-added activities	Collection, bulking, transportation	Collection, bulking, transportation	Collection, bulking, transportation	Collection, bulking, transportation, processing
	Services such as inputs provision	Very narrow	Narrow to medium	Broad	Very broad
Customer value proposition	Value-added activities	Collection, bulking, transportation	Collection, bulking, transportation, cooling	Collection, bulking, transportation, cooling;	Collection, bulking, transportation, cooling, processed products, varied products
	Product safety and quality control	None	Low	Medium	High
Key resources	Physical assets	Very small	Small to medium	Large	Very large
	Professionals	Short-term	Short-term	Permanent	Permanent
Governance structure	Decision control	General meeting	General meeting, management committee	Management committee	General meeting, management committee
	Decision management	Management committee	Management committee, professional staff	Professional staff	Professional staff
Customer segment	Customer segment	Very narrow	Narrow to medium	Broad	Very broad
Revenue stream	Revenue source	Membership fee, sale of products	Membership fee, sale of products and services, capital contribution	Membership fee, sale of products and services, shares, capital contribution	Membership fee, sale of products and services, shares, capital contribution
Cost structure	Administrative expenses	Very low	Low	High	Very high
Legal form	Legal form	Self-help groups, cooperative	Cooperative	Company	Cooperative

Sources: Framework based on Osterwalder *et al.* (2005); Dilger *et al.* (2017); Mazzarol *et al.* (2018)

While POs using a bargaining business model mostly have a single customer, POs using a cooling business model have multiple customers including traders, unions, private, and government processors. Collection and transportation of farm produce, as well as access to knowledge and inputs at affordable prices, are important benefits for members. The value offered to customers is collective bulking of farm produce, transportation, and improved product safety and quality. The cooperative is the main legal form.

The third model is the ***hub business model***. This business model is unique as it allows POs to offer a broad range of services compared to those of POs using a bargaining of cooling business model. Apart from milk collection, bulking, transportation, cooling, and marketing, POs of this model provide services like access to artificial insemination, financial, technical training, soil analysis, health insurance, and sale of feeds. There is a higher investment in physical resources in POs using the hub business model compared to investment in organizations using a bargaining or cooling business model. The cooling tanks have a capacity of above 50,000kg and the daily milk intake is high, ranging from 12,000 to 70,000kg. POs own trucks and motorcycles that are used for product and service delivery. Proper investment in human resources is depicted by the existence of professional staff hired under a permanent contract. Professionals have different expertise such as agricultural extension, accounting, administrative among others. The offices are well developed with advanced information and technology services such as real-time data on the volume of milk collected that is made available using mobile phones.

POs that use a hub business model are made up of members, who are patrons, owners and investors, and shareholders who play the role of patrons and investors but do not participate in annual general meetings. The membership size is large (>5,000). POs introduce non-members who supply milk. A unique feature of the governance structure of POs using a hub business model is that the general meeting does not participate in decision control. Members are only informed of the decisions made by the management committee and the professional staff. Therefore, there is a complete shift of decision control rights from the general meeting to the management committee. The management committee in turn shifts decision management rights to the professional staff, who is responsible for implementation of projects.

Apart from the sale of milk and dairy-related services, additional revenue in POs adopting a hub business model is got from share capital contribution. The main costs are administrative and operational. Profits are common in this model and are mostly reinvested. Customers are many compared to those of POs using a bargaining or cooling business model and include government processors, private processors, institutions, and hotels. The value offered to members is related to access to a wide range of services and sometimes better prices while customers benefit from a reliable supply of milk, bulking, cooling, and transportation services. Customers may also benefit from low prices. POs using a hub business model adopt a company legal form.

Finally, the ***processing business model*** is our fourth model. POs using a processing business model vertically integrate into processing. The range of services provided by these POs is almost similar to those provided in the hub business model. However, food safety-related services are key here compared to POs using the three aforementioned business models. Because of carrying out processing activities, POs have larger physical, human, information, and technology, and financial resources compared to POs using a bargaining, cooling, or hub business model. The daily milk intake is high ranging from 60,000 to 160,000kg, and a processing facility of a capacity of about 150,000kg. Heavy investment in trucks and motorbikes for transportation is evident as well as cooling tanks and milk collection and storage equipment at decentralized locations. The POs using a processing business model have a feed manufacturing facility, decentralized feed stores, milk bars, and shops. POs in this model hire professional staff of different expertise permanently and have well-developed information and technological resources.

Members, who are also shareholders, can be individual farmers or primary cooperatives. The individual farmer-members total to more than 20,000. In rare cases, a private investor is introduced in a joint-venture model. The investor's role is to contribute capital to invest in the processing facility. Non-members such as large traders and self-help groups also supply milk to POs using a processing business model.

Unlike POs using a hub business model where the general meeting does not control decisions, in POs with a processing business model the general meeting and management committee hold decision control rights while decision management rights are shifted from the management committee to the professional staff. Revenue streams include sale of a portfolio of processed products, sale of feeds, share contribution, capital contribution, and sale of other services to members. Higher profits are realized in these POs compared to those using a bargaining, cooling, or hub business model. The profits can be reinvested or distributed to shareholders as dividends or to members as a patronage refund.

More customers are served in POs using a processing business model compared to those served in POs using a bargaining, cooling, or hub business model. These customers include institutions, retailers, wholesalers, supermarkets, and direct consumers. The main benefit accrued by customers is the availability of processed products while members benefit from a patronage refund and higher prices. The cooperative is the main legal form of POs with a processing business model.

2.5 Discussion of findings from a broader perspective

This paper starts from the premise that POs adopt different business models to carry out business activities competitively in modern agri-food value chains. Our findings based on the business model framework confirm this argument in that POs in Kenya choose a bargaining, cooling, hub, or processing business model. In this section, we discuss the findings from a broader perspective using the global value chain theory as presented in section 2.2.

Traditionally, horizontal coordination is the main objective of a PO where members come together to improve economies of scale and bargaining power (Michalek *et al.*, 2018). We find that such POs exist in Kenya and show the lowest upgrading mainly functional. Minimal activities are performed in the value chain, mainly coordinating the collection and bulking of members produce and selling. Low process upgrading is achieved as indicated by small volumes handled and reduction of transaction costs related to sourcing for a buyer. Membership is small, which improves interactions among members and between members and the PO to monitor the business (Tadesse & Kassie, 2017). High trust can act as an incentive for farmers to join or continue membership (Nilsson *et al.*, 2012). Given the low investments, the cost of membership is low which favors poor farmers, and thus can lead to inclusivity. However, these traditional characteristics imply that POs are likely to face problems inherent in traditional organizations in Africa including limited access to financing, weak management capacity, competition from other buyers, lack of access to inputs, and lack of information on technologies (Latynskiy & Berger, 2016). These challenges hinder upgrading efforts of POs.

As the need to increase vertical coordination and upgrading in value chains rises, POs have to change their business models. First, a functional upgrading trajectory is adopted where POs vertically integrate into other activities in the value chain. Additional services such as access to inputs, credit, and technical training are incorporated that contribute to reducing smallholder's transaction costs. Vertical integration calls for investment in physical assets, meaning that capital requirement is high. We find that POs meet the need for capital financing by increasing membership size, membership fees, introducing shares, and sometimes partnering with an external investor. Large membership size, however, means that it is difficult to control the PO in a democratic way which can lead to a loss of trust and member commitment (Nilsson, 2001). Vroegindewey *et al.* (2018) note that it is difficult to monitor and manage large and heterogeneous membership base in cereal POs in Mali. This monitoring can be on food safety issues. Moreover, inefficiencies arise when members' interests conflict with those of non-member investors who are focused on maximising profits.

Second, POs adopt a process upgrading trajectory focusing on improving compliance with food safety standards. Vertical coordination becomes key to ensure efficient flow of information and technologies related to food safety, markets and technologies between the organization and the farmers. Information flow is enhanced by managing decisions centrally

through professional staff hired by members and by using Internet and Communication Technologies (ICT). Consistent with our findings, Mishra and Dey (2018) show that Gujarat cooperative, a processing dairy PO in India adopts a decision-making system whereby decisions on price, technology, products, and practices are centrally managed. The downside of hiring professional staff is that members shift some decisions to professional staff, which can cause a principal-agent problem (Fama & Jensen, 1983).

Still, on process upgrading, our findings show that POs adopt strict food safety measures. These measures involve farm inspection, provision of access to credit for investing in food safety-related assets such as milk cans, concrete milking floors, e.t.c, and access to technical training. These measures have been emphasized in literature as key in improving food safety compliance among members of POs (Zhou *et al.*, 2019). High adoption of food safety measures among members is particularly necessary for vertical integration (Bijman *et al.*, 2011). Tighter food safety measures improve competitiveness and profitability of POs but can be costly for poor farmers who cannot invest in meeting the required standards (Moustier *et al.*, 2010; Hoffmann *et al.*, 2019). Self-selection may arise where better-off farmers that can invest in meeting the food safety requirements of buyers join POs. The literature indicates that poor farmers are excluded from agri-food value chains with tight food safety measures (Reardon *et al.*, 2019).

Third, a product upgrading trajectory involving processing of various final products, improving product quality, packaging, and branding is undertaken in POs as the need for economic upgrading increases in value chains. Processing, product differentiation, and quality improvement increase prices potentially leading to high member value proposition. Customer value proposition is also increased through products of improved shelf-life. More value for customer increases customer satisfaction which can lead to long-term relationships. While processing can add value, it is costly and needs advanced technology.

In this thesis, a processing business model is associated with highest levels of vertical integration and economic upgrading, while a bargaining business model is associated with low economic upgrading and vertical integration. Cooling and hub business models show intermediate levels of vertical integration and economic upgrading. Because of their focus on improving competitiveness in value chains, we consider POs using a processing business model as more business-oriented than POs using bargaining, cooling and hub models. POs using a bargaining business model are a typical example of a traditional organization or in other words, a less business-oriented organization.

2.6 Conclusion and implications

While most POs have been established as rural community organizations, originally providing a broad range of services to the community, they have evolved into rural businesses that now target the economic needs of their members as well as the demands of their customers (Bijman & Wijers, 2019). To understand the business activities of the PO, this paper examines the characteristics of POs from a business model perspective. The study highlights key components that should be considered when evaluating the PO business model. These include key activities, value proposition, key resources, customer segments, customer relationships, cost structure, and revenue streams, governance structure, legal form and members. Based on these business model components, four business models of POs are derived including baragining, cooling, hub and processing.

The study uses the business models derived to explain the role of POs in value chain coordination and upgrading. We show that where low coordination and economic upgrading exist in value chains, POs adopt a bargaining business model and perform traditional functions of collection and bulking to improve economies of scale. However, as the need for coordination and economic upgrading increases, POs shift to a processing business model. Such organizations vertically integrate into processing, provide additional services such as inputs and technical training, hire professional staff, improve the value proposition for members and customers and adopt strict food safety control measures. This thesis complements the study of Bijman *et al.* (2016) by showing the importance of adopting business strategies, particularly professionalization and vertical integration, in POs in competitive value chains. We conclude that POs are responsive to changes in value chain coordination and upgrading. This can have implications for investment, and thereby social inclusion and sustainability of the model.

Although we focus on POs in the Kenyan dairy value chain, the business model classification is relevant for organizations in other countries of the developing world. Dairy POs in India, for instance, employ similar functional and organizational characteristics as dairy POs in Kenya (Trebbin & Hassler, 2012; Trebbin, 2014). The typology derived in this thesis could also be extended to POs in non-dairy value chains. Previous literature suggests that POs in tea, coffee, and cereals value chains have similar characteristics in terms of governance, legal forms, and functions as dairy POs (Rondot & Collion, 2001; Shiferaw *et al.*, 2011). Like in dairy POs, non-dairy POs are formed by members and engage in different functions along the value chain including collection, bulking, cooling, and processing.

The typology can be used by managers, board members, and development practitioners to re-design POs and is also useful in formulating a business model design when establishing a new PO. For researchers, the typology is important for analyzing the impact of different POs on smallholder livelihoods and the performance of the organizations.

Our study is not without limitations. The study approach is qualitative, based on interviews and observations aimed at identifying the business models of POs. To provide further evidence, future studies could do an in-depth analysis of the evolution of business models of POs due to changing functions. A quantitative study on the performance of the different business models, for instance regarding inclusiveness and adoption of technologies, is similarly a topic that future researchers may consider.

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Appendix A

Appendix A.1: Overview of POs studied

PO code	County	Established	Registered membership	Active suppliers	Average milk intake in the wet season	Average milk intake in the dry season
B1	Nyandarua	2013	600	400	2600	800
B2	Meru	2017	60	40	400	300
B3	Nyandarua	2002	70	60	800	320
B4	Nyandarua	2014	240	800	15000	3000
B5	Meru	2013	1833	750	6100	5500
B6	Nyandarua	2014	59	30	2000	800
B7	Meru	2016	120	90	500	400
B8	Nyandarua	2008	600	250	1500	1200
B9	Meru	2014	30	27	1000	1000
B10	Meru	2013	25	20	270	200
B11	Meru	2000	400	365	2100	1900
B12	Meru	2016	495	350	2400	2000
C1	Nyandarua	1964	1350	2100	17000	10000
C2	Nyandarua	2002	15751	5927	70000	12000
C3	Meru	2017	200	150	3000	2800
C4	Meru	2013	2044	950	7800	6800
C5	Meru	1996	2200	450	4000	3200
C6	Meru	2016	527	450	3200	1400
C7	Meru	2011	253	120	1300	600
C8	Nyandarua	2009	2152	800	11000	3000
P1	Meru	1967	38*	38*	160000	90000
P2	Nyandarua	1989	21000	7551	105000	60000

B refers to the collection and bulking PO, c is the cooling PO and p is the processing PO; *members are primary POs, individual farmers in the 38 primary POs amount to 40,000

Appendix A.2: Interview protocol

1. What are the general characteristics of the PO? Talk about the legal form of the PO, when the PO was established, the current membership size, both active and total registered, the assets and milk intake, number of employees.
2. Describe the functions and services offered by the PO, focusing on economic functions.
3. How does the PO get its capital for investment?
4. How is the profit of the PO allocated?
5. Describe the organizational structure of the PO.
6. How are the decisions in the PO made? Describe how the members, the management committee, and the staff are involved in decision making regarding the purchase of assets and marketing strategies.
7. Describe the transaction arrangements between the PO and its buyer(s), talk about the contracts, pricing system, and other agreements involved.

Appendix A.3: List of stakeholders interviewed

Name	Position	Organization	Location
S1	Business Advisor	Agriterra	Nairobi
S2	Regional Business and Partnership Manager	Heifer International	Nairobi
S3	Deputy Program Leader, Policies, Institutions and Livelihoods	International Livestock Research Institute	Nairobi
S4	County Livestock Officer	Government Ministry	Meru
S5	Sub-county Livestock Officer	Government Ministry	Meru
S6	Sub-county Livestock Officer	Government Ministry	Meru
S7	Sub-county Livestock Officer	Government Ministry	Meru
S8	Sub-county Livestock Officer	Government Ministry	Nyandarua
S9	Sub-county Livestock Officer	Government Ministry	Nyandarua
S10	Sub-county Cooperative Officer	Government Ministry	Nyandarua
S11	Trader 1	N/A	Nyandarua
S12	Private processor	Lucky	Nyandarua
S13	Processor	Meru Central Dairy Farmers Cooperative Union	Meru
S14	Transporter 1	N/A	Nyandarua
S15	Transporter 2	N/A	Nyandarua

Appendix A.4. Observation units

Observation instance	Organization	Location
Cooling plant visit and office tour	C1, C7	Nyandarua
Processing plant	P2	Nyandarua
Bulking center	B1	Meru
Dairy farmers agricultural show	P1	Meru
Feed mill	C1, B9	Meru
Farmer 1	C1	Meru
Farmer 2	B9	Nyandarua

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Chapter 3

Which type of producer organization is (more) inclusive? Dynamics of farmers' membership and participation in the decision-making process

Abstract

Producer organizations (POs) provide benefits to smallholders by alleviating market access challenges. However, whether all farmers benefit from a PO is still a question. Limited evidence is available on whether POs are inclusive of poor farmers. Even if the poor join, do they participate in decision-making? We conducted interviews with 595 smallholder dairy farmers in Kenya. We distinguish three groups; members of a bargaining PO, members of a processing PO, and non-members. We show that membership is related to the structural characteristics of the organization: processing POs favor membership of farmers that are wealthier, more educated, and more innovative. As to participation in the decision-making process: older, male, and specialized farmers have a higher chance of being involved than poor farmers. Factors distinguishing farmer participation in decision-making between bargaining and processing POs are highlighted. We find that a bargaining PO is more inclusive of all groups of farmers, while women and poor farmers are excluded from decision-making in a processing PO. Our findings contribute to policymaking on inclusive development.

Keywords: inclusiveness, membership participation, dairy farmer cooperative

3.1 Introduction

Policymakers promote producer organizations (POs) as mechanisms for inclusive smallholder development in the agri-food markets of emerging economies (FAO, 2017b). POs are supported because of the increasing concentration of downstream and upstream actors in the food chain, which negatively impacts the position of the farmer in negotiating better terms of trade (Reardon *et al.*, 2019). It is argued that by acting collectively, smallholders can cope more effectively with marketing challenges, leading to improved livelihoods (Markelova *et al.*, 2009). However, from a rural development perspective, the question is whether all farmers benefit from the organization? Are the poorest farmers, that is, those with few assets, and the vulnerable groups in terms of age, gender and location included in PO membership? Even if all farmers are members, do they have an equal chance to express their interests through participation in the decision-making process? In short, are POs inclusive?

A skewed distribution of inclusion in POs presents a problem for policymakers. If the PO is not inclusive of poor and vulnerable groups of farmers, it may not be the appropriate organization to support those groups. The inclusion debate in POs revolves around two issues. First, it is about inclusiveness versus competitiveness. Some authors indicate that a PO should be selective in accepting members when seeking to strengthen its economic position (Lutz & Tadesse, 2017). In a market economy in which buyers not only impose stringent transaction conditions on smallholders, but also often change delivery requirements, POs need to adopt competitive strategies (Blanc & Kledal, 2012). However, a competitive strategy may lead to the exclusion of poor households when those farmers cannot comply with buyer requirements (Bijman & Wijers, 2019).

The second debate refers to the participation of members in the governance of the PO (Bijman *et al.*, 2014; Meier zu Selhausen, 2015). Members' participation in the decision-making process promotes accountability of PO management, which improves PO performance (Jussila *et al.*, 2012). It is argued that participation of the poor in the decision-making process has the potential of alleviating poverty (Thorp *et al.*, 2005). Do POs include the poor in the decision-making process? While in theory POs operate on the democratic principle of one-member-one-vote, in practice participation in the decision-making process may be in the hands of a few individuals (Liang & Hendrikse, 2013). If so, the interests of the non-participating farmers may not be considered, and the PO may pursue strategies that are mostly in the interest of the more resourceful farmers.

Researchers have documented the theory of inclusion and exclusion in POs, but there is surprisingly little empirical information on whether and to what extent POs are inclusive, and under what conditions they can become (more) inclusive. The objective of this paper is to provide empirical evidence on two inclusiveness outcomes: membership and involvement in decision-making. Most research on farmers' inclusion in the decision-making process has modeled various forms of participation independently (Cechin *et al.*, 2013). Our study

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contributes to the literature by employing a dynamic model that relates membership to participation in decision-making. The investigation takes the sequential nature of the different stages of participation into account; to participate in a given stage a farmer must pass the previous stage. For instance, to speak up in the Annual General Meeting (AGM), as one form of participation, a farmer must attend the AGM. In exploring the determinants of participation, we use a sequential logit model to account for the sequential nature of participation decisions.

While most studies do not make any distinction between business models of POs, we seek to understand inclusiveness patterns in different types of organizations. Because POs differ in their business models, we expect to see different inclusiveness outcomes (Kormelinck *et al.*, 2019). We consider two types of POs; the bargaining PO, which does collection and bulking and coordinates the sale of farmers' products, and the processing PO, which processes the farm products into final consumer products. Using farm-level data from 595 smallholder dairy farmers in two regions in Kenya, we answer the following research questions. What determines membership in a PO? Are these determinants different for bargaining versus processing POs? What determines participation in the decision-making process of POs? Is there a difference in factors of participation between bargaining and processing POs? Understanding the determinants of membership and of participation in decision-making is vital for designing policies for improving the inclusion of smallholders in these organizations.

In the remaining sections, we present the rationale for inclusion, followed by a description of the context and the conceptual framework in section 2. The data and methods are presented in section 3. Section 4 describes the results and discussion. In section 5 we conclude with the academic contribution, policy implications limitations, and further research.

3.2 Background

3.2.1 Rationale for inclusion in POs

The term inclusiveness is mostly used within the concept of inclusive development. Inclusive development can be defined as development that aims to reduce poverty and inequality (Gupta *et al.*, 2015). The discussion on inclusiveness can refer to different groups of disadvantaged or marginalized people. As our focus is on POs as inclusive organizations, we will particularly explore the inclusion of different types of farmers as beneficiaries of the goods and services provided by these organizations. From a development perspective, discussions on inclusion are centered on whether poor farming households have access to PO services. We define inclusion as the participation of those farmers with few land and livestock resources and those that are vulnerable in terms of age, gender, and location (Gupta *et al.*, 2015). For simplicity, we refer to both groups as the poor.

We address inclusion in POs using two dimensions suggested by Bernard and Spielman (2009b): i) membership that is inclusive of the poor, and ii) a decision-making process that represents the interests of the poor. Households make four decisions about their participation in a group (Agarwal, 2001). These include; i) nominal, or just membership, ii) passive, which relates to attending the meetings, iii) active, that is speaking up in meetings, and iv) pro-active, that is having a voice in group decisions. The latter form of participation is attained by serving on the board of the PO.

Empirical and case studies present a different picture concerning the inclusion of smallholders in POs. The literature emphasizes the incentives and barriers associated with membership as the main determinants of inclusion. Concerning the membership of vulnerable groups, Minah and Malvido Perez Carletti (2019) show that the cost of membership fees and share contribution is inversely associated with membership of female-headed households in Zambian POs. The authors indicate that by venturing into processing, the organizations accrue additional funds which are used to offer financial services to assist vulnerable members in paying membership fees. The findings contradict the common argument that higher participation costs discourage the inclusion of poor farmers (Latynskiy & Berger, 2016). Better-off farmers, that is, older, educated, socially networked, and farmers living in accessible geographical locations, are more likely to join POs in Ethiopia (Mojo *et al.*, 2017). Regarding inclusion in the decision-making process, Fischer and Qaim (2014) demonstrate that wealthier farmers benefit more from group services than poorer farmers, leading to the exclusion of the latter in attending meetings in banana groups in Kenya.

Some authors use the new institutional economics framework, particularly transaction costs economics to explain participation. Blanc and Kledal (2012) report that the balance between the time Mexican farmers spend in coordination and exchange practices in the PO, and the income received in return is unsatisfactory. What appears as benefit to some farmers, such as creating social ties and participative decision-making, is experienced as high coordination and transaction costs by others. Further, due to stringent and specific transaction conditions imposed by buyers, members of POs experience opportunistic behavior (Blanc & Kledal, 2012). Several transaction conditions lead to the exclusion of poor farmers from both membership and decision-making.

Having both men and women contributing to management and leadership can improve PO performance (Baltenweck *et al.*, 2016). Coleman and Mwangi (2013) find that improved women's participation in the decision-making process in forest organizations leads to better governance practices. Yet, women are often absent in decision-making positions in agricultural organizations because of their lack of time, unfavorable locations of meetings, women's multiple commitments and sometimes lack of interest (Pini, 2002).

POs may have good reasons not to include everyone. This is often true for organizations in which the majority of the members prioritize competitiveness over inclusiveness. When a PO chooses a competitive strategy, issues of increasing product quantity and quality, as well as increasing investment for innovation, product development and marketing, all become important (Bijman & Iliopoulos, 2014). Poor farmers may not be able to contribute to PO investment.

What is evident from this literature is that most studies focus on inclusion in terms of membership. Little effort has been made to understand inclusion in the decision-making process. Furthermore, most studies consider POs to be of one type. Recently, authors have argued that there are substantial differences in organizational structures and functionality of POs and that studies on the performance of POs should pay more attention to those differences (Bijman *et al.*, 2016; Michalek *et al.*, 2018; Zhong *et al.*, 2018). We fill a knowledge gap by providing evidence on the dynamics of inclusion of the poor in two types of POs in the Kenyan dairy sector: the bargaining and the processing PO.

3.2.2 Context: Producer organizations in Kenya

A PO is defined as a rural business, owned and controlled by producers, and engaged in collective marketing activities (Penrose-Buckley, 2007). POs play a critical role in the dairy sector in Kenya, handling about 40 percent of marketed milk (Muriuki, 2011). Most PO members are smallholder farmers (KDB, 2016), together owning over 80 percent of the dairy herd, with each cow producing 7 to 8 liters of milk per day (Kilelu *et al.*, 2018). POs in Kenya can be primary POs, with individual farmers as members, or unions, whose members are primary POs (Wanyama, 2009). They may have various legal forms: self-help group, cooperative, or producer company (Mutinda *et al.*, 2015). Dairy POs may focus on bargaining only or also do processing (Grashuis & Cook, 2013). In the following paragraphs, we provide a detailed description of the POs in our study context, using the distinction by economic function.

The bargaining PO collects, bulks, and coordinates the sale of raw milk. Membership is open, membership size is small (<500 smallholders), the daily volume intake is small (<2,000 kg) and resources are few. The legal form is typically a self-help group. The bargaining PO acts as intermediary between farmers and processors or traders. In this role, the organization improves the negotiation position of farmers in obtaining a better price and contract terms. Farmers benefit from milk collection, organized at central milk collection points close to the farm. The bargaining PO does not provide technical assistance and has only minimum quality requirements. Members receive payment for products after 35 days. The cost of membership includes a fixed membership fee of about KES 150. A fixed KES 50 per member and about KES 3 per kg of milk is deducted from the monthly milk payment to cover administrative costs.

The internal governance structure of the bargaining PO consists of a General meeting (GM) and a board. The GM convenes once a year in the AGM, where members make major decisions on a one-member-one-vote basis. During this meeting, the GM elects the board. The board sets policy directions and develops a vision for the PO. Besides the daily management activities of individual board members, the full board meets roughly once a month. The board sometimes hires staff to coordinate sales and keep records.

A processing PO does actual milk processing, either directly or in partnership with a private company. We observe two types of processing POs. The first type is a two-tier federated structure. Individual farmers form a primary PO, which collaborates with other primary POs to form a cooperative union. The union is taking care of processing on behalf of the primary POs. The second type is a joint venture between a primary PO and an investor, where they jointly own a processing plant.

Processing POs operate on a large scale, have a large membership size, ranging from 2000 to 20,000 smallholders, (indirectly) own physical assets, and take the legal form of a cooperative. As a cooperative, the PO experiences a considerable degree of government intervention, as state officials supervise cooperative elections, monitor accounts and authorize capital expenditures. The processing POs organize milk collection at the farm gate. They provide technical assistance, credit, veterinary services, and artificial insemination. Product quality is important to the extent that a processing PO has its own brand to protect. Food safety and quality checks are carried out at milk purchase, bulking, and processing points. However, product quality does not determine the price of milk, as farmers are paid only on the basis of the quantity delivered. The processing PO pays its members after 35 days. Members pay a fixed fee of about KES 500, a capital contribution of at least KES 2500 and in some cases make monthly share contributions. A monthly fee of about KES 3 per kg of milk is charged for administrative costs.

Regarding internal governance, the processing PO has a GM, a board, a supervisory committee, and a management staff. As the GM takes the major decisions during the AGM, members need to participate in this meeting. The board meets once a month to discuss current developments and future strategy. It provides oversight of the management staff, sets policy direction, and presents a vision. The board appoints the manager, who manages the day to day activities. The supervisory committee acts as the internal auditor by checking the work of the board and the management staff (Rademaker *et al.*, 2016b).

3.2.3 Conceptual framework

We now turn to the question of what factors explain farmers' inclusion in POs. Economists apply the rational decision-making model, which postulates that all costs and benefits of action can be attributed to a specific value. A rational individual will weigh the costs and benefits of membership in deciding whether to join or not. Once they are members, farmers choose how to participate in the decision-making process.

This research borrows from the study of Fischer and Qaim (2014) on the costs and benefits of participation in marketing groups. We first discuss factors of inclusion in membership, then we move to the decision-making process. Costs of membership include membership fees, share contribution, delayed payment and specific investments in producing according to the safety and quality requirements of the PO. Benefits are access to markets, technical training, inputs and credit. The costs of membership are independent of the cost of participating in the decision-making process, as members have access to services even if they do not attend meetings.

The type of PO affects farmers' membership decision. Because a bargaining PO has low investments, the membership fee is low and thus attractive for poor farmers. Given its more substantial assets, a processing PO requires a higher contribution from its members and/or even ownership of shares, which is difficult for poor farmers. If a processing PO sells under a brand name, it is necessary to guarantee quality and monitor users (Ménard, 2004).

Farmers' characteristics such as age, gender, and assets ownership, influence the costs and benefits of membership. In terms of gender, female farmers may face time and norm-related constraints, which may negatively influence their membership in collective activities (Quisumbing *et al.*, 2015). Physical assets, such as land and livestock, are important in increasing production which contributes to lower average costs of membership. Education and age increase "the ability to perceive, interpret and respond to new events" (Schultz, 1961). Although a farmer is not required to adopt improved breeds when becoming a member, access to artificial insemination and related extension is one of the advantages of membership (Twine *et al.*, 2018), and therefore farmers with improved breeds are more likely to be members. Membership in social groups, which indicates social capital, facilitates information exchange and trust-building, thereby reducing transaction costs (Fischer & Qaim, 2014). Investment in milk production requires cash to buy inputs and adopt improved breeds, which underscores the importance of access to credit. The geographical location of a farmer affects the benefits of membership. Farmers incur transportation and opportunity cost of time in milk collection activities, and these costs increase with increasing distance to the milk collection point. Regions with alternative buyers tend to have low collective action because of the higher bargaining power of individual farmers (Abate, 2018).

Farmer participation in the decision-making process is influenced by various factors. The costs involve time and money to attend meetings. In return, farmers benefit from representing their interests in the PO. Another benefit is the creation and reinforcement of networks of information exchange. The characteristics of the PO are important in influencing farmers' participation. In a bargaining PO, the number of members is small. A small membership is associated with a higher level of trust among members and their leaders, leading to higher member participation (Feng *et al.*, 2016). Being almost entirely controlled by the members, the bargaining PO requires the active participation of members in the AGM and the board. However, the cost of participation may be beyond the means of poor farmers. In processing POs, a large number of members implies a more anonymous membership. Anonymity leads to a lower level of trust among members and between members and leaders (Nilsson *et al.*, 2012). A large number of members may also imply more heterogeneity in member interests, which leads to higher costs of collective decision-making. Also, conflicts may arise due to the separation of decision rights between members and professional staff (Bijman *et al.*, 2014). Low trust, conflicting interests, and high costs entail weak incentives to become involved.

Household characteristics influence the costs and benefits of participating in the decision-making process (Weinberger & Jütting, 2001). Age, gender, physical and human assets are determining factors. Older farmers have more time to attend meetings because younger members of the household take care of the farm activities (Cechin *et al.*, 2013). Women are mostly involved in household chores and therefore have less time to attend meetings (Birchall & Simmons, 2004). The high opportunity cost of time in small dairy farms work as a disincentive to engage in PO meetings. Benefits from the PO, such as access to inputs and extension on credit, provide incentives for participation in governance (Grashuis & Su, 2018). Previous experience with collective action is important in determining present behavior (Ostrom, 2000). Experience in managing collective activities will influence farmers' willingness to participate in the decision-making process. High trust between PO members and the management reduces the transaction costs in monitoring PO management (Tadesse & Kassie, 2017). The geographical location of the farm is a determinant. Farmers living in remote areas face higher costs in engaging in collective action (Abate, 2018). Costs associated with time and transport are significant barriers to attending meetings.

3.3 Methods and data

3.3.1 The estimation techniques

Our empirical approach to examining membership in POs is modelled as a choice, given the households' social and economic characteristics. We apply the random utility framework, which states that a given household chooses to be a PO member if the utility from being a member is larger than from being a non-member. Following Field (2013), a household is hypothesized to prefer a particular sales arrangement if the utility from supplying to that sales arrangement exceeds the utility of choosing a different type of sales arrangement. A

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household has three choices; to supply to a trader, to a bargaining PO or to a processing PO. However, the sales arrangements cannot be ordered, and a household can select only one of the available choices. A multinomial logit model is employed dealing with the multiple choices that are not ordered.

Once a farmer has joined a PO, he/she is expected to participate in decision-making. In modelling farmers' participation decisions, several alternative modelling techniques such as ordered, multinomial and nested logit models can be considered, but these are not appropriate for our dataset. For example, the multinomial and nested logit models do not account for the ordering of the decision-making process. The conventional approach would be to apply an ordered probit/logit model. However, the decisions are not only ordered but also sequential. Attending the AGM (passive) is conditional on being a member (nominal), speaking up in the AGM (active) is conditional to attending the AGM (passive), and serving on the board (pro-active) is conditional on speaking up in the AGM (active). There is self-selection for each higher level of participation in the decision-making process. An ordered probit estimate would be biased since it does not take into account the conditional sequence or the self-selection involved in these decisions.

We adopt a sequential logit model as proposed by Fullerton (2009). The model explores the association between household characteristics and the PO type on the decision to move from one stage to the next. The decision to move to the next higher stage is correlated with the previous decision, and the subsequent decisions are subject to selectivity with respect to earlier decisions. A key advantage of the sequential logit model is that it clarifies previous empirical and theoretical explanations for participation by considering that decisions are driven by household characteristics and PO type at each stage. Knowing the influence of household characteristics and PO type on each stage gives a complete picture of how inequalities in participation come about, describing the disparities in the process, rather than in the outcome. However, the sequential model cannot eliminate latent variable bias that derives from an individual's unobserved motivation to participate.

3.3.2 Farm survey

We conducted a survey in Kenya between October and December 2018. Purposive sampling was used to select Meru and Nyandarua Counties, which are among the main milk sheds in Kenya (Rademaker *et al.*, 2016b). The counties have a high number of dairy POs but differ in market structure. Meru county, which is located 270km from Nairobi, has a cooperative union as the main processor. Meru is not within the immediate reach of traders in and around Nairobi, although the city itself is home to many traders. Nyandarua is located 100km from Nairobi and enjoys a high demand for milk from many processors and traders (Van der Lee *et al.*, 2018). High demand for milk comes from the urban population from nearby cities, including Nairobi, Nakuru, Naivasha, and Nyahururu.

We purposively selected one sub-county in Meru and two sub-counties in Nyandarua, targeting those having a mixed pattern of collective and individual milk marketing systems. At the sub-county level, we used stratified sampling with three strata; bargaining POs, processing POs, and non-members. We purposively selected the POs based on the accessibility and receptiveness of the PO staff. Two processing POs out of seven and one bargaining PO out of seven in Imenti-south sub-county in Meru were chosen. One processing PO operating in Kinangop and Ol-Kalou sub-county in Nyandarua was selected as it was the only one available and had members in both sub-counties. We picked one bargaining PO out of the seven present in Ol-Kalou sub-county in Nyandarua. The processing and bargaining POs selected are representative as they share similar characteristics with the population of POs in terms of size, resource capacity, and services. We used reports from the Kenya Dairy Board, Agriterra (Kagathi, 2014), and Wageningen University and Research and the FAO (Ton *et al.*, 2016) as well as journal articles (O'Brien & Cook, 2016) to verify the representativeness of our sample. Further support information was given by the government staff from the selected counties.

The biggest challenge in a cross-sectional survey is to obtain a random sample of households. We could not identify members from the PO register because the contact details of the members were either missing or not updated. To ensure a random sample, we obtained a list of milk collection routes from the POs. Enumerators followed a different route every morning. The first enumerator started to identify households at the start of the collection route. The remaining enumerators proceeded on the same route with each enumerator starting to identify households at least four kilometers from where the previous enumerator had stopped. When the first household was identified, enumerators were instructed to skip four to five households before picking the next household. Enumerators repeated this process until the targeted number of respondents was reached. For the selection of non-members, enumerators followed the routes of traders, using a similar identification procedure as for PO members. We sampled 375 PO members (112 in bargaining and 263 in processing POs) and 220 non-members. Data was collected using the one-on-one interviewing technique. The sampling procedure is summarized in Appendix B.1.

3.3.3 Variables

Our dependent variables include membership, captured by asking a farmer to indicate whether he/she is a member of a dairy PO (1=yes). Attending the AGM is determined using a Likert scale in which members rated the extent to which they agree with the following statement "I regularly attend annual general meetings" on a scale of 1 to 7, where 1 is "completely disagree", and 7 is "completely agree". Speaking up in the AGM is measured on a similar Likert scale where the following statement was asked "I always express my ideas during AGMs". Lastly, about serving on the board, a question of whether a member serves on the board is asked (1=yes).

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We draw our explanatory variables from the literature. We consider the type of PO that a farmer belongs to by using a dummy variable, where membership in a processing PO=1. About 70 percent of the members sampled belonged to the processing PO. Age, education and hired labor are used as indicators of human capital. Since we expect participation to decrease with age, we also include a squared term of age. We include a variable male as a control variable. The main physical assets in dairy households include land and livestock measured as farm size and the number of cows owned. We add cow breed, indicating whether any of the cows are pure breed as a measure of innovation adoption, and the number of hours spent in the dairy farm signifying specialization. Social capital variables include networks which are measured indirectly, by asking whether farmers are members of other groups, such as church and saving groups. Other measures are membership trust and leadership trust. We use two measures of access to credit. Access to a loan from financial providers like banks is considered to be an indicator of financial capital. Only 25 percent of the sampled farmers had access to a loan. We use access to credit from the PO, which is observed when a farmer buys feeds, extension, and veterinary services on credit terms, as a measure of the benefits of membership.

The distance to the PO office, distance to the milk collection point, terrain, county, and the number of traders are used to capture geographical location variables. A dummy variable for terrain and a dummy for the county are included. The number of traders indicates the market structure that the farmers face. The explanatory variables are summarized in Appendix B.2.

3.4 Results and discussion

3.4.1 Summary statistics of variables used in empirical analysis

Table 3.1 presents the basic summary statistics of variables used in the empirical analysis. Slightly over 60% of the households belong to a PO, with most households being members of a processing PO. Male farmers represent 50% of the members. On average, member households have high trust in other members and leaders. Regarding farm characteristics, the households represent smallholder dairy farmers owning 2 cows and on average less than 4 acres of a farm.

Table 3.1: Summary statistics of variables used in empirical analysis

Variable	Mean	Standard deviation	Minimum	Maximum	Observations
Dependent variables					
Membership	0.63	0.48	0	1	595
Attending the AGM	4.61	2.51	1	7	375
Speaking up in the AGM	4.10	2.47	1	7	375
Serving on the board	0.08	0.27	0	1	375
Processing PO	0.70	0.45	0	1	375
Independent variables					
Age	49.11	13.24	22	96	595
Education	9.37	3.53	0	20	595
Hired labor	0.42	0.42	0	1	595
Male	0.50	0.50	0	1	595
Farm size	3.61	1.06	0.13	120	595
Number of cows	2.22	1.81	1	20	595
Hours spent in dairy	3.62	2.18	0	12.25	595
Pure breed cow	0.52	0.50	0	1	595
Group membership	0.63	0.48	0	1	595
Access to loan	0.25	0.43	0	1	595
Distance to the PO's office	7.05	7.63	0.01	35	595
Distance to the milk collection point	0.74	1.85	0	22	595
Hilly terrain	0.54	0.50	0	1	595
Nyandarua County	0.53	0.50	0	1	595
Number of traders	4.97	1.89	1	7	595
Membership trust	5.75	1.15	1	7	375
Leadership trust	5.67	1.43	1	7	375
Credit from PO	3.77	2.65	1	7	375

3.4.2 Household characteristics of members and non-members

We present the statistical differences between members of bargaining and processing organizations and non-members, and between members of bargaining and processing POs (Table 3.2). Both members of bargaining POs and processing POs are more likely to be man, older and with hired labor compared to non-members. In addition, members of a processing PO are likely to be more educated, own pure breed cows and are located close to the milk collection point compared to non-members. Ownership of improved breeds and hiring of farm workers indicate entrepreneurial behavior. Some distinctions can be seen between members of bargaining and processing POs. Members of a processing PO have a significantly higher level of education and are located in less remote areas implying that they have fewer constraints in accessing information.

Which type of producer organization is (more) inclusive?
Dynamics of farmers' membership and participation in the decision-making process

3

Table 3.2: Statistical differences of household characteristics between members and non-members

Variable name	Non-members (1) N=220		Bargaining PO (2) N=112		Processing PO (3) N=263		t-test (2)-(1)	t-test (3)-(1);	t-test (3)-(2)
	Mean	SD	Mean	SD	Mean	SD	t value	t value	t value
Age	47.28	14.22	51.29	13.28	49.72	12.20	2.483**	2.034**	-1.106
Male	0.44	0.50	0.56	0.49	0.52	0.50	2.184**	1.854*	-0.737
Hired labor	0.32	0.47	0.50	0.50	0.46	0.50	3.181***	3.096***	-0.707
Education	8.85	3.53	9.16	3.74	9.90	3.37	0.732	3.327***	1.881*
Pure breed cow	0.45	0.50	0.51	0.50	0.59	0.49	0.937	2.890***	1.369
Hours spent in dairy	3.23	1.93	3.96	2.32	3.80	2.27	3.025***	2.935***	-0.616
Number of cows	1.76	1.19	2.40	1.23	2.52	2.32	4.555***	4.384***	0.513
Farm size	3.33	10.05	3.43	2.83	3.92	4.89	0.099	0.819	1.000
Group membership	0.63	0.48	0.57	0.50	0.67	0.47	-0.984	0.873	1.735*
Nyandarua County	0.55	0.50	0.52	0.50	0.51	0.50	-0.476	-0.704	-0.081
Distance to the milk collection point	1.12	2.69	0.65	0.88	0.44	1.09	-1.712*	-3.756***	-2.005**
Distance to the PO office	6.80	8.55	3.91	4.63	8.60	7.43	-3.341***	2.472**	6.188***
Hilly terrain	0.57	0.50	0.60	0.49	0.49	0.50	0.444	-1.889*	-1.984**
Number of traders	5.56	1.61	4.71	2.18	4.60	1.86	-4.040***	-6.021***	-0.491
Access to loan	0.10	0.29	0.25	0.43	0.37	0.48	3.824***	7.326***	2.243**
Credit from PO			3.44	2.65	3.91	2.64			1.592
Membership trust			5.84	1.25	5.71	1.12			-1.017
Leadership trust			5.79	1.47	5.62	1.41			-0.983

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively; SD means the standard deviation

3.4.3 What determines membership in POs?

Table 3.3 presents the determinants of membership in a PO. The goodness-of-fit tests indicate that the selected covariates provide good estimates of the conditional density of membership. The explanatory variables are jointly statistically significant (LR $\chi 2$ test statistic= 177.910; p=0.000). We explain the average marginal effects. An additional laborer on the dairy farm increases the likelihood of membership in a bargaining PO by 7.5 percentage points compared to non-membership. Owning a pure breed cow increases the chances of joining a processing PO by 8.8 percent, indicating a higher ability to innovate. Additionally, a farmer with more cows is likely to be a member of a processing PO versus being a non-member. The results point to the importance of assets. A large dairy farmer faces higher transaction costs, thus needs assurance of having a buyer (Pascucci *et al.*, 2011).

Table 3.3: Multinomial logit results for determinants of membership

Variables	Bargaining PO Coefficient (SE)	Processing PO Coefficient (SE)	Non-membership Marginal effects (SE)	Bargaining PO Marginal effects (SE)	Processing PO Marginal effects (SE)
Age	0.104* (0.060)	0.112**(0.053)	-0.024**(0.011)	0.007 (0.009)	0.018 (0.012)
Age squared	-0.001 (0.001)	-0.001*(0.001)	0.000**(0.000)	0.000 (0.000)	0.000 (0.000)
Male	0.193 (0.268)	-0.063 (0.229)	-0.004 (0.047)	0.038 (0.039)	-0.034 (0.050)
Education	0.024 (0.038)	0.089***(0.033)	-0.015**(0.007)	-0.004 (0.005)	0.020***(0.007)
Hired labor	0.640**(0.279)	0.336 (0.241)	-0.095**(0.048)	0.075*(0.041)	0.020 (0.051)
Pure breed cow	0.019 (0.259)	0.366*(0.219)	-0.057 (0.045)	-0.032 (0.038)	0.088*(0.047)
Hours spent in dairy	0.156**(0.063)	0.127**(0.055)	-0.030***(0.012)	0.014 (0.009)	0.017 (0.011)
Number of cows	0.200*(0.102)	0.218**(0.095)	-0.047**(0.021)	0.012 (0.011)	0.035**(0.017)
Group membership	-0.307 (0.267)	0.269 (0.233)	-0.017 (0.048)	-0.079*(0.041)	0.096*(0.049)
Distance to the milk collection point	-0.130 (0.087)	-0.382***(0.100)	0.067***(0.019)	0.015 (0.014)	-0.082***(0.023)
Hilly terrain	-0.087 (0.273)	-0.856***(0.233)	0.134***(0.046)	0.067*(0.038)	-0.201***(0.048)
Number of traders	-0.277***(0.073)	-0.373***(0.064)	0.076***(0.013)	-0.010 (0.010)	-0.066***(0.013)
Access to loan	0.969***(0.337)	1.518***(0.289)	-0.260***(0.043)	-0.005 (0.041)	0.265***(0.050)
Constant	-3.618**(1.627)	-2.845**(1.39)	-	-	-
Observations	595				
LR $\chi 2$ test statistic	177.910				
P value	0.000				

The base outcome for multinomial logit is non-membership; *, **, and *** denote significance at the 10%, 5%, and 1% level; SE is the standard error

The distance to a milk collection point is not associated with the decision to be a member of a bargaining PO, but it does explain the decision to join a processing PO. Consistent with Ngeno (2018), a one unit increase in the distance decreases the chance of joining a processing

PO by 8.2 percentage points. The strong negative relationship could be explained by the increasing cost of transportation.

Our findings, consistent with Abdul-Rahaman and Abdulai (2018), show that having access to loans increases the chance of a farmer to be a member of a processing PO over non-membership. Access to finance helps farmers to procure inputs. In this regard, a processing PO seems to exclude the poor.

So far, we have shown which variables influence membership in a PO as opposed to non-membership. However, the factors of membership in a processing PO versus a bargaining PO have not been compared. A post estimation of the multinomial logit using the likelihood ratio test helps us to see this relationship (Appendix B.3). Highly educated farmers are more likely to join a processing PO than a bargaining PO. The processing PO supplies to modern agri-food chains that have relatively higher food safety and quality standards (Ledo *et al.*, 2019); knowledgeable farmers are better able to comply with the production and delivery requirements. Additionally, educated farmers could be more receptive to technologies and innovations of a processing PO. Group membership increases a farmer's chance to join a processing PO as opposed to a bargaining PO. Having more social networks increases access to information which is important for managing the farm.

Farmers who are situated far from the milk collection point and located in hilly terrain have a lower likelihood of being members of a processing PO compared to a bargaining PO. Remote location often implies high transaction costs, which are not compensated by the margin received if the farmer is to join a processing PO. Our results corroborate the finding of Hung Anh and Bokelmann (2019) on the determinants of market preferences among smallholder coffee farmers in Vietnam. Access to loans, which indicates financial capability, significantly distinguishes between membership in a processing PO versus a bargaining PO. The role of geographical and financial factors underscores the importance of costs in a farmer's decision to join a PO.

3.4.4 Participation in the decision-making process

We construct the dependent variable of participation for estimating the sequential logit model as follows. Likert scale variables measuring "attendance to the AGM" and "speaking up in the AGM" are dichotomized into 1=a farmer attends the AGM, and 1=a farmer speaks up in the AGM, respectively. The responses "completely disagree" and "mostly disagree" are allocated the value of 0 while the other responses are allocated the value of 1. After dichotomization, we create the participation variable following the conditional sequential restriction. Hence, simple membership=1, attending the AGM=2 (conditional to being a member), speaking up in the AGM=3 (conditional to attending the AGM) and serving on the board=4 (conditional to speaking up in the AGM). We acknowledge that the dichotomization of the Likert variables may lead to a loss of information (Royston *et al.*, 2006). However, as MacCallum *et al.*

(2002) note, dichotomization is justified if the distribution of the response is skewed so that there is a large number of observations in the extremes of the scale, as is in our case (see Appendix B.4 and B.5).

We then estimate the sequential logit model of factors associated with farmers' participation in the decision-making process. The sequential logit model estimates three decisions. The first decision is between "simple membership versus attending the AGM or more"; the second decision is the choice between "attending the AGM versus speaking up in the AGM or more" while the third decision relates to "speaking up in the AGM versus serving on the board". First, we model the sequential logit on the full sample using membership in the processing PO as one of the independent variables to test whether the type of PO is associated with participation (Appendix B.6). The model output shows some variance in the three stages of participation, which is an indication of the correlation between stages. Therefore, we cannot consider the participation stages as being independent, which supports our decision to use a sequential logit model. The model is highly significant, as shown by the p-value. Further, the robustness of the sequential logit model is shown by the Akaike Information Criterion (AIC). Lower values of AIC signify a better fit model (Cameron & Trivedi, 2005). Based on this test, we prefer the sequential logit model (AIC=692.54) over the multinomial logit (AIC= 700.44).

In line with the theory, membership in a processing PO reduces the likelihood of speaking up in the AGM compared to membership in a bargaining PO. We link this to the tiered structure of the PO, where members have less influence as the union decides on many issues. The alternative organizational structure of joint ownership of the processing plant between members and a private investor has similar implications because members may have less control as the private partner takes most decisions. The reduced members' control and separation of decision rights weaken members' incentives to express opinions (Bijman *et al.*, 2013).

Besides, members of a processing PO have a lower probability of serving on the board. From our observations, there are delivery requirements to be met, such as a minimum quantity of milk, for a farmer to qualify as a board member of a processing PO. Most farmers are too small to meet the requirements. Additionally, the political interference of the local government can explain low participation in the management of processing POs. Previous research relates low member participation in African POs to high state interference, where PO support is framed in political interests as opposed to member interests (Wanyama, 2013; Wedig & Wiegratz, 2018).

Knowing that membership in a PO affects participation is not sufficient for understanding participation dynamics. Table 3.4 presents the factors that determine farmers' participation in bargaining and processing POs. Age is not important in explaining farmers' participation in the decision-making process in a bargaining PO, but it positively and significantly relates to a farmer's decision to serve on the board of a processing PO. The culture of respecting seniors

may contribute to having older members serving on the board. Cechin *et al.* (2013) further suggest that farmers, as they get older, may seek to pursue political careers through cooperatives. Given that age squared is significant in influencing the decision to serve on the board of a processing PO, very old and very young farmers are excluded. Maybe, very young farmers have not yet built up the social capital necessary to become elected.

Even though gender is not significant in influencing membership in a processing PO, once farmers join, women are excluded from the decision-making process. National culture may affect the willingness of men to accept a woman's contribution. As noted by Grillos (2018), while women in Kenya are more likely to attend community decision-making meetings, they are not likely to speak at those meetings. Additionally, farmers require time to seek knowledge to make meaningful contributions to the AGM's discussions. Bryceson (2019) study in sub-Saharan African countries shows that rural women have longer working hours with less flexibility for reducing their labor input compared to men. Due to these constraints, women view organizational labor as a burden on their time, which limits their ability to fully participate in PO governance (Lyon *et al.*, 2016).

Large farmers are more advantaged for participating in the decision-making process in a processing PO than in a bargaining PO as they are likely to attend the AGM, speak up in the AGM and serve on the board of the processing organizations. The lower probability of participation of small farmers could partly be because of their expected lower marketable surplus, which in turn makes the benefit from participation only marginal. While access to credit from the PO does not relate to the farmers' decision to participate in the bargaining PO, this factor positively relates to the decision to attend the AGM and serve on the board of a processing PO. Perhaps more importantly, results suggest that having access to credit from the PO increases the benefits to farmers motivating them to be involved. Gyau *et al.* (2016) found that the intensity of participation in group activities among avocado farmers in Kenya depends on the farmer's perceived economic benefits of the group.

Consistent with Barraud-Didier *et al.* (2012) and Tadesse and Kassie (2017), the relationship between farmers' leadership trust and their participation in POs is positive and significant. Trust increases a member's chance to attend the AGM of a bargaining PO and to speak up in the AGM of a processing PO. Membership in other groups positively correlates with farmers' decision to attend the AGM, speak up in the AGM and serve on the board of a processing PO. Groups are platforms for information exchange. Farmers who belong to other groups are likely to participate actively, probably because they are more outgoing or see more benefits in building social capital.

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Table 3.4: Determinants of participation in decision-making in bargaining and processing POs

	Bargaining PO			Processing PO		
	Simple membership vs attending the AGM, speaking in the AGM and serving on the board	Attending the AGM vs speaking in the AGM and serving on the board	Speaking in the AGM vs serving on the board	Simple membership vs attending the AGM, speaking in the AGM and serving on board	Attending the AGM vs speaking in the AGM and serving on the board	Speaking in the AGM vs serving on the board
Variables	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
Age	0.115 (0.132)	0.442 (1.228)	0.091 (0.255)	0.034 (0.101)	0.079 (0.165)	1.089**(0.447)
Age squared	-0.001 (0.001)	-0.002 (0.012)	-0.001 (0.002)	-0.000 (0.001)	-0.001 (0.002)	-0.010**(0.004)
Male	-0.679 (0.594)	1.391 (1.922)	1.249 (1.064)	1.104***(0.370)	1.179*(0.625)	0.937 (0.787)
Hired labor	0.88 (0.606)	0.875 (1.803)	1.395 (1.063)	0.079 (0.412)	0.413 (0.653)	2.214**(0.944)
Education	0.017 (0.077)	0.574 (0.436)	-0.235*(0.131)	0.012 (0.055)	0.079 (0.084)	-0.074 (0.129)
Pure breed cows	2.09***(0.666)	-0.657 (1.795)	0.797 (1.038)	0.277 (0.350)	-0.425 (0.642)	-0.382 (0.821)
Number of cows	0.645**(0.280)	-0.228 (0.872)	0.602 (0.461)	0.231*(0.131)	-0.051 (0.107)	0.310***(0.118)
Farm size	-0.23**(0.113)	0.059 (0.485)	-0.089 (0.168)	-0.030 (0.037)	0.342**(0.156)	-0.684*(0.367)
Distance to PO office	-0.006 (0.069)	-0.063 (0.236)	-0.395 (0.378)	-0.034 (0.035)	0.216***(0.076)	-0.178 (0.175)
Nyandarua County	-2.34***(0.720)	-1.058 (2.310)	-1.324 (1.335)	-2.451***(0.584)	-3.012***(0.935)	0.800 (1.895)
Credit from PO	0.039 (0.110)	0.321 (0.444)	0.01 (0.207)	0.198***(0.066)	0.173 (0.111)	0.302*(0.173)
Membership trust	0.27 (0.242)	1.973**(0.933)	0.472 (0.586)	-0.016 (0.160)	0.397 (0.257)	0.256 (0.450)
Leadership trust	0.607***(0.225)	0.446 (0.922)	1.097 (0.809)	0.365***(0.133)	0.400**(0.236)	0.126 (0.334)
Group membership	0.878***(0.543)	4.556 (3.061)	2.614**(1.229)	0.676*(0.373)	2.021***(0.631)	2.628**(1.277)
Constant	-8.447 (4.188)	-34.584 (37.029)	-15.402 (8.376)	-3.151 (2.678)	-9.493**(4.752)	-37.415***(13.689)
Observations	112	74	67	263	179	158
Variance (SE)	0.200 (0.028)	0.002 (0.006)	0.009 (0.011)	0.198 (0.017)	0.076 (0.026)	0.003 (0.004)
P value	0.000			0.000		

Figures in parenthesis are the standard errors; * , ** , and *** denote significance at the 10%, 5%, and 1% level; SE is the standard error

3.5 Conclusion

3.5.1 Academic contribution

An increasing number of studies document the benefits of POs in terms of improving smallholders' welfare (Mojo *et al.*, 2017; Ngeno, 2018). However, the question of whether all farmers in an area where the PO operates benefit from the organization has not been addressed. This study looks at the inclusion of farmers in bargaining and processing POs. We examine inclusion in membership and participation in the decision-making process. Based on the analysis of 595 smallholder dairy farmers in Kenya, we find that farmers are more likely to be members of a bargaining PO if they have hired labor and live in remote locations. Farmers who are more educated, own pure breeds, and have a large number cows are likely to belong to a processing PO. These factors indicate an entrepreneurial behavior that is likely to be present among members of a processing PO. Furthermore, farmers who are located in less remote areas are more likely to be members of a processing PO.

The relationship between membership in a processing PO and participation in decision-making is negative. Members of a processing PO are less likely to speak up in the AGM or to serve on the board. We find that farm assets such as ownership of pure breed cows, number of cows and farm size are positively associated with attending the AGM of a bargaining PO, implying that poor farmers are excluded from these meetings. Young farmers and women are likely to be excluded from the decision-making process of a processing PO. Likewise, the probability of small farmers and those with low social capital to participate in the processing PO is low.

This study contributes to the research on the inclusiveness of POs. First, our study extensively assesses farmers' membership decisions and their participation in the decision-making process, particularly in the context of African countries. We show that studying inclusion in membership is necessary but not sufficient in explaining farmers' involvement in POs. To promote inclusion, it is important to consider participation in the decision-making process. For instance, this study indicates that although men and women have an equal chance of joining a PO, the decision-making process excludes women.

Second, the relationship between the type of PO and farmer participation in decision-making is an important aspect of this study. Being a member of a bargaining PO is positively associated with participation which implies that this PO considers the interests of a wide range of members. On the contrary, a member of a processing PO is less likely to be involved in the decision-making process. Processing POs often strengthen the autonomy of the professional staff and reduce member influence on operational decisions (Bijman & Iliopoulos, 2014).

Third, we contribute to the debate on the representation of the interests of different sections of a community in POs (Bernard & Spielman, 2009b). We have shown that older, male, specialized farmers with a high level of trust are more likely to participate in the decision-making process. Our study points towards the exclusion of the poor, in terms of physical and social capital, and of women farmers from the decision-making process. A discerning contribution of this paper is the establishment of factors that distinguish farmers' participation in bargaining and processing POs. Previous studies did not make this distinction. We add to the broader debate about the inclusiveness versus competitiveness objectives of farmer organizations (Lutz & Tadesse, 2017). We show that a bargaining PO is more inclusive of poor farmers, but a processing PO favors membership of entrepreneurial farmers. The latter are better able to adapt to the strict delivery conditions of a processing PO. The situation observed in this study is in line with Lutz and Tadesse (2017): community-oriented organizations are more inclusive while entrepreneurial organizations are more selective.

3.5.2 Policy implications

Development agencies and policymakers increasingly support POs as institutions for improving smallholder participation in the modern agri-food value chain. POs are expected to compete with other buyers by capitalizing on economies of scale and bargaining power. The competition requires growth of POs either horizontally, thus focusing on bargaining power, or through vertical integration into processing. In Kenya, both the national and the county governments have increased funding to POs to make them shift from bargaining to processing (Rademaker *et al.*, 2016a). However, we show that the focus on a vertical integration strategy leads to the exclusion of poor farmers. Our results suggest that for inclusion of different groups of farmers, POs should focus on bargaining only.

Our second policy recommendation is on farmers' participation in the decision-making process. We argue that policies supporting the participation of all groups of farmers, in an equitable way, may produce broader benefits to the organization and the participants. It has been reported that including the poor in groups can provide a route out of chronic poverty (Thorp *et al.*, 2005). Based on this, we suggest that wherever possible, decision-makers in POs could pay attention to the needs and interests of those farmers that may not be able to participate adequately. Policies to support higher and equal participation could focus on lowering the costs of participation for the poor, and on considering women's workload in setting the location and times for PO meetings. Women's confidence in speaking in meetings may be enhanced by strengthening participatory methods (Pandolfelli *et al.*, 2008), including organizing a separate meeting for women.

3.5.3 Limitations and further research

The main limitation of our study is that we consider only two types of POs. Other types, such as dairy hubs, are not included because of financial and time constraints. Those other models could perhaps provide a different picture of farmers' inclusion. Besides, we do not directly predict the causal relationship between social and economic characteristics of farmers and membership or participation in POs because of the limitations of the empirical models used. The POs were purposively selected, which means that we need to be careful about making broader recommendations.

We do not capture the role of farmers' personal motives, like political ambitions, in influencing decisions to join POs and participate in the decision-making process. These factors have been considered important for participation in cooperatives in Europe (Kronholm & Wästerlund, 2013; Morfi *et al.*, 2018). Our study focuses on POs in Kenya. Since the characteristics of smallholders in Kenya are similar to other East African countries (Jayne *et al.*, 2016), this study may be used to understand PO development in East Africa. Generalization of the findings to other regions may not be applicable as contexts may differ. To support the debate on inclusion, we encourage future studies to assess the impact of the inclusion of the poor and women in the decision-making process on the performance of POs.

As suggested by one of the reviewers, our findings could also be relevant for producer organizations in the European Union context. The new EU policy to promote POs to help farmers gain a stronger bargaining position also gives rise to the question of which farmers will be included, and whether processing cooperatives are more or less inclusive compared to (new) bargaining POs. This is another opportunity for further research.

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Appendix B

Appendix B.1 Sampling procedure
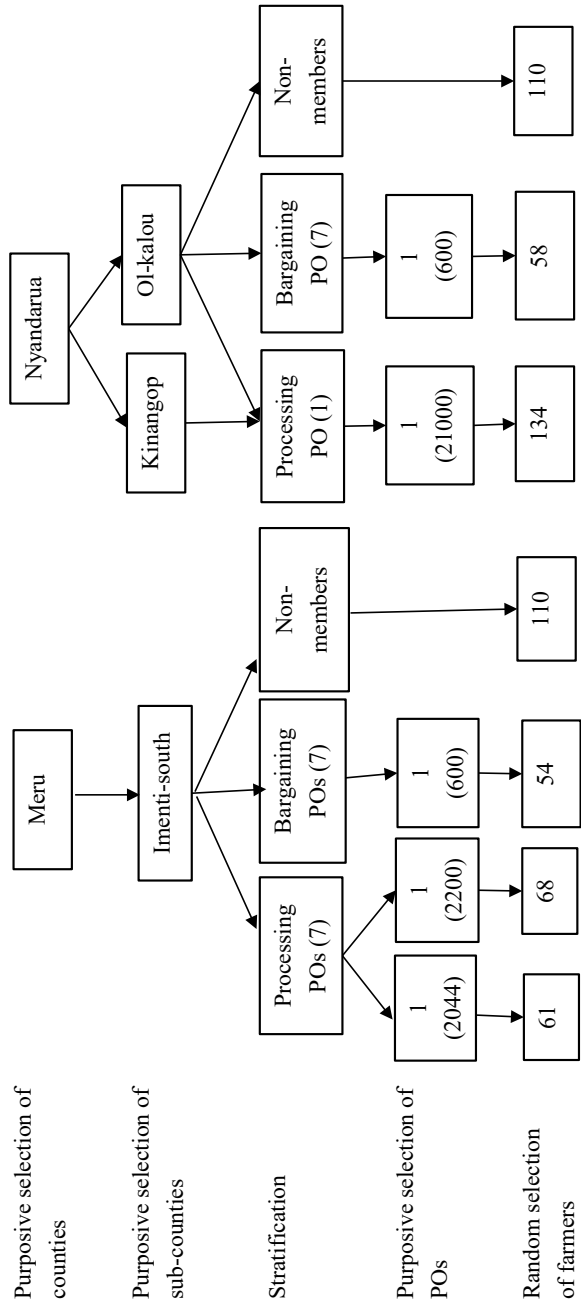
Appendix B.2: The definition of variables used for analysis

Variable	Description
Dependent variable	
Membership	Whether a farmer is a member of a PO=1, 0=otherwise
Attending the AGM	I regularly attend the annual general meetings
Speaking up in the AGM	I always express my ideas during AGMs
Serving on the board	Whether a farmer serves on the board=1,0 otherwise
Processing PO	Whether a farmer is a member of a processing PO=1, 0=bargaining PO
Independent variables	
Age	Age of the farmer in years
Education	Number of years of formal schooling of the farmer
Hired labor	Whether the household has a part-time or a full-time farm worker=1, 0 otherwise
Male	If the farmer is male=1, 0 otherwise
Farm size	The total size of the farm in acres
Number of cows	The total number of cows owned by the farmer
Hours spent in dairy	The average number of hours the farmer spends on dairy activities in the previous day
Pure breed cow	Whether any of the cows are pure breed=1, 0 otherwise
Group membership	Whether the farmer belongs to another group apart from a dairy group=1, 0 otherwise
Membership trust	Members of this PO trust each other (1=completely disagree, 7=completely agree)
Leadership trust	I trust the management capability of our PO leaders (1=completely disagree, 7=completely agree)
Access to loan	Farmer accessed loan from a financial service provider in the past year=1, 0 otherwise
Credit from PO	If a farmer accessed credit from the PO in the past year (1=completely disagree, 7=completely agree)
Distance to the PO's office	Distance to the PO's office in kilometers
Distance to the milk collection point	Distance to the nearest PO milk collection point in kilometers
Hilly terrain	The terrain of the farmer's village is hilly=1, 0 otherwise
Nyandarua County	Whether a farmer lives in Nyandarua County=1, 0 otherwise
Number of traders	In this village, there are many milk traders (1=completely disagree, 7=completely agree)

Appendix B.3: Factors distinguishing membership in a processing PO versus a bargaining PO

	Processing PO vs bargaining PO	
Variables	B	z
Age	0.007	0.118
Age squared	-0.000	-0.169
Male	-0.256	-0.998
Education	0.064*	1.799
Hired labor	-0.303	-1.176
Pure breed cow	0.347	1.412
Number of cows	0.018	0.292
Hours spent in dairy	-0.029	-0.527
Group membership	0.576**	2.272
Distance to the milk collection point	-0.252**	-2.397
Hilly terrain	-0.769***	-2.996
Number of traders	-0.096	-1.524
Access to loan	0.549**	2.066

b = raw coefficient; z = z-score for test of b=0; *, **, and *** denote significance at the 10%, 5%, and 1% level

Appendix B.4: Likert scale response on attending the AGM

N=375

3
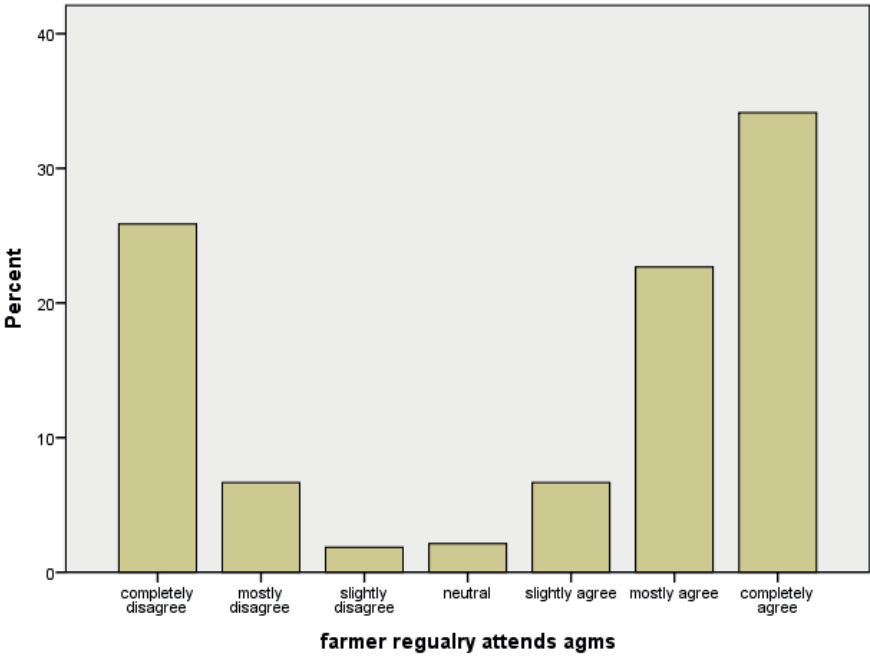
Appendix B.5: Likert scale response on speaking up in the AGM

N=375

farmer expresses his/her ideas during meetings

Appendix B.6: Determinants of participation in the decision-making process

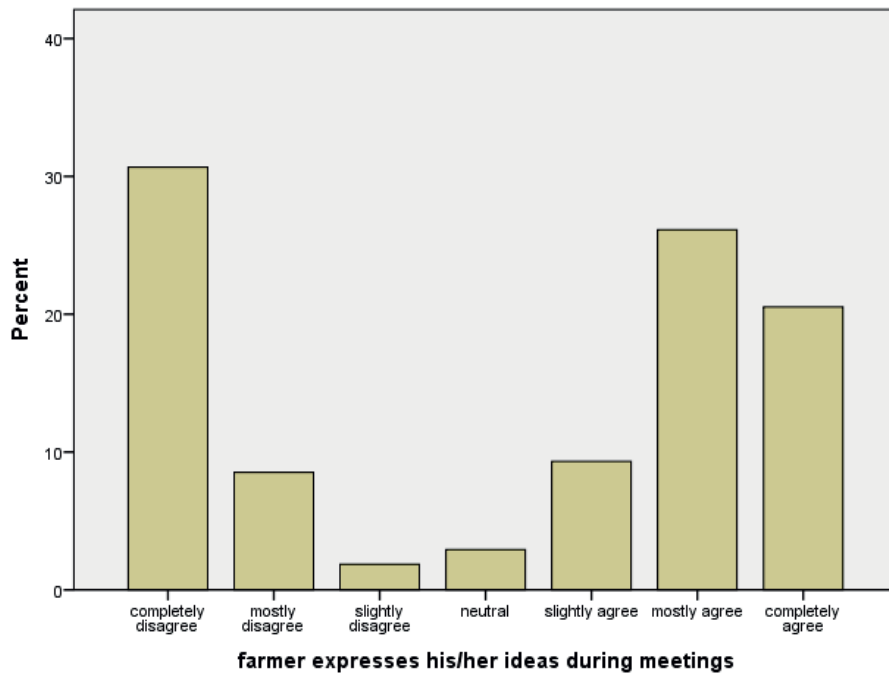| Variables	Simple membership vs attending the AGM, speaking up in the AGM and serving on the board		Attending the AGM vs speaking up in the AGM and serving on the board		Speaking up in the AGM vs serving on the board	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Processing PO	0.186	0.333	-1.656**	0.655	-1.327**	0.559
Age	0.102	0.069	0.102	0.135	0.383**	0.171
Age squared	-0.001	0.001	-0.001	0.001	-0.003**	0.002
Male	0.507*	0.288	1.138**	0.516	1.024*	0.549
Hired labor	0.238	0.314	0.023	0.536	1.467**	0.583
Education	0.008	0.041	0.116	0.074	-0.111	0.073
Pure breed cows	0.812***	0.285	-0.491	0.542	0.191	0.543
Number of cows	0.271**	0.113	-0.039	0.1	0.217**	0.096
Farm size	-0.056	0.037	0.277**	0.129	-0.147	0.124
Distance to PO office	-0.025	0.026	0.118**	0.055	-0.23	0.148
Nyandarua	-2.183***	0.407	-1.820***	0.7	-1.175	0.868
Credit from PO	0.133**	0.052	0.112	0.092	0.153	0.105
Membership trust	0.031	0.121	0.523**	0.21	0.242	0.311
Leadership trust	0.380***	0.106	0.384*	0.207	0.394	0.319
Membership in groups	0.638**	0.29	2.066***	0.545	1.67**	0.674
Constant	-5.122***	1.965	-9.005**	3.97	-17.067***	5.443
Observations	375		238		206	
Variance	0.207	0.013	0.071	0.021	0.010	0.009
P value	0.000					

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively; SE is the Standard Error

Chapter 4

Do producer organizations empower women? Analyzing the effect of smallholder membership

Abstract

In developing countries, women's empowerment is increasingly promoted for rural development, and producer organizations (POs) are considered as an important means for achieving this empowerment. On the one hand, POs increasingly target women in developing countries with an expectation that having access to the organization's services and resources advances women empowerment. On the other hand, increased commercialization through membership results in a shift of control over the farm to men thereby reducing women empowerment. We use quantitative data from dairy smallholders in Kenya to contribute to the discussion about PO membership and women empowerment. Applying the Women Empowerment Livestock Index (WELI) tool, we capture six dimensions for measuring women empowerment namely (1) decisions about agricultural production; (2) decisions related to nutrition; (3) access to and control over resources; (4) control over and use of income; (5) access to and control over opportunities; and (6) workload. We find that joining a PO, regardless of whether the man or the woman in the household is the registered member, increases women's control over production decisions, buying and selling of land and cows, use of loans and receiving dairy income. Distinguishing the membership effect by the gender of membership, there is stronger women empowerment when the woman in the household is a member compared to when the man is a member. Regarding the type of PO, we find that woman membership in bargaining POs results in greater empowerment, in terms of ownership of cows and decision-making on buying and selling of cows, than woman membership in processing POs. The paper suggests that there is a relationship between the functional characteristics of POs and women empowerment.

Keywords: women empowerment; decision-making; producer organizations; smallholder membership; Kenya

4.1 Introduction

More than twenty years have passed since 1995's World Beijing Conference on Women that placed a focus on closing the gender gap. However, gender inequalities persist around the world, particularly in rural areas of developing countries (Duflo, 2012; Jayachandran, 2015). Women in Sub-Saharan Africa have unequal access to economic opportunities (UN-Women, 2020) and have less control over key production resources such as land and livestock (Quisumbing *et al.*, 2015; Ragsdale *et al.*, 2018). Empowering women can improve food security, reduce rural poverty and improve nutrition and health as suggested by the CGIAR (CGIAR-IEA, 2017), the United Nations (UN, 2016) and The World Bank (World-Bank, 2012a). According to FAO (2011), if women have equal access to production resources and services as men, they can increase production on their farms by 20–30%. Furthermore, women's participation in agricultural development benefits families and generations. Impact evaluations of a homestead food production project in Bangladesh and Nepal show that women's control over production decisions and income increases their decision-making power regarding children's health and nutrition (HKI, 2010).

As women empowerment is increasingly seen as a pillar for sustainable economic development and social well-being, alternative models to development that support women's participation in agriculture are needed. Producer organizations (POs) are promoted as an important entry point for rural development (ILO, 2014). Guided by values of self-help, equality, and equity, as well as economic growth through cooperation, the business model of cooperatives can facilitate women empowerment (Manchón & Macleod, 2010; Burchi & Vicari, 2014). However, by improving access to markets and technologies, membership in POs results in commercialization of smallholder farming, leading to women disempowerment because men take over control of the farm (Quisumbing *et al.*, 2015; Johnson *et al.*, 2016; Achandi *et al.*, 2018). PO membership is further associated with participation in formal activities like training and meetings, which increase women's workload because of their other responsibilities to care for farm and family (Ragasa *et al.*, 2013; Lyon *et al.*, 2016). These mixed findings could be because the authors ignore the diversity of POs and membership.

The effect of membership on women empowerment may vary depending on gender, i.e. whether the man or the woman is the member. Providing member households with access to resources and technologies does not directly translate into women's control and benefit (FAO, 2015). In Ethiopia, women in households participating in apple cooperatives have low bargaining power because of men's control over the apple business (Alemu *et al.*, 2018). However, when women become members of a PO, they gain an opportunity to participate in modern dairy markets, a domain that has largely been dominated by men (Quisumbing *et al.*, 2015). The improved economic status enhances women's bargaining power in the household. Fischer and Qaim (2012a), based on survey data from small-scale banana producing farmers

in Kenya, show that women membership in banana groups has a positive effect on gender equality and female-controlled income share.

Recently, a growing number of scholars are becoming interested in how the type of PO enables rural women to overcome gender-specific challenges in decision-making and ownership of resources (Dohmwirth & Hanisch, 2017, 2019). The distinction is made between a mixed-gender PO and a single-sex PO with a basic argument that single-sex POs can allow women to control benefits from membership. However, in India, membership in women-only POs did not enhance women's control over income or their intrahousehold decision-making power (Dohmwirth & Hanisch, 2017). We have not seen any study that distinguishes the empowerment effect of POs based on the functions. We distinguish between two types of POs: bargaining and processing (Bijman *et al.*, 2016). The bargaining PO collects and bulks produce and coordinates the marketing of members' products while a processing PO processes raw milk into consumer products as well as provides access to services such as training, credit, veterinary, and inputs. Theoretically, we expect membership in a processing PO to increase women empowerment because of households' access to numerous services and value added functions.

Our study seeks to contribute to the discourse on women empowerment and membership in POs by addressing the following questions: 1) What is the effect of PO membership on women empowerment? 2) Does the effect vary between bargaining and processing POs? 3) What is the effect of woman membership on empowerment? 4) Does the woman membership effect vary between bargaining and processing POs?

We use the dairy value chain in Kenya as our case study. In East Africa, POs are promoted by development practitioners and governments, and their contribution to women empowerment in the livestock sector is a major topic of discussion in gender and development studies (Njuki *et al.*, 2014; Tavenner & Crane, 2018; Tavenner *et al.*, 2018; Basu *et al.*, 2019; Galiè *et al.*, 2019). Most studies, however, focus on the dairy hubs initiated by the East Africa Dairy Development (EADD) project, which has an integrated gender framework to improve women's participation. The hub is a farmer-owned milk collection center with chilling and bulking facilities and offering access to a wide range of inputs and services that are important for the dairy farmer (Omondi *et al.*, 2017). Not much research has paid attention to bargaining and processing POs. Understanding the role of POs in women empowerment is critical in designing agricultural policies and development programs that increase productivity and reduce poverty.

We utilize data obtained from a survey on 267 men and 207 women in member and non-member households. The entropy balancing technique suggested by Hainmueller (2012) and regression analysis are used to establish the effect of membership on women empowerment.

The next section presents the Kenyan dairy value chain, followed by section 3 with the conceptual framework of women empowerment and membership. In section 4 the methods and data are outlined before presenting the results and discussion, in sections 5 and 6 respectively. We conclude, in section 7, with policy implications and the limitations of the study.

4.2 Literature review and theoretical framework

4.2.1 The Kenyan dairy value chain

In Kenya, family members contribute labor to the success of a dairy enterprise (Gallina, 2016). Women play a dominant role in activities that are carried out daily such as milking, watering, and feeding while men tend to have a larger role in activities that are seasonal such as animal health management. Traditionally, in most communities, milk production is regarded as a women's enterprise to meet food requirements and as a source of income (Katothya, 2017). However, this is changing because of commercialization of the dairy value chain. The type of market outlet determines whether a man or a woman participates in dairy production and marketing (Katothya, 2017).

About 55% of milk production in Kenya enters the market through formal or informal value chains, while 45% is consumed at the household level (FIintrac & USAID-KAVES, 2014). According to Alonso *et al.* (2018), the informal chain sells non-processed dairy products and includes both licensed and unlicensed businesses. This chain handles about 70 percent of the marketed milk and is dominated by smallholder farmers and traders (KDB, 2017). Milk is collected from farms by traders who sell to milk bars and mobile vendors, who in turn sell to rural consumers or poor urban consumers. There is minimal compliance with milk safety measures due to a lack of knowledge and testing technology (FIintrac & USAID-KAVES, 2014).

POs operate in the formal value chain and represent 30 percent of the milk reaching the market in processed form (KDB, 2017). The formal chain commercializes processed, packaged and branded dairy products. It includes only licensed businesses. At minimum, the POs act as intermediaries between farmers and processors thus performing milk collection, bulking and cooing functions (Makoni *et al.*, 2014). Advanced organizations process milk and provide additional dairy production-related services (Ton *et al.*, 2016; Kilelu *et al.*, 2017a). Traditionally, membership registrations represent household heads, who are mostly men in married households. This implied that men mostly benefited from the services of the PO. However, women's membership is increasing (Katothya, 2017; Mwambi *et al.*, 2020).

4.2.2 Women empowerment and membership in producer organizations

In analyzing the impact of farmer membership in POs on rural development, economists consider the income gain of members (Verhofstadt & Maertens, 2014; Ma & Abdulai, 2016). But the focus on income excludes the issue of empowerment which is valued by members (Alkire, 2002). While the term empowerment is subject to various conceptualizations and interpretations (Kabeer, 1999; Narayan, 2005; Alsop *et al.*, 2006), we define it as the process by which an individual acquires the capacity for self-determination (Kabeer, 1999; Galiè *et al.*, 2018). Resources, agency, and achievements are central elements of empowerment. Resources refer to the control over economic, human and social resources (Kabeer, 1999), while agency is the ability to act on behalf of oneself (Sen, 1999; Kabeer, 2005). Both resources and agency constitute peoples' capabilities, that is, their potential for living the lives they want (Kabeer, 1999). The term 'achievements' refers to the extent to which the potential is realized (Kabeer, 2005).

Literature on participation in development programs and women empowerment can educate us on the possible effects of membership in POs. According to Basu *et al.* (2019), the effect of participation in development programs can be conceptualized using two kinds of strategies; presence and property. Presence refers to participatory activities that recognize and involve women in development through their work and knowledge at the household level and provide women access to collective organizations and training. Property refers to policies addressing gender inequalities by linking women to material resources (e.g. land, livestock, income). The authors' study on household participation in a dairy development program in Kenya and Uganda shows that women membership in cooperatives (presence) enabled them to achieve some control of part of the income from milk (property). Where women were provided cattle by the development program (property), this led to increased women's workload in the dairy farm (presence).

Using the sustainable livelihood framework, Quisumbing *et al.* (2015) argue that development programs distribute assets to beneficiaries directly affecting the individual's asset holdings. Differences in women's and men's asset ownership have implications for bargaining power within the household. The authors report that a dairy program intervention in Mozambique provided improved cattle breeds to households leading to increased ownership by men because the cattle were registered under the household head who was in most cases a man. Women's workload increased as more labor was required to manage and care for the highly productive breeds.

Fischer and Qaim (2012a) adopt Fafchamp's model of intrahousehold resource allocation which states that productive household members allocate their total time to labor for own income-generating activities, labor provided to others, and leisure. A woman will contribute labor to the man's agricultural plot if she benefits more from intra-household cooperation compared to working off-farm. Fischer and Qaim (2012) show that membership in a farmer

group increased commercialization of the banana farm leading to more male control over banana production and revenues. Still, women in member households provided a higher share of labor than women in non-member households.

In India, Dohmwirth and Hanisch (2017) show that PO membership has a negative effect on women empowerment. Members of a women-only cooperative had less control over dairy income when compared with unorganized women dairy farmers or members of a mixed-gender dairy cooperative. This adverse effect could be explained by men increasing their control over dairy production when women-only dairy cooperatives are formed. Contrary, women in Uganda increased their control over agricultural production and marketing by joining women farmer cooperatives (Ferguson & Kepe, 2011). Women also increased their involvement in decision-making on marketing through membership in dairy farmer groups in Zambia (Kafle *et al.*, 2018).

The effect of participation in development programs on women empowerment is mixed. Differing contexts and social norms in communities may explain these differences (Galiè *et al.*, 2015; Quisumbing *et al.*, 2015). We contribute to this discussion by examining how PO membership affects women empowerment and whether the effects depend on the type of PO or gender of membership.

4.2.3 The Women Empowerment Livestock Index

Although quantifying women empowerment is difficult, it is necessary for measuring impact. A comprehensive and standardized measure used in agriculture is the Women Empowerment in Agriculture Index (WEAI), which was jointly developed by the United States Agency for International Development (USAID), IFPRI, and the Oxford Poverty and Human Development Initiative (OPHI) (Alkire *et al.*, 2013). WEAI is a survey-based index reported at the country or regional level, based on individual-level data collected by interviews with man and woman within the same household. WEAI evaluates five domains of empowerment: (i) production; (ii) income; (iii) resources; (iv) leadership; and (v) time.

Building on the WEAI, The International Livestock Research Institute (ILRI) and Emory University, recognizing the importance of livestock to rural communities in East Africa, developed the Women Empowerment in Livestock Index (WELI), a measure to assess the empowerment of women in the livestock sector (Galiè *et al.*, 2018). The dimensions of empowerment in the WELI include (1) decisions about agricultural production; (2) decisions related to nutrition; (3) access to and control over resources; (4) control over and use of income; (5) access to and control over opportunities; and (6) workload. Recently, WELI has been used in a qualitative study measuring women empowerment in livestock in Tanzania (Price *et al.*, 2018) and in a mixed-methods study on the relationship between women empowerment, household food security and nutrition in Tanzania (Galiè *et al.*, 2019). By

using WELI, we contribute to understanding how POs affect factors related to women empowerment in livestock value chains.

4.3 Methods and data

4.3.1 Farm survey

The key questions of the study are to assess the effect of PO membership on women empowerment and how the effect varies by PO type and gender of membership. To answer these questions, we conducted a household survey in Kenya between October and December 2018 to collect data on household decision-making and asset ownership. Purposive sampling was used to select Meru and Nyandarua counties, which are among the main milk sheds in the country (Rademaker *et al.*, 2016b). We purposively selected one sub-county in Meru and two sub-counties in Nyandarua, targeting those having a mixed pattern of PO and non-PO milk value chains. At the sub-county level, we used stratified sampling with three strata; processing PO, bargaining PO, and non-member farmers.

Two processing POs out of the seven and one bargaining PO out of seven in the Imenti-South sub-county in Meru were chosen. One processing PO operating in the Kinangop and Ol-Kalou sub-counties in Nyandarua was selected as it was the only one available; it has members in both sub-counties. We selected one bargaining PO out of the seven present in Ol-Kalou sub-county in Nyandarua. We purposively selected POs based on accessibility, receptiveness of PO staff and representativeness. The processing and bargaining POs selected are representative as they have similar characteristics with other POs in terms of size, resource capacity, functions, and services. We used reports from the Kenya Dairy Board and Agriterra (Kagathi, 2014), a study by Wageningen UR and the FAO (Ton *et al.*, 2016), as well as scientific articles (O'Brien & Cook, 2016) to verify the representativeness of selected POs.

The biggest challenge in a cross-sectional survey is to get a random sample of households. PO membership registers were not updated; therefore, a list of milk collection routes was used to sample the households/respondents for the survey. Enumerators, seven in number, followed a different route every morning. The first enumerator started to identify households at the start of the collection route. The rest of the enumerators proceeded in the same route with each enumerator starting to identify households at least four kilometers from where the previous enumerator was left. We used the following technique to identify households belonging to the targeted PO. When the first household was identified, enumerators were required to skip four to five households to pick the next household. This process was repeated until the targeted number of respondents was reached. For the selection of non-members, enumerators converged in the village center and followed a particular route belonging to the trader. A similar identification procedure as that of PO members was used. A total of 484 households were reached. The number of sampled households by membership status is presented in Table 4.1.

Table 4.1: Number of sampled households by membership status

	Bargaining PO	Processing PO	All members	Non-members	Full sample
Total number of households	91	208	299	175	474
Man	60	126	186	81	267
Woman	31	82	113	94	207

In all the sampled households, we collected data using face-to-face interviews with individual farmers. Only married households were selected. For member households, we interviewed the man or woman who is a member of a PO while for non-member households, we interviewed the man or woman who was responsible for the dairy farm. While we acknowledge that interviewing both men and women in a household can lead to a better understanding of gender dynamics because of different perceptions, we believe that our approach provides useful data. Time and money were major limitations in interviewing both the man and woman in the household. The data collected provide information on the production, assets, income, and workload of the households and how these are distributed within and across households.

4.3.2 Definition and measurement of outcome variables

We took our outcome measures from the WELI tool (Galiè *et al.*, 2018). The first outcome variable is the "Decisions about agricultural production" (in the past year). We asked "who made most decisions on (i) buying inputs, (ii) breeds of cows, and (iii) land use (0=man, 1= woman, 2=jointly). On the nutrition dimension, we asked: "who made most decisions on the amount of milk to be used for home consumption?" (0=man, 1= woman, 2=jointly) and "who was mostly responsible for managing cow health, milking, cleaning the milking area, cleaning the milking vessels, milk storage, and milk transportation?" From the literature, we know that dairy farm activities are undertaken by different people, so our response categories for the last question included; 0=man, 1= woman, 2=male child, 3=female child, 4=male employee, 5=female employee, 6=no such activity in the farm.

The dimension "Access to and control over resources" covered land, livestock and financial resources. We distinguished between ownership of assets and control over assets. As noted by Njuki *et al.* (2013) ownership of livestock does not always imply that control over them. For instance, women may own livestock, acquired through the market or inheritance before or during marriage, but may not have decision-making authority over such livestock. Analyzing decision-making on livestock and land is therefore necessary. We asked, "who makes most decisions on (i) buying and selling of cows and (ii) buying and selling of land". Questions like "who owned most of the cows" and "who owned most of the land" were asked to measure asset ownership (in the past year). Regarding access to credit, the first question aimed at prompting whether the household has access to credit; "Did any member of the household take a loan or borrow cash in the past 12 months?" (1=yes, 0=no). Follow up questions were asked to determine how decisions were made on the loan. These included "If yes, who decided on the amount of money to be borrowed?" and "Who decided on how to use the

money?" The response categories were (0=man, 1=woman, 2=jointly between man and woman, 3=male child, or 4=female child).

Two questions were asked on control and use of income; (i) "who received most of the income from the sale of milk in the past year?" and (ii) "who made most decisions on how the income from sale of milk was to be spent?" (0=man, 1= woman, 2=jointly). We captured access to and control over opportunities in the following ways; (i) "who mostly accessed agricultural extension services in the past year?" and (ii) "who made most decisions on where to sell milk in the past year?" (0=man, 1= woman, 2=jointly).

For labor and workload, we first questioned the person that was most responsible for feed collection, purchasing feeds, feeding, watering, managing cow health, milking, cleaning the milking area, cleaning the vessels, milk storage and milk transportation in the past year. Our response categories included; 0=man, 1= woman, 2=male child, 3=female child, 4=male employee, 5=female employee, 6=no such activity in the farm. Then we used a module of detailed time allocation to get an idea about man's and woman's time spent in different activities both on the farm and in the home. The farmer was required to provide information on a log of the activities carried out in the last complete 24 hours. The time intervals were presented in 15 min and one to two activities could be marked for each time. A summary of the women empowerment measures, indicators, and their description is presented in Appendix C1.

4.3.3 The estimation strategy

We use an impact evaluation approach where membership in a PO is our treatment. This approach requires constructing a counterfactual, that is, the outcome for those being treated had they not been treated. Given the non-experimental nature of our data, our counterfactual is missing. We can only observe the difference in outcomes between members and non-members – the problem known as selection bias (Heckman & Hotz, 1989). Most non-experimental methods tackle this issue building on the assumption of "selection-on-observables", that is, conditional on observable characteristics the difference between treated and non-treated is due to the treatment (Heckman & Robb, 1985). If this assumption holds, then treated observations can be matched with those non-treated that are sufficiently comparable according to specific criteria.

In our study, the units of analysis are individuals. $Y(1)$ and $Y(0)$ is the outcome of the members and non-members respectively, and T is a binary variable being equal to 1 when a unit was exposed to the treatment and 0 otherwise. Our measure of interest is the so-called Average Treatment Effect on the Treated (ATT), which can be expressed as follows;

$$\tau_{ATT}(X) = E[Y(1) - Y(0)|T = 1] = E[Y(1)|T = 1] - E[Y(0)|T = 1], \qquad (1)$$

The ATT measures the difference between the expected empowerment for those individuals that are not members and the expected empowerment for those who are members. While the outcome for the members is available, the outcome for the members if they had not received the treatment cannot be observed but can be approximated. This identification is possible if the conditional independence assumption (CIA) holds, which implies that once we control for observable characteristics the decision of membership or non-membership can be considered random (Dehejia & Wahba, 1999). Propensity Score Matching (PSM) was introduced by Rosenbaum and Rubin (1983) for this purpose and became the most commonly used matching technique for non-experimental impact evaluation. Concerning the CIA, the distribution of covariates between treatment and control group needs to be balanced after matching on propensity scores (Rosenbaum & Rubin, 1983). This condition involves an intricate and often ineffective process of searching for the balancing solution (Hainmueller, 2012; Watson & Elliot, 2016).

To overcome the shortcomings of PSM method in achieving satisfying balance, an entropy balancing method, as described by Hainmueller (2012), is used. Instead of checking for covariate balance after preprocessing, in entropy balancing the desired level of covariate balance is prespecified using a set of balance conditions. Entropy balancing then searches for the set of weights that satisfies the balance constraints. The balanced weights for treated and control units are subsequently employed for estimating the ATT using a probit model that includes women empowerment measures as the outcome variables. The estimated coefficient is interpreted as the ATT because only the untreated group observations are weighted. Since we have binary outcomes, we use probit models with entropy weights. In selecting conditioning variables for obtaining entropy weights all factors that affect membership and the outcome variable are included.

Entropy balance method has already gained some popularity in applied economics (Marcus, 2013; Neuenkirch & Neumeier, 2016; Meemken & Qaim, 2018). The key advantage of entropy balancing, as compared to traditional matching techniques, is the ease with which the balancing property of covariates is achieved (Hainmueller, 2012). Balance constraints imposed directly by the researcher to estimate entropy weights ensure that the reweighted groups match exactly on the specified moments. Besides, matching methods assign binary weights to the observations in the control group – 1 if they match and 0 otherwise – and discards those observations with 0 weights. Instead, entropy balancing assigns positive weights to all the units in the control group, allowing to exploit the full sample. Third, the estimated weights are maintained as close as possible to the base weights which prevents loss of information for the subsequent analysis.

One shortcoming for all weighting and matching approaches is that they can only control for selection bias due to observable differences between the treatment and control groups. In our case, it could be that the members differ from non-members in terms of unobserved factors, such as personal motivation, risk preferences, and entrepreneurial skills. Other approaches to deal with possible selection bias due to unobserved heterogeneity include Heckman selection models and endogenous switching regression. However, these methods require instrumental variables that are correlated with membership and uncorrelated with all outcome variables. Given the large number of outcome variables used in this study, we were unable to find instruments that meet those restrictions.

4.4 Results

4.4.1 Descriptive statistics of the sampled households

Table 4.2 presents the results comparing characteristics of member and non-member households. The selected variables are also the variables used for generating entropy weights. The variables are drawn from literature and include individual and farm characteristics such as age, gender, farm size, and education; they all may influence membership decisions or women empowerment (Trommlerová *et al.*, 2015; Miedema *et al.*, 2018). With an average farm size of less than 4 acres, dairy farmers can be characterized as smallholders. Members are most likely to be male, use more hired labor, have higher production and are located in more accessible areas than non-members.

Distinguishing characteristics by PO type, members of the processing PO are more educated and a higher percentage of them own pure breed cows compared to non-members, but these variables are not significantly different between members of a bargaining PO and non-members. Ownership of pure breeds is probably a result of access to breeding services.

The differences between members and non-members suggest that there is a selection bias, for instance, farmers who join a PO are better educated. Failing to account for this bias could mean that we would overestimate or underestimate the effect of PO membership on women empowerment. To correct the bias, we reweigh the data using the variables presented in Table 4.2.

Table 4.2: Descriptive statistics of key variables used in entropy balancing

Variable name	Description	Full sample N=474	Non-members (1) N=175	Bargaining PO (2) N=91	Processing PO (3) N=208	All members (4) N=299	t-test (2)-(1)	t-test (3)-(1)	t-test (4)-(1)
Age	Age of the farmer in years	48.39	46.73	49.56	49.27	49.36	1.67*	1.98**	2.20**
Male	If a farmer is male=1, 0=otherwise	0.56	0.46	0.66	0.61	0.62	3.09***	2.82***	3.41***
Education	Number of years of formal schooling	9.57	9.03	9.42	10.09	9.89	0.90	3.17***	2.68***
Hired labor	If a farmer has a casual or permanent worker on the dairy farm=1, 0=otherwise	0.43	0.32	0.49	0.49	0.49	2.81***	3.32***	3.62***
Logarithm of milk production	The log of the total amount of milk produced on the farm per year (in kg)	8.49	8.16	8.59	8.72	8.68	5.12***	7.48***	7.71***
Pure breed cows	If the farmer has pure breed cows=1, 0=otherwise	0.52	0.43	0.49	0.61	0.57	0.93	3.39***	2.91***
Farm size	The size of the farm in acres	3.31	2.80	3.31	3.74	3.61	0.63	1.50	1.52
Ownership of transport	If the farmer has transport means=1, 0=otherwise	0.39	0.34	0.43	0.42	0.42	1.37	1.61	1.76*
Group membership	Whether the farmer belongs to another group apart from a dairy group=1, 0 otherwise	0.64	0.65	0.58	0.65	0.63	-1.10	0.05	-0.42
Nyandarua County	If the farmer is located in Nyandarua county=1, 0=otherwise	0.48	0.49	0.48	0.48	0.48	-0.12	-0.30	-0.28
Distance to collection point	The distance to the nearest PO milk collection center in km	0.79	1.19	0.67	0.50	0.55	-1.66*	-3.09***	-3.38***
Number of traders	In this village, there are many milk traders (1=completely disagree, 7=completely agree)	4.92	5.47	4.59	4.60	4.60	-3.60***	-4.84***	-4.93***
Access to loan	Farmer accessed loan from a financial service provider in the past year=1, 0 otherwise	0.26	0.11	0.26	0.37	0.34	3.32***	6.26***	5.79***

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively

4.4.2 The effect of household membership on women empowerment

4.4.2.1 Decisions about agricultural production

The results in Table 4.3 show significant differences by gender between member and non-member households regarding their involvement in decisions on agricultural production. Columns (1) to (3) show simple comparisons without controlling for selection bias. Column (4) shows the differences after controlling for selection bias using entropy balancing. These differences are the impact of membership. In most of the outcome variables, differences can be observed in the effects of simple comparisons and entropy balancing estimates, indicating that bias would occur if we relied on the simple comparisons of means.

Household membership in a PO reduces men's dominance in decisions about buying dairy inputs and choice of the cow breed by 1.5 and 1.3 percentage points respectively. Membership increases women's independent and joint contribution to decisions about breed selection. There are no significant effects of membership on land use decisions.

Table 4.3: Decisions about agricultural production

	Simple comparison			Entropy balancing
	Member N=299	Non-member N=175		
Production decisions	(1)	(2)	(3)	(4)
Buying dairy inputs	Mean (SE)	Mean (SE)	t value	ATT (SE)
Man	0.49 (0.50)	0.58 (0.49)	-1.85*	-1.52** (0.64)
Woman	0.15 (0.36)	0.22 (0.41)	-1.74*	1.02 (0.86)
Jointly	0.34 (0.47)	0.20 (0.40)	3.30***	1.33 (0.83)
Decision on breeds of cows to be kept				
Man	0.51 (0.50)	0.67 (0.47)	-3.50***	-1.27*** (0.49)
Woman	0.10 (0.31)	0.09 (0.30)	-0.23	2.84*** (0.70)
Jointly	0.38 (0.49)	0.23 (0.42)	3.32***	0.85* (0.50)
Decision on land use				
Man	0.44 (0.50)	0.54 (0.50)	-2.21**	-0.34 (0.48)
Woman	0.09 (0.29)	0.13 (0.34)	-1.28	-0.49 (0.81)
Jointly	0.46 (0.50)	0.33 (0.47)	2.92***	0.54 (0.49)

t value is the test statistics.*,**,***=significant at 10%, 5% and 1% level respectively; ATT is the average treatment effect on the treated; SE is the standard error

4.4.2.2 Access to and control over resources

Table 4.4 reports the effect of household membership on gender access to and control over resources. Membership decreases men's independent decision-making concerning buying and selling of cows and increases women's independent decision-making. Additionally, women's independent control over buying and selling of land increases by 2.75 points as a result of membership. Positive effects of membership on credit are observed where women increase

their independent decision-making on the amount of loan to be borrowed and loan use. However, membership does not change gender ownership of livestock and land.

Table 4. 4: Access to and control over resources

Resources	Simple comparison			Entropy balancing
	Member N=299	Non-member N=175		
	(1)	(2)	(3)	(4)
Decisions on buying and selling of cows	Mean (SE)	Mean (SE)	t value	ATT (SE)
Man	0.52 (0.50)	0.70 (0.45)	-3.99***	-0.94** (0.45)
Woman	0.08 (0.27)	0.05 (0.23)	0.94	2.03*** (0.64)
Jointly	0.40 (0.49)	0.24 (0.43)	3.54***	0.65 (0.46)
Ownership of cows				
Man	0.47 (0.50)	0.59 (0.49)	-2.40**	-0.76 (0.49)
Woman	0.09 (0.29)	0.07 (0.26)	0.72	0.34 (0.82)
Jointly	0.42 (0.50)	0.34 (0.47)	1.89*	0.67 (0.52)
Decisions on buying and selling of land				
Man	0.52 (0.50)	0.67 (0.47)	-3.15***	-0.24 (0.48)
Woman	0.05 (0.21)	0.03 (0.17)	0.98	2.75*** (1.06)
Jointly	0.43 (0.50)	0.30 (0.46)	2.72***	0.06 (0.48)
Ownership of land				
Man	0.79 (0.41)	0.83 (0.37)	-1.19	-0.22 (0.50)
Woman	0.00 (0.06)	0.00 (0.00)	0.76	0 (.)
Jointly	0.20 (0.40)	0.17 (0.37)	1.03	0.18 (0.50)
Decision on the loan amount				
Man	0.12 (0.33)	0.03 (0.18)	3.21***	-0.38 (0.75)
Woman	0.03 (0.16)	0.02 (0.13)	0.67	3.39*** (0.91)
Jointly	0.19 (0.40)	0.06 (0.23)	4.17***	0.14 (0.57)
Decision on loan use				
Man	0.09 (0.29)	0.03 (0.17)	2.60***	-0.70 (0.77)
Woman	0.02 (0.15)	0.02 (0.15)	0.04	3.25*** (0.92)
Jointly	0.23 (0.42)	0.06 (0.23)	4.94***	0.33 (0.56)

t value is the test statistics.*,**,***=significant at 10%, 5%, and 1% level respectively; ATT is the average treatment effect on the treated; SE is the standard error

4.4.2.3 Control over and use of income

The effect of household membership on control over income is shown in Table 4.5. Women in member households increase their probability of receiving dairy income. Non-significant effects are reported on receiving and use of dairy income among men and jointly by men and women.

Table 4.5: Control and use of income

Control and use of income	Simple comparison			Entropy balancing
	Member N=299 (1)	Non-member N=175 (2)	(3)	(4)
Recipient of dairy income	Mean (SE)	Mean (SE)	t value	ATT (SE)
Man	0.51 (0.50)	0.37 (0.48)	2.96***	-0.45 (0.48)
Woman	0.26 (0.44)	0.38 (0.48)	-2.71***	1.89*** (0.48)
Jointly	0.22 (0.42)	0.25 (0.44)	-0.76	-0.57 (0.52)
Decision on the use of dairy income				
Man	0.30 (0.46)	0.22 (0.42)	1.85*	0.27 (0.47)
Woman	0.13 (0.34)	0.25 (0.43)	-3.12***	-0.12 (0.78)
Jointly	0.56 (0.50)	0.53 (0.50)	0.5	-0.20 (0.48)

t value is the test statistics.*,**,***=significant at 10%, 5%, and 1% level respectively; ATT is the average treatment effect on the treated; SE is the standard error

4.4.2.4 Access to and control over opportunities

Household membership in a PO significantly reduces men's independent decisions on the market outlet but increases women and men joint decisions (Table 4.6). A positive membership effect is observed regarding extension where men in member households increase their access to these services.

Table 4.6: Access to and control of opportunities

Extension	Simple comparison			Entropy balancing
	Member N=299 (1)	Non-member N=175 (2)	(3)	(4)
Decision on market outlet	Mean (SE)	Mean (SE)	t value	ATT (SE)
Man	0.39 (0.49)	0.47 (0.50)	-1.57	-0.88* (0.48)
Woman	0.17 (0.38)	0.26 (0.44)	-2.31**	-0.12 (0.68)
Jointly	0.42 (0.49)	0.27 (0.44)	3.37***	1.09** (0.48)
Access to extension services				
Man	0.62 (0.49)	0.39 (0.49)	4.96***	0.86* (0.48)
Woman	0.25 (0.43)	0.14 (0.34)	2.96***	1.09 (0.67)

t value is the test statistics.*,**,***=significant at 10%, 5%, and 1% level respectively; ATT is the average treatment effect on the treated; SE is the standard error

4.4.2.5 Distribution of farm responsibilities

Regarding the distribution of responsibilities on the dairy farm, several gender implications of membership are observed (Figure 4.1). All household members are involved in dairy production and marketing activities. Men dominate purchasing dairy feeds, feeding and watering the cows, while women dominate cleaning of milk vessels and milk storage. The boy child performs feeding, milking and cleaning activities while the girl child is involved in cleaning of milking vessels.

Distinguishing by membership, a higher percentage of men in member households are responsible for purchasing feeds, cleaning the milking area, transportation of milk and watering the cows compared to men in non-member households. Transportation of milk in non-member households is mostly done by women. A lower proportion of women in member households are involved in feed collection, feeding and watering duties than their counterparts in non-member households.

Results on two dimensions of women empowerment, that is, (i) decisions on nutrition and (ii) workload, are not further discussed since household membership does not significantly influence men's and women's involvement in these activities.
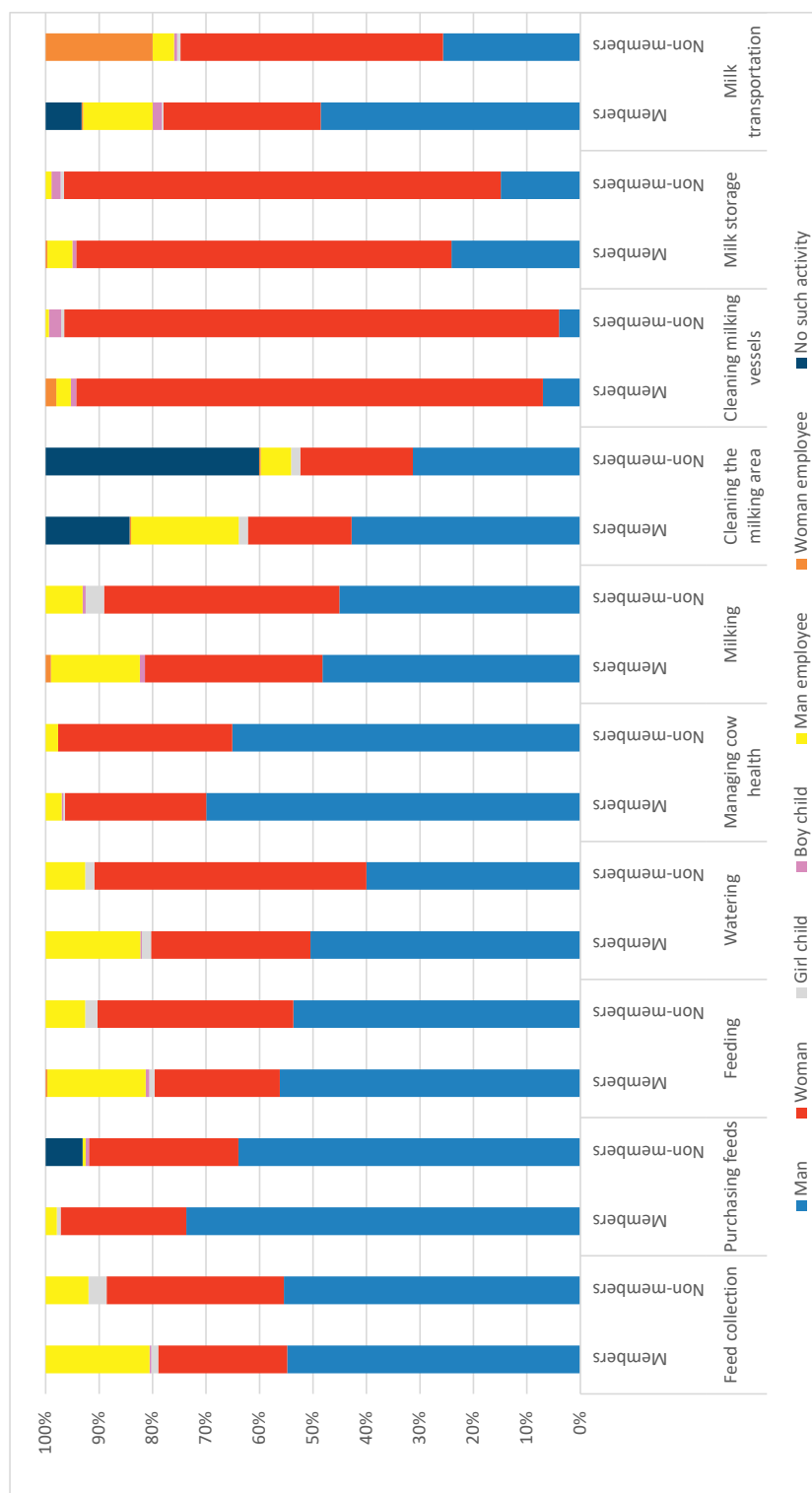
4

Figure 4.1: Distribution of responsibilities on the dairy farm

4.4.3 Effects of household membership across POs

To analyze differential membership effects, we estimate the effect of household membership in bargaining and processing POs. In the first stage of modeling, we reweight the data of household members of bargaining POs versus non-member households and household members of processing POs versus non-member households, using variables presented in Table 4.2. The second stage is the ATT estimate with selected dependent variables including control over production decisions, resources and income by man, woman and jointly. Household membership in a bargaining PO has a negative effect on men's independent decision-making on buying inputs but has a positive effect on joint decision-making between men and women (Table 4.7). More so, women's independent decision-making on choice of breeds and buying and selling of cows increases by 2 and by 1.4 percentage points respectively among household members of a bargaining PO compared to non-members.

In the processing PO, the effect of household membership reduces men's role in production decisions and increases women's decision-making just like in bargaining POs, but the coefficients and magnitude are lower. Contrary to membership effects in bargaining POs, effects of membership in processing PO on men and women decision-making about buying and selling of cows and their ownership of cows are non-significant.

Table 4.7: Distinguishing effect of membership across POs

	Household membership in a bargaining PO and non-membership N=266	Household membership in a processing PO and non-membership N=383
Production decisions	ATT (SE)	ATT (SE)
Buying of dairy inputs		
Man	-1.232*** (0.445)	-0.910** (0.415)
Woman	0.578 (0.666)	0.211 (0.649)
Jointly	1.331*** (0.463)	1.007** (0.461)
Decision on breeds of cows to be kept		
Man	-0.649 (418)	-0.586 (0.385)
Woman	2.037*** (0.615)	1.537*** (0.462)
Jointly	0.189 (0.433)	0.309 (0.396)
Resources		
Decisions on buying and selling of cows		
Men	-0.293 (0.420)	-0.587 (0.384)
Woman	1.407** (0.685)	1.030 (0.657)
Jointly	-0.007 (0.435)	0.416 (0.396)
Ownership of cows		
Men	-0.741* (0.412)	-0.617 (0.389)
Woman	0.069 (0.913)	0.278 (0.927)
Jointly	0.798* (0.794)	0.561 (0.389)
Control and use of income		
Recipient of dairy income		
Men	-0.588 (0.398)	0.052 (0.371)
Woman	0.756* (0.422)	0.708* (0.407)
Jointly	0.152 (0.474)	-0.661 (0.426)
Decision on the use of dairy income		
Men	-0.005 (0.435)	0.463 (0.396)
Woman	0.152 (0.638)	-0.112 (0.563)
Jointly	-0.067 (0.408)	-0.318 (0.375)

*,**,***=significant at 10%, 5% and 1% level respectively; ATT is the average treatment effect on the treated; SE is the standard error

4.4.4 Does women membership matter for women empowerment?

Following Fischer and Qaim (2012), we evaluate the effect of women membership in POs by comparing households in which the woman is the member (=1) versus those where the man is the member (=0). We further distinguish women membership effects by PO type: bargaining and processing POs. Women's membership has strong positive effects on women's independent decision-making on agricultural production, buying and selling of cows, ownership of cows, and receiving and use of dairy income (Table 4.8). There is increased joint decision making between men and women regarding cow ownership when the woman in the household is a member. A significant reduction of men's independent decisions as well as reduced men independent ownership of the mentioned outcomes are reported.

Results in Table 4.8 further show that distinguishing by PO type, women independent ownership of cows and joint ownership between men and women in a household increases by 6 and 2 percentage points respectively if the women in a household belong to a bargaining PO (but not when the women in a household belong to a processing PO). A 3.5 percentage point increase in women's independent decision-making on the use of dairy income is attained through women membership in a bargaining PO (but not in a processing PO). Women increase chances to receive dairy income by 2.7 percentage points when they belong to a processing PO. Women's membership in processing POs reduces their control over the use of income.

Table 4.8: Effect of women membership on women empowerment

	Women membership and man membership in a bargaining PO N=91	Women membership and man membership in a processing PO N=208	Women membership and man membership in all POs N=299
Production decisions	ATT (SE)	ATT (SE)	ATT (SE)
Buying of dairy inputs			
Man	-0.621 (0.710)	-1.270***(0.403)	-1.124***(0.320)
Woman	5.123***(0.915)	1.900**(0.904)	2.640***(0.580)
Jointly	-1.160 (0.726)	0.222 (0.395)	-0.197(0.331)
Decision on breeds of cows to be kept			
Man	-1.079 (0.771)	-0.909**(0.396)	-0.779**(0.319)
Woman	-	1.522 (1.050)	3.094***(1.031)
Jointly	-0.557 (0.777)	0.275 (0.388)	-0.245 (0.328)
Resources			
Decisions on buying and selling of cows			
Man	-1.108 (0.777)	-0.643 (0.391)	-0.878***(0.312)
Woman	-	1.085 (1.028)	2.518***(0.900)
Jointly	-0.094 (0.770)	0.262 (0.383)	0.171 (0.317)
Ownership of cows			
Man	-2.940***(0.662)	-1.183***(0.410)	-1.748***(0.302)
Woman	5.740***(1.147)	1.323 (0.900)	2.339***(0.725)
Jointly	2.085***(0.633)	0.572 (0.403)	0.978***(0.290)
Control over income			
Recipient of dairy income			
Man	-1.896**(0.836)	-2.400***(0.466)	-2.184***(0.359)
Woman	1.547 (1.045)	2.709***(0.769)	2.296***(0.524)
Jointly	0.448 (0.673)	0.257 (0.476)	0.190 (0.350)
Decision on the use of dairy income			
Man	-1.711**(0.810)	-1.392***(0.451)	-1.378***(0.357)
Woman	3.522***(0.965)	1.283*(0.712)	1.487**(0.670)
Jointly	-0.070 (0.706)	0.317 (0.391)	0.168 (0.306)

*,**,***=significant at 10%, 5%, and 1% level respectively; ATT is the average treatment effect on the treated; SE is the standard error

4.5 Discussion

This article explores the relationship between PO membership and women empowerment in dairy value chains in Kenya. We use quantitative data from 267 men and 207 women in member and non-member households and use probit models with entropy weights to assess the effect of membership. Using the Women Empowerment Livestock Index (WELI), we capture various dimensions of women empowerment. In answering the first question on the effect of household PO membership on women empowerment, overall, we find that membership increases women's independent decision-making on agricultural production, control over resources, buying and selling land and cows, using loans and receiving dairy income. Men experience a reduced role in independent decisions regarding production, buying and selling cows and marketing. Household membership in a PO does not affect gender-based ownership of cows and land.

These findings suggest that women in member households benefit in terms of increased independent decision-making on assets and control over income but not on their ownership of land and livestock. Our study comports with several studies which show that POs empower women (Ferguson & Kepe, 2011; Burchi & Vicari, 2014; Groot-Kormelinck, 2014). We note that PO membership is important in achieving empowerment, but not sufficient. This is because of the continued separation of control from ownership, which may be problematic as studies have shown that women's control over income is not satisfactory if cows are still owned by men (Basu *et al.*, 2019). The reported non-significant effect of membership on ownership of cows and land implies that social norms related to ownership do not change with membership. Noteworthy, our ownership data reflects an individual respondent's perception of who owns assets. According to literature, people may define ownership differently: using an asset, selling or inheriting an asset, deriving benefits from the asset, or investing in the asset (Galiè *et al.*, 2015; Quisumbing *et al.*, 2015; Basu *et al.*, 2019). Thus, asset ownership is more complex and needs to be nuanced to fit the context, which was not done in this study. Knowing how farmers understand and interpret asset ownership is important for POs in introducing policies that reduce gender constraints.

Concerning access to opportunities, household PO membership increases men's access to extension services but does not affect women's access. According to men's and women's contributions to workload (Figure 4.1), men in member households have more responsibilities in dairy production activities than women. It could be that men in member households have higher access to extension services than women because they need knowledge on dairy farm management. Additionally, through our interviews, we found that men have fewer responsibilities in family care than women and therefore have more time to attend training programs. Women's domestic workload has been cited in other studies as a major hindrance to their participation in development programs (Haile *et al.*, 2012; Altenbuchner *et al.*, 2017). A study in Ethiopia also shows that in most married households women do not have access to

extension services because the head of the household is the one that participates in the training (Achandi *et al.*, 2018).

Our second question assesses the varying membership effects across POs. We see that membership in a bargaining PO increases women's independent decision-making on buying and selling of cows and joint ownership of cows, but membership in a processing PO does not have a significant effect on these dimensions. A significant effect among members of a bargaining PO reflects a small move towards women empowerment regarding asset ownership. Our descriptive statistics reveal that members of a processing PO are commercial farmers as indicated by their higher ownership of pure breeds, years of education and milk production than members of a bargaining PO. Previous studies have shown that women control less market-oriented farms (Fischer & Qaim, 2012a; Sell & Minot, 2018), which may explain why women in households belonging to a bargaining PO have more control.

Thirdly, we examine whether women's membership in POs affects their empowerment. We find evidence that women's membership increases independent decision-making on agricultural production, buying and selling of cows, ownership of cows, receiving of dairy income and use of dairy income. Women gain independent access to and control over resources and men reduce independent access and control. Our results contradict those of Dohmwirth and Hanisch (2017) who find that women membership in dairy POs has a negative effect on women empowerment. This study supports the argument in cooperative bargaining models, that non-cooperation leads to *Pareto-inefficiency* in the household allocation of resources – that is a situation where resources cannot be reallocated to make one individual better-off without making the other individual worse-off.

In the fourth research question, we distinguish the effect of women membership across POs and find that women membership in a bargaining PO increases women's independent ownership of cows but membership in a processing PO does not have a significant effect. Theoretically, women membership in a processing PO serves to improve empowerment because of the numerous services of this PO compared to those offered in a bargaining PO. However, our study reveals that membership of women in processing POs does not necessarily mean that women benefit or become empowered. Cultural norms in some parts of Kenya that cows, especially improved breeds, belong to men could be the limiting factor for ownership of cows among women members in processing POs (Tavenner & Crane, 2018).

4.6 Conclusions

Smallholder households join POs to access modern marketing channels. Commercializing farm produce that is traditionally controlled by women often leads to a transfer of control rights to men once households join POs (Quisumbing *et al.*, 2015; Johnson *et al.*, 2016). One could argue therefore that POs contribute to women disempowerment. Using quantitative household data from Kenyan dairy value chains, we contribute to the discussion about PO membership and women empowerment. We find that joining a PO, regardless of who in the household is the registered member, enhances women empowerment. Women in member households increase their independent decision-making on agricultural production and independent control over resources, specifically, buying and selling of land and cows, borrowing and use of loans and receiving dairy income. The effects are stronger if the women themselves are members. Our study clearly shows that POs can spur and support women empowerment.

In terms of societal contribution, the observed increase in women's independent control over resources, decrease in men independent control and the non-significant impact in joint control reflect increased independent responsibilities among member households in the allocation of resources in dairy production. This raises the question of whether increased women's independent control over resources is beneficial for women empowerment or means that women assume the role of providers while men become less involved in this role. More so, increased women's independent control over resources may lead to intra-household conflicts and gender-based violence (Haile *et al.*, 2012; Johnson *et al.*, 2016). We suggest that development practitioners create awareness among men to avoid these problems occurring in member households.

Our other contribution relates to development policy regarding women empowerment in different types of POs. We argue that while women membership in a bargaining PO improves empowerment, membership in a processing PO fails to challenge traditional gender inequalities in ownership of cows. In these POs, women membership alone cannot eliminate gender disparities but should be complemented with other interventions that improve men's and women's awareness of women empowerment. There is a need to incorporate the inequalities that characterize the household in the implementation of development programs in processing POs, for instance, regarding how men and women share the benefits received through membership. From a research perspective, our findings challenge the analyses that focus too narrowly upon one specific PO model. We argue rather that the type of PO is key to understanding empowerment.

We use a cross-sectional survey approach which provides limitations to our estimation. A randomized control trial of PO membership would allow a rigorous and unbiased evaluation of the impact of PO membership on empowerment. Perhaps even better, to minimize the bias of using recalled data, a baseline and end-line data can be collected from the treatment group and the control group to allow establishing the impact using quasi-experimental methods. Indeed, as noted by Galiè *et al.* (2018) empowerment is a process that can be best understood by capturing data on changes in empowerment using a longitudinal panel design. However, these approaches are costly. Focus group discussions could be necessary to help explain the gender dynamics observed. We collected data from one member of the household. Probably men and women may have different perceptions of decision making and intra-household allocation of resources. The study collected data on key livestock assets, not the entire asset portfolio, and did not collect information on the value or share of the assets or income owned by gender. Future studies should collect more detailed asset and income data to be able to grasp a full understanding of gender-based access.

Appendix C

Appendix C.1: Empowerment dimensions, indicators and their description

Dimension	Indicator	Description
1. Decisions about agricultural production	a. Input into production decisions	Who made most decisions on; -(i) buying of dairy inputs, (ii) breeds of cows to be kept and (iii) land use. (0=man, 1= woman, 2=jointly)
	b. Autonomy in production	Who was mostly responsible for managing cow health, milking, cleaning the milking area, cleaning the milking vessels, milk storage, and milk transportation? 0=man, 1= woman, 2=male child, 3=female child, 4=male employee, 5=female employee, 6=no such activity in the farm
2. Decisions related to nutrition	a. Input into nutrition decisions	Who made most decisions on the amount of milk to be left for home consumption? (0=man, 1= woman, 2=jointly)
3. Access to and control over resources	a. Ownership and control of livestock assets	Who makes most decisions on buying and selling of cows; who owned most of the cows (0=man, 1= woman, 2=jointly)
	b. Ownership and control of land	Who makes most decisions on buying and selling of land; who owns most of the land? (0=man, 1= woman, 2=jointly)
	c. Credit access	If any member of the household took a loan or borrowed cash in the past 12 months? (1=yes, 0=no)
	d. Control of credit	If yes, who decided on the amount of money to be borrowed?; who decided on how to use the money? (0=man, 1=woman, 2=jointly between man and woman, 3=male child, or 4=female child)
4. Control and use of income	a. Control and use of income	Who received most of the income from the sale of milk?"; who made most decisions on how the income got from sale of milk was to be spent?" (0=man, 1= woman, 2=jointly)
5. Access to and control of opportunities	a. Access to markets	Who made most decisions on where to sell milk? (0=man, 1= woman, 2=jointly)
	b. Access to training, information, and groups	Who mostly accessed agricultural extension services? (0=man, 1= woman, 2=jointly)
6. Extent of work time	a. Total workload	The person that was most responsible for various dairy farm activities (0=man, 1= woman, 2=male child, 3=female child, 4=male employee, 5=female employee, 6=no such activity in the farm)\n\nA module of detailed time allocation capturing information on a log of the activities carried out in the last complete 24 hours

Source: Adapted from the WELI tool (Galiè *et al.*, 2018)

Chapter 5

Adoption of food safety measures: The role of bargaining and processing producer organizations

Abstract

Increasing demand for safe food in developing countries entails meeting stringent food safety requirements. Food retailers and regulatory bodies impose food safety measures related to production and handling of farm produce. For smallholders to remain competitive in such a system, institutional arrangements are necessary. We examine the role of producer organizations (POs) in influencing safe food production behaviors among farmers. Using data from 11 expert interviews and a quantitative survey involving 595 smallholder dairy farmers in Kenya, a propensity score matching estimation is employed to assess membership effects. We show that membership in POs positively and significantly influence smallholders' adoption of food safety measures related to milk storage and milking area. We highlight the importance of social incentives in improving food safety adoption among farmers even when price incentives are absent. Our recommendation is that PO policies that alleviate barriers to food safety adoption among farmers will be helpful in scaling up adoption.

5.1 Introduction

Demand for safe food in developing countries has increased because of two main factors: the modernization of food systems through the rise of supermarkets that impose food safety requirements (Reardon *et al.*, 2019), and the outbreaks of food-borne diseases that, according to World Health Organization report, caused 91 million cases of foodborne diseases and 137,000 deaths in Africa in 2010 (WHO, 2015). Safe food is food without biological (e.g. bacteria), chemical (e.g. veterinary drug residues, disinfectants), or physical hazards (e.g. plastic, metal) (FSA, 2009). Availability and accessibility of safe food products is of particular concern because it increases food security as stated in the 1996 World Food Summit declaration: "Food security exists when all people, at all times, have physical, social and economic access to sufficient, *safe* and nutritious food to meet their dietary needs and food preferences for an active and healthy life (UN/FAO, 1996)". In addition to health benefits, safe food is fundamental for low-income countries' access to increasingly high-value regional and global food markets (Ehrich & Mangelsdorf, 2018). This, in turn, increases the income of smallholder households, which can improve rural livelihoods (FAO, 2017a).

Despite the importance of safe food, improvement in food safety remains a major challenge in developing countries because of a lack of knowledge, low incentives to invest in food safety along the food value chain, the weakness of the public institutions responsible for regulatory enforcement and limited empirical knowledge regarding food safety application and food-borne diseases (Hoffmann *et al.*, 2019). Nonetheless, given the perishable nature of agricultural products and the demand for safe food, institutional arrangements that enhance skills and coordination mechanisms are essential to improve food safety compliance in the value chain.

Policymakers and development practitioners consider producer organizations (POs) as critical in influencing food safety (FAO, 2017a; IFAD, 2017). POs in developing countries operate in the formal value chain which handles processed and packaged products sold to supermarkets and urban consumers (Kiambi *et al.*, 2018). Literature shows mixed impact of POs regarding food safety improvement. On the one hand, additional compliance costs in high-value market chains constitute a burden, challenging smallholders' adoption of food safety measures and posing a threat to their inclusion in POs requiring strict compliance (Ait Hou *et al.*, 2015). On the other hand, if POs facilitate smallholders' compliance with food safety requirements, these farmers gain entry to high-value markets (Narrod *et al.*, 2009). By addressing these mixed impacts, this study will contribute to the debate about POs and food safety.

While the theory provides information on why POs influence food safety, not much has been done to understand when these organizations achieve impact. The objective of this paper is to analyze the impact of membership in POs on the adoption of food safety. We argue that the type of PO influences members' adoption depending on the organization's functional and organizational structures. Recent research has emphasized considering these differences in

evaluating the effect of POs for rural development (Kormelinck *et al.*, 2019). Here, we distinguish between bargaining and processing POs. A typical bargaining PO collects and bulks members' products, mostly sells to traders, has a small membership size and is controlled by members (Bijman *et al.*, 2016). Small membership size and member control are associated with a high level of trust among members and between members and the leaders (Nilsson *et al.*, 2012). Trust improves members' commitment (Feng *et al.*, 2016), including commitment to comply with food safety requirements. However, because a bargaining PO does not provide technical assistance, has low food safety requirements and applies non-professional management, it cannot easily influence members' adoption of food safety measures.

A processing PO collects, bulks, processes and packages members' products which are sold to supermarkets and high-end consumers (Michalek *et al.*, 2018). The functions of this organization are complex, membership is large and management is often carried out by professional staff (Bijman *et al.*, 2016). Complex business functions and shifting of decision rights from members to professional staff may lead to dissatisfaction, lack of trust, low member involvement and low commitment (Nilsson, 2018). This, in turn, negatively impacts food safety adoption. However, a processing PO confers benefits to smallholders in terms of access to technical assistance, information, credit and inputs, which are central for adoption of food safety measures (Naziri *et al.*, 2014). Additionally, tight monitoring, coordination and food safety evaluation services linked to a processing PO facilitate adoption (Moustier *et al.*, 2010; Cai *et al.*, 2016). Profit motives and competitive behavior of processing organizations can also drive investment in food safety when organizations seek to protect brand reputation (Hoffmann & Moser, 2017).

Our paper is a contribution to the scarce literature analyzing, the effect of PO membership on the adoption of food safety measures among smallholders. We use the Kenyan dairy value chain as our case study. Kenya is an interesting case as the government and development practitioners remain highly proactive and decisive in improving smallholder farmers' market participation through POs (GoK, 2013; SNV, 2015). In the dairy sector, where collective marketing and food safety concerns have been growing, the government has made considerable efforts in restructuring traditional value chains and supporting POs to increase food safety compliance (KDB, 2017). The government released the "Code of hygienic practice for milk and milk products" in 2000 in which good hygienic production practices were developed to enhance compliance (KEBS, 2015). It is interesting to understand farmers' compliance with food safety in the country especially because compliance involves costs. Yet, markets in Kenya do not reward for food safety.

Most research on food safety issues in Kenya focuses on the value chain actors' compliance with food safety requirements in the bulking, processing and consumer nodes shows a low level of compliance (Bebe *et al.*, 2018; Nyokabi *et al.*, 2018). Little information is available

on the safety practices at the farm level, yet many food safety risks originate at the production stage (Lemma *et al.*, 2018). Potential channels of milk contamination reported in Kenyan farms include inefficient personnel hygiene and udder cleaning (Mwangi *et al.*, 2016), the use of plastic containers that are not easy to clean (Wafula *et al.*, 2016) and the lack of adherence to withdrawal periods after treating cows with antibiotics (Orwa *et al.*, 2017).

For our case study, we use empirical data from 11 experts and a quantitative survey involving 595 smallholder farmers to answer two objectives: i) To assess whether and to what membership in POs affects dairy farmers' adoption of food safety measures, and ii) To examine the potential heterogeneity effects of membership in POs on farmers' adoption of food safety measures across bargaining and processing POs and farm-level characteristics.

5.2 Literature review and theoretical framework

5.2.1 The dairy value chain in Kenya

The dairy sector in Kenya is important to the economy as it contributes 12% to the agricultural gross domestic product (KDB, 2016). Kenya has about 700,000 smallholder farmers, owning on average 0.4-1.6 hectares of land, and 1-3 cows, and producing about 80% of the national output (Makoni *et al.*, 2014). Food safety issues in the country have become a matter of growing concern because of increasing demand for dairy products in the cities that have led to longer and food safety risk-prone value chains (Ndambi *et al.*, 2019).

Dairy can be an important source of foodborne diseases and milk can be contaminated from the farm itself. The dominance of rural smallholder production farms in Kenya's dairy sub-sector present challenges to the effective monitoring and enforcement of food safety measures at the farms (ILRI, 2018). Constraints of smallholder dairy farmers' adoption of food safety measures are a lack of equipment, knowledge, and skill in food safety and a lack of access to professional and financial services (ILRI, 2018).

The dairy market in Kenya is composed of formal and informal value chains (Appendix D.1). The informal value chain, handles about 70 percent of the marketed milk and is dominated by smallholder farmers and traders (KDB, 2017). Milk is collected from farms by traders who sell to milk bar operators and mobile vendors, who in turn sell to rural consumers or poor urban consumers. There is minimal compliance with milk safety standards due to a lack of knowledge and testing equipment (FIintrac & USAID-KAVES, 2014), exposing consumers to a high risk of contracting milk-related diseases.

The formal value chain, which is the market segment licensed by the Kenya Dairy Board (KDB), represents 30 percent of the marketed milk. Milk in the formal value chain is marketed in processed form (KDB, 2017). POs are major actors in the formal sector and act as intermediaries between farmers and processors or as processors themselves (Makoni *et al.*,

2014). Both bargaining and processing POs are found in the formal value chain in Kenya (Ton *et al.*, 2016).

5.2.3 Theoretical framework

One possible way to improve food safety in dairy is through smallholder's membership in POs. Farmers benefit from the POs services related to food safety including training, coordination of milk collection, monitoring and evaluation of food safety measures, and provision of milk storage equipment (Ndambi *et al.*, 2019). In the next section, we explain the theory relating PO membership to food safety and add nuance to the role of different types of POs.

We hypothesize that depending on the functions and organizational structures, POs can influence members' adoption of food safety measures. A social control, process control, and output control framework is used to illustrate the effect of PO membership on food safety adoption (Figure 5.1). Social control refers to the social mechanisms in a PO that directly or indirectly influence members' behavior. Members have a common interest in complying with the food safety requirements of the buyer, but individually they may not assume the cost of adopting food safety measures (Nilsson *et al.*, 2012). This encourages free-riding, that is, an individual provides low-safe milk in the hope that other farmers provide safe milk. In contrast, trust, which is high in the relationship between farmers and the PO as opposed to that in the relationship between farmers and trader, enhances commitment (Lu *et al.*, 2010), and this commitment can be on food safety compliance.

Process control is process monitoring and input control that lead to changes in food safety. Monitoring helps the PO to gather information about members' compliance with food safety requirements (Hueth *et al.*, 1999). If there is an indication of inadequacy in food safety, POs may provide advice or training. Training enhances farmers' knowledge and skills to apply food safety measures (Lindahl *et al.*, 2018). In Vietnam, members of a vegetable PO improved food safety at the farm after receiving technical assistance from the organization (Naziri *et al.*, 2014). Furthermore, the process control of inputs is implemented when POs provide specific inputs and equipment for member farmers (Zhou *et al.*, 2019).

Output control refers to the direct assessment of product safety, for instance through subjecting milk to laboratory tests. PO's evaluation of milk safety may encourage members to adopt food safety measures to minimize milk rejection. Besides, by employing a quality-based payment system, a PO can award farmers implementing food safety measures (Hueth *et al.*, 1999).

The type of PO may influence farmers' adoption of food safety measures. Focusing on social control, we argue that in a large PO there is an opportunity for members to free ride on product safety and quality because of the anonymity of members (Pennerstorfer & Weiss, 2013; Naziri *et al.*, 2014). Moreover, the professional management of a processing PO is

more autonomous, and members have limited influence on the PO decision making (Bijman *et al.*, 2014). Such low members' control weakens members' trust in the organization (Deng & Hendrikse, 2013), which can lead to a low commitment to food safety requirements. In a small PO, social control is stronger which reduces free ridership. More so, members influence decision-making, which increases their feeling of attachment to the organization and trust in leadership.

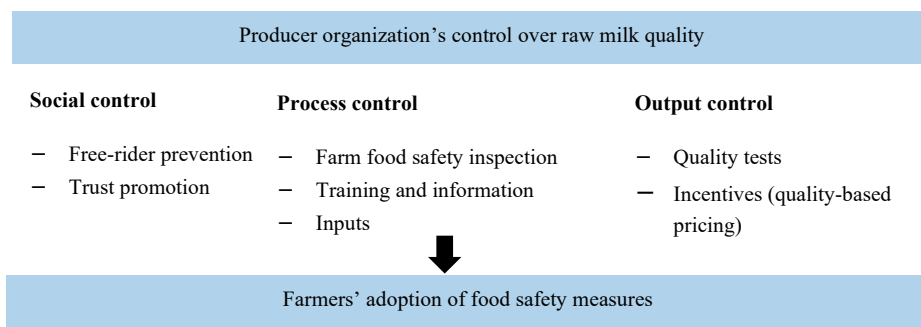| Producer organization's control over raw milk quality		
Social control	**Process control**	**Output control**
− Free-rider prevention	− Farm food safety inspection	− Quality tests
− Trust promotion	− Training and information	− Incentives (quality-based pricing)
	− Inputs	
Farmers' adoption of food safety measures		

Figure 5.1: A conceptual framework on PO control over members' food safety behavior

Process control differs between processing and bargaining organizations in that processing POs enhance adoption of food safety practices through information exchange that is facilitated by tight coordination, monitoring and access to information, training and inputs (Bijman & Bitzer, 2016). Such inputs and training services are often lacking in a bargaining PO. Further, a processing PO may put more emphasis on output control measures than a bargaining PO because of protecting brand reputation and increasing processing efficiency.

5.3 Methods and data

5.3.1 Farm survey

We conducted a survey in Kenya between October and December 2018. We purposively selected one sub-county in Meru and two sub-counties in Nyandarua, on condition that they were having a mixed pattern of collective and individual milk marketing channels. At the sub-county level, we used stratified sampling with three strata: bargaining POs, processing POs, and non-members. Two processing POs out of the seven and one bargaining PO out of seven in the Imenti-south sub-county in Meru were chosen. One processing PO operating in the Kinangop and Ol-Kalou sub-counties in Nyandarua was selected as it was the only one available; it has members in both sub-counties. We selected one bargaining PO out of the seven present in Ol-Kalou sub-county in Nyandarua. We purposively selected the POs based on accessibility, receptiveness of the PO staff and representativeness of either bargaining or processing POs in the counties. The processing and bargaining POs selected are representative as they share similar characteristics with excluded POs in terms of size, resource capacity,

functions and services. We used reports from the Kenya Dairy Board, Agriterra (Kagathi, 2014), and from a joint study by Wageningen University and Research and the Food and Agricultural Organization (Ton *et al.*, 2016) as well as journal articles (O'Brien & Cook, 2016) to verify the representativeness of selected POs. Further support information was given by the government staff from the selected counties.

The biggest challenge in a cross-sectional survey is to get a random sample of households. We could not identify members from the PO register because the contact details of the members were either missing or not updated. To ensure a random sample, we obtained a list of milk collection routes from the POs. Seven enumerators followed a different route every morning. The first enumerator started to identify households at the start of the collection route. Along the same route, the next enumerator started to identify households at least four kilometers from where the previous enumerator was left. We used the following technique to identify households belonging to the targeted PO: when the first household was identified, enumerators were required to skip five households to pick the next household. For the selection of non-members, we first identified areas in which traders were operating. In regions with POs, trader activities were minimal. Thus, we also sampled non-members from areas in which POs were not active. Trader-dominated areas had similar geographical characteristics as areas with active POs. We first identified the village from which traders were collecting milk. Then enumerators converged in the village center and followed a particular milk-collection route followed by traders. A similar identification procedure as that of PO members was used. We sampled 375 PO members (112 in the bargaining POs and 263 in the processing POs), and 220 non-members. Data were collected using the one-on-one interviewing technique.

5.3.2 Adoption measures

After carefully reviewing the code of hygienic measures for milk and milk products (FAO/WHO, 2011; KEBS, 2015), and manuals about hygienic milk production practices (Lore *et al.*, 2006; Pandey & Voskuil, 2011; Goopy & Gakige, 2016), we identified a total of 42 food safety measures on a dairy farm. Then, we consulted experts (Appendix D.2) with experience in food safety issues in Kenya to identify the relevant measures in the study context. A total of 21 food safety measures were retained, grouped into four broad categories; i) milking─ the health of the milker and hygiene followed during milking (9), ii) milk storage─ storage of milk, type of milking equipment and cleaning of equipment (7), iii) milking area─ structure and cleaning of milking area (2), and iv) animal health─ care of veterinary and microbiological aspects (3). Farmers scored each food safety measure on a scale of 1 to 100 depending on the perceived level of adoption, where 0 means lowest level of adoption and 100 means highest level of adoption. These measures are described in Table 5.1.

Table 5.1: Average level of adoption of food safety measures

Food safety measure	%
Milking	
The milker does not milk when suffering from communicable diseases such as cough, cold, diarrhea	69
The milker washes his/her hands with soap up to the elbow before initiating milking	82
After washing the hands, the milker dries his/her hands with a cloth/towel	84
The udder and teat of the cow are washed before milking	94
A clean, dry towel is used to wipe the udder dry after washing	86
The milker uses only one towel per cow	66
The milker checks for mastitis before milking	74
The cows are milked fast but gentle, without any interruptions	92
After milking, the teats are dipped or sprayed with an antiseptic solution	42
Milk storage	
Milk is filtered immediately after milking	93
The cloth/strainer is disinfected after use	71
After milking, milk is stored in clean sealed containers	85
Where the milk is stored for more than two hours, cooling to 10 degrees or below is undertaken	74
The milking vessels and equipment are made from approved material e.g. steel, aluminium	69
The milking vessels and equipment are sterilized with boiling water or dairy sanitizing solution after cleaning	81
The milking vessels and equipment are put upside down on a drying rack, in the sun, after cleaning	92
Milking area	
The floor of the milking area is made of concrete	51
The milking area is cleaned thoroughly after every milking	49
Animal health	
The cows being milked are free from diseases such as tuberculosis, brucellosis, mastitis	90
The cows suffering from mastitis are milked last and their milk is discarded	90
If the cow is on antibiotics, the milk from such cows is not consumed until the withdrawal period is over	89

N=595

We developed an adoption index using a framework proposed by Kumar *et al.* (2017). We calculated the average score of the food safety measures practiced in each category. However, the contribution of food safety measures in the hygienic milk production process may not be similar across four categories of food safety measures. Thus, we computed for each farm, the food safety index in each of the four categories. Using expert interviews, weights of the four categories were obtained with reference to their relative importance in ensuring milk safety (Appendix D.3). These weights sum to 1.

The adoption index (AI) for each category for the ith farm was calculated by;

$$AI = w_j p_j \qquad\qquad (1)$$

where w_j is the weight assigned to the jth food safety practice category, and p_j is the average score of food safety measures practiced in the jth category. Column 2 of Table 5.2 provides the

definition of all key variables including the four food safety categories, which are the outcome variables.

5.3.3 The evaluation method: Propensity score matching

Cross-sectional studies risk the presence of selection bias, as characteristics that affect outcomes can also influence an individual's decision to join a PO. We use the propensity score matching (PSM) method to minimize observable selection bias by matching members and non-members with similar observed time-invariant characteristics (Rosenbaum & Rubin, 1983). The PSM is modelled in two stages. In the first stage, a logit model for membership in PO is estimated to calculate the propensity score for each observation. Then, each member is matched to a non-member with comparable propensity score values. Members for whom an appropriate match cannot be found, as well as non-members not used as matches, are dropped from further analysis.

We make two critical assumptions to use the propensity score. The first is the conditional independence assumption, which means that, conditional on the observable covariates (X), membership (the treatment) and food safety adoption (the outcome) are independent (Caliendo & Kopeinig, 2008). This means X can only contain observable characteristics. The second assumption is the presence of common support: there must be sufficient overlap in the propensity scores of the member and non-member groups to run analyses that compare individuals with similar scores.

This study uses nearest neighbor and kernel methods of matching members and non-members. In the nearest neighbor matching, each treated individual is matched with the control individual that has the closest propensity scores(s). In the kernel method, all treated subjects are matched with a weighted average of all controls, using weights that are inversely proportional to the distance between the propensity scores of the treated and control groups. A matching estimator is considered good if it does not eliminate too many of the original observations from the final analysis while at the same time yielding statistically equal covariate means for member and non-member units (Caliendo & Kopeinig, 2008).

The second stage of PSM involves calculating the Average Treatment Effect on the Treated (ATT) of PO membership on the outcome variable Y using the matched observations of members and non-members. The PSM estimator of the ATT is the difference in outcomes between the treatment and control group appropriately matched by the propensity score:

$$\text{ATT} = \text{E}(Y_1 - Y_0 / U_i = 1) = \text{E}(Y_1 / U_i = 1) - \text{E}(Y_0 / U_i = 1) \text{........................ (2)}$$

Where Y_1 is the outcome (food safety adoption index) in the treated condition; Y_0 is the outcome in the control condition; and U_i indicator variable (treatment status) denoting membership in the PO.

5.4 Results and discussion

5.4.1 Descriptive statistics

The adoption level of each practice is presented in Table 5.1. Farmers self-scored level of adoption is high for most of the food safety measures, which is consistent with the study of Kumar *et al.* (2017) about the adoption of food safety measures among dairy farmers in India. Of the nine measures included in the milking category, washing hands with soap before milking, drying hands after washing, cleaning the udder and teat of the cow before milking and milking without interruptions are highly adopted measures. A measure that is less adopted (<50%) is dipping or spraying of teats with an antiseptic solution after milking, which is an indication of low availability of antiseptics or a lack of knowledge among farmers.

Seven measures are included in the milk storage category. Filtering of milk immediately after milking and drying of milk vessels in the sun after cleaning are the highly adopted measures. Milking area measures are important since dairy farm surroundings can promote spread of pathogens and diseases if unclean. Farmers rarely use a concrete milking floor, which partly explains why they are less likely to clean the milking area because of the difficulties in cleaning non-concrete floors.

The three measures related to animal health i.e. ensuring cows being milked are free from diseases, discarding milk from cows suffering from mastitis, and non-consumption of milk from cows on antibiotics, are highly adopted.

Table 5.2 presents the food safety adoption indexes across the four categories. Higher adoption is reported for milking, milk storage and animal health measures than for milking area measures. Kumar *et al.* (2017) support our findings by reporting that dairy farmers in India report a higher adoption measures related to milking and milk storage than milking area. Distinguishing by membership status, the adoption level is high for members compared to non-members with regard to milking, milk storage, and milking area measures. However, the mean differences presented in this section do not account for confounding factors. We will deal with this problem later by employing the propensity score matching method.

The experts' ranking of the importance of the food safety adoption categories in influencing milk hygiene are presented in Appendix D.3. Milking is the most important category (0.31), followed by milk storage (0.26), animal health (0.25), and milking area (0.18). One of the experts explained that milking is vital as it serves two objectives: it contributes to the production of clean milk (by following recommended cleaning procedure) and to maintain good cow health (by checking for mastitis).

Table 5.2: Summary statistics

Variable name	Description	Full sample N=595	Non-members (1) N=220	Bargaining PO (2) N=112	Processing PO (3) N=263	All members (4) N=375	t-test (2)-(1)	t-test (3)-(1)	t-test (4)-(1)
Age	Age of the farmer in years	49.11	47.28	51.29	49.72	50.19	2.48**	2.03**	2.60***
Male	If a farmer is male=1, 0=otherwise	0.50	0.44	0.56	0.52	0.53	2.18**	1.85*	2.29**
Education	Years of formal schooling	9.37	8.85	9.16	9.90	9.68	0.73	3.33***	2.77***
Household size	Number of household members	4.07	4.05	4.10	4.09	4.09	0.26	0.26	0.30
Hired labor	If a farmer has a casual or permanent worker on the dairy farm=1, 0=otherwise	0.41	0.32	0.50	0.46	0.47	3.18***	3.10***	3.60***
Logarithm of milk production	The log of the total amount of milk produced kg/farm/year	8.46	8.16	8.57	8.65	8.63	5.24***	7.26***	7.61***
Number of cows	Total number of cows owned	2.22	1.76	2.40	2.52	2.49	4.56***	4.38***	4.76***
Pure breed cows	If the farmer has pure breed cows=1, 0=otherwise	0.52	0.45	0.51	0.59	0.56	0.94	2.89***	2.56**
Farm size	The size of the farm of the farmer in acres	3.61	3.33	3.43	3.92	3.78	0.10	0.82	0.72
Ownership of transport	If the farmer has transport means=1, 0=otherwise	0.35	0.31	0.37	0.37	0.37	1.04	1.38	1.46
Training about farm hygiene	If the farmer has received formal training on hygiene in the past 3 years=1, 0=otherwise	0.48	0.26	0.61	0.59	0.60	6.35***	7.65***	8.25***
Nyandarua County	If the farmer is in Nyandarua county=1, 0=otherwise	0.53	0.55	0.52	0.51	0.51	-0.48	-0.70	-0.73
Distance to collection point	The distance to the nearest PO milk collection center in km	0.74	1.12	0.65	0.44	0.51	-1.71*	-3.76***	-3.93***
Milking	Index of adoption of milking measures in percentage	76.31	74.01	76.61	78.11	77.66	1.65*	3.27***	3.14***
Milk storage	Index of adoption of milk storage measures in percentage	80.63	74.52	82.54	84.91	84.21	4.78***	8.58***	8.50***
Milking area	Index of adoption of milking area measures in percentage	49.93	34.39	51.39	62.31	59.04	3.79***	8.14***	7.57***
Animal health	Index of adoption of animal health measures in percentage	89.74	89.21	89.80	90.15	90.04	0.39	0.74	0.72

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively; the t-value is presented under t-test

5

Summary statistics of variables used to create propensity scores are presented (Table 5.2). The explanatory variables include a set of social and economic factors that could influence membership and adoption of food safety (Fischer & Qaim, 2012b; Chagwiza *et al.*, 2016; Mojo *et al.*, 2017; Wossen *et al.*, 2017). An average dairy farmer in the study sample is 49 years, with 9 years of formal education and owns about 2 cows. A higher percentage of men are members compared to women. Besides, a farmer belonging to a PO is older, has high farm milk production and number of cows compared to a non-member. A member of a processing PO has higher education, owns more pure breed cows, is better trained on farm hygiene, and lives in a less remote area compared to a non-member.

5.4.2 Propensity score matching

5.4.2.1 Logit model on determinants of PO membership

To derive the propensity scores to match members and non-members, we estimated three logit models comparing the determinants of farmers' membership in a bargaining PO versus non-membership, membership in a processing PO versus non-membership and membership in any of the two POs versus non-membership (Table 5.3). The dependent variable of the logit model takes a value of one for members and zero for others.

Table 5.3: Determinants of PO membership (logit model)

Variable	Membership in a bargaining PO versus non-membership	Membership in a processing PO versus non-membership	Members versus non-members
	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
Age	0.031 (0.06)	0.121**(0.054)	0.085* (0.045)
Age squared	0.000 (0.001)	-0.001*(0.001)	-0.001 (0.000)
Male	0.208 (0.284)	0.106 (0.221)	0.13 (0.203)
Education	0.017 (0.040)	0.059* (0.034)	0.049* (0.030)
Household size	-0.016 (0.079)	-0.028 (0.062)	-0.013 (0.057)
Hired labor	0.512*(0.290)	0.215 (0.253)	0.282 (0.226)
Log of milk production	0.957***(0.251)	0.779***(0.186)	0.807***(0.175)
Pure breed cows	-0.302 (0.282)	0.108 (0.222)	-0.041 (0.204)
Farm size	-0.032** (0.016)	-0.029**(0.013)	-0.029**(0.013)
Training on farm hygiene	1.377***(0.279)	1.525***(0.250)	1.413***(0.221)
Distance to collection point	-0.174* (0.105)	-0.347***(0.096)	-0.308***(0.084)
Ownership of transport	-0.448 (0.308)	-0.138 (0.236)	-0.266 (0.220)
Nyandarua County	-0.053 (0.287)	0.385 (0.250)	0.170 (0.221)
Constant	-10.293*** (2.387)	-10.785***(1.937)	-9.572*** (1.717)
Pseudo R^2	0.172	0.196	0.18
LR Chi2 (13)	73.02	130.13	140.56
Prob>chi2	0	0	0
Observations	332	483	595

***, **, * denote significance at 1% level, 5% level, and 10% level, respectively; SE is the standard error; numbers in parenthesis are the standard errors

As the main aim of estimating the logit model is to obtain propensity scores, we will not elaborate on the determinants of membership. However, it is noteworthy to mention that training and farm milk production factors positively influence membership in POs. Furthermore, older and educated farmers join processing POs. The distance to the milk collection point has an inverse relationship with membership, which is expected because of transportation costs.

After obtaining the predicted propensity scores from the logit model, we use the scores to match members to non-members. Details on the effectiveness of the matching quality between members and non-members are presented in Appendix D.4 to D.6a-c.

5.4.2.2 The overall treatment effects of PO membership

We report the PSM estimates on the effect of PO membership, using a sample of all members and non-members, on the adoption of food safety measures in Table 5.4. The nearest neighbor matching and kernel matching indicators yield almost similar results. PO membership improves smallholders' adoption of food safety of two outcome categories, that is, milk storage and milking area. Specifically, members achieve higher adoption of milk storage and milking area measures by 5.8 and 12.7 percentage points, respectively compared to non-members. Since most POs sell to supermarkets and urban modern retail chains that have superior food safety control systems than informal chains (Kiambi *et al.*, 2018), members supplying to the organizations abide by food safety measures. Another factor that explains higher adoption among member-farmers compared to non-members is trust between the farmers and the POs. Previous research has shown that trust induces commitment to a trading relationship, including commitment to food safety (Lagerkvist *et al.*, 2013). Farmers trust their PO because it is a recognized institution with well-known collection center and office, and farmers have repeated transactions with the organization. Contrary, we noted that there is little information on the identity of traders operating in a village. A trader may default on a farmer and move to a different village where he/she is not known.

Table 5.4: The overall treatment effects of PO membership

	Full sample	
Dependent variable	Nearest neighbor	Kernel
Milking	-0.722 (1.891)	-0.023 (1.224)
Milk storage	5.790*** (1.875)	5.830*** (1.625)
Milking area	11.897*** (4.535)	12.680** (4.967)
Animal health	0.804 (2.190)	0.967 (2.118)
Balancing property satisfied	Yes	Yes
Common support imposed	Yes	Yes
Number of observation	595	595
Members	375	375
Non-members	220	220

*, ** and *** denote significance at the 10%, 5%, and 1% level, respectively; numbers in parenthesis are the standard errors

5.4.2.3 Estimating treatment effects across producer organizations

So far, the treatment variable in this analysis combines different types of POs. Examining how the effects vary across POs reveals some interesting results (Table 5.5). We compare the effect of membership in bargaining POs versus non-membership and membership in a processing POs versus non-membership. We find very small changes in the statistical significance of the ATT and in the magnitude of the effect of membership in bargaining POs as compared to membership in processing POs on the adoption of milk storage measures. Membership in these POs leads to an adoption increase of 5-6 percentage points regarding these measures. However, some heterogeneity is observed in the effect of membership across POs on the adoption of milking area measures. Specifically, households that are members of a bargaining PO increase adoption of milking area measures by 13 percentage points. The result is weakly significant (at 10 percent). The effect of membership in a processing PO is also positive but the statistical significance of the ATT is stronger (at 1 percent) and has a higher effect size (16 percentage points) compared to the effect of membership in bargaining POs.

Investing in farm structures to reduce food safety risks requires a high initial fixed cost which can be a burden for smallholders (Unnevehr, 2015). Members of a processing PO access financial credit, hence, are better able to invest in concrete milking floors than members of bargaining POs. A study in Kenya supports this finding by stating that smallholders' capacity to invest in concrete sheds on the farm is boosted by joining POs that provide financial support (Okello & Swinton, 2007). Value chain coordination, monitoring and technical advice of processing POs could also be linked to increased members' adoption of food safety measures. Fieldwork evidence shows that extension officers of processing POs visit member farms from time to time to monitor food safety production practices.

Table 5.5: Heterogenous effects across producer organizations

Dependent variable	Bargaining PO membership		Processing PO membership	
	Nearest neighbor	Kernel	Nearest neighbor	Kernel
Milking	0.830 (2.640)	-0.931 (1.844)	1.786 (2.042)	0.537 (1.729)
Milk storage	5.158** (2.531)	4.954** (2.027)	6.019*** (2.066)	6.090*** (1.447)
Milking area	12.977* (7.521)	6.947 (6.513)	17.708*** (6.309)	16.256*** (4.620)
Animal health	3.568 (2.661)	0.990 (2.224)	2.460 (2.877)	1.115 (2.337)
Balancing property satisfied	Yes	Yes	Yes	Yes
Common support imposed	Yes	Yes	Yes	Yes
Total observations	332	332	483	480
Members	112	112	263	260
Non-members	220	220	220	220

*, ** and *** denote significance at the 10%, 5%, and 1% level, respectively; ; numbers in parenthesis are the standard errors

5.4.2.4 Heterogeneous effects across other indicators

The above computations of ATTs assume a common treatment effect among members. However, in reality the treatment effects can vary with farmers' characteristics. Thus we conduct additional analyses using data from different subsamples. Four variables including education, age, training and the distance to milk collection point are assessed (Table 5.6). Consistent with earlier studies, we find that there is heterogeneity of the effect of membership on the adoption of food safety measures across farmers' characteristics (Abebaw & Haile, 2013; Shumeta & D'Haese, 2016; Wossen *et al.*, 2017).

PO membership increases the adoption of milking area measures among less-educated farmers. Our findings differ from the common argument that less-educated farmers are less likely to adopt improved farm production technologies because of their limited ability to understand and interpret new information (Mudhara & Sinyolo, 2018). We argue that less-educated farmers depend on PO's training on food safety as the training is probably tailored to the farmers' level of understanding. The results show that the effect of PO membership on food safety measures varies with farmers' age. In particular, the adoption of milk storage and milking area measures increases significantly for younger farmers. Contrary, Shumeta and D'Haese (2016) found that PO membership benefits older member farmers in the coffee sector in Ethiopia. Our findings may indicate that POs are less effective in improving adoption of food safety measures among older farmers. If the majority of the members are old then this poses a challenge to the competitiveness of POs in a market where food safety requirements are growing.

Table 5.6: Heterogenous effects across other indicators

	Education		Age		Training		Distance to the collection point	
							<=0.5km	>0.5km
	1-8 years	>8 years	<60 years	=>60 years	No	Yes		
Milking	2.160 (1.933)	-1.892 (2.015)	2.083 (1.822)	-7.224 (4.345)	1.769 (1.654)	-0.832 (2.176)	-1.020 (1.624)	-2.474 (5.263)
Milk storage	5.843*** (1.798)	5.873*** (2.170)	5.670*** (1.779)	5.372 (4.218)	7.294*** (2.274)	5.070*** (1.949)	4.200** (1.916)	8.115** (4.078)
Milking area	19.336*** (6.048)	9.382 (7.776)	12.088*** (3.644)	10.814 (15.798)	10.997** (5.413)	15.364** (6.457)	9.714* (5.222)	15.037 (15.793)
Animal health	0.478 (2.541)	2.083 (3.838)	2.121 (2.172)	-2.427 (5.130)	-2.123 (1.991)	3.173 (4.074)	-0.591 (2.071)	5.482 (6.547)
Balancing property satisfied	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Common support imposed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total observations	284	311	474	121	310	284	452	143
Members	158	217	299	46	150	225	297	78
Non-members	126	94	175	45	161	59	155	65

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively; Kernel matching was used; numbers in parenthesis are the standard errors

5.5 Conclusion and policy implications

The main aim of this study was to assess the effect of membership in a PO on the adoption of food safety measures. We contribute to the literature on the role of POs in developing countries on food safety improvement. We conducted 11 expert interviews and a quantitative household survey with 595 smallholder dairy farmers in Kenya. We identified four categories of dairy food safety measures related to production; milking, milk storage, milking area, and animal health, and empirically evaluated the effect of membership on the adoption of the food safety measures across the four categories. Using the PSM technique, our results show that membership positively and significantly improves smallholders' adoption of food safety measures related to milk storage and milking area. The magnitude of the effect ranges from 6 to 12 percentage points. We attribute the increase in adoption to the social and process control measures of POs.

The issue of social incentives versus economic incentives of POs in influencing member behavior has been a long-standing debate (Borgen, 2004; Deng & Hendrikse, 2017). We contribute to this debate by highlight the importance of social incentives in improving food safety adoption among member farmers even when price incentives are absent. One policy lesson is that smallholders can cope with food safety requirements of high-value chains if collective organizations are being strengthened. However, social incentives may not be sustainable in the long term. We recommend that the government could play a key role in enforcing economic incentives for food safety compliant farmers.

Notably, the estimation of the membership effects across POs reveals some heterogeneity with members of processing POs achieving higher adoption of milking area food safety measures than members of bargaining POs. The effects of membership in processing POs are larger and statistically stronger than those in bargaining POs. These results suggest a linkage between adoption of food safety measures and the functional and organizational structures of POs. Higher adoption among processing PO members can be related to higher value chain coordination, as well as monitoring and technical and financial service delivery. The finding supports the organizational theory that associates food safety compliance with more integrated value chains, and increased process and output control measures by collective organizations (Hueth *et al.*, 1999; Borgen, 2011).
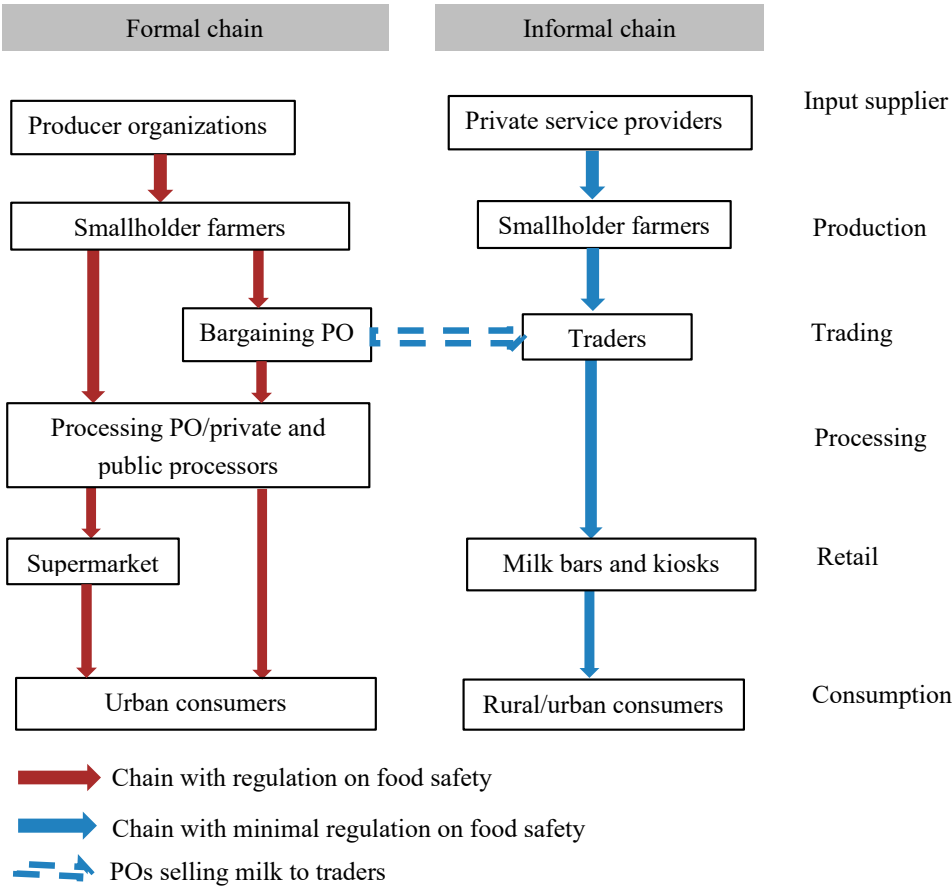
Lastly, we find that the effects of PO membership are heterogenous across several household characteristics. Farmers who are less educated and younger perform better in the adoption of food safety measures associated with milk storage and milking area. Results imply that membership in POs alleviates the technical and financial barriers of less educated and younger farmers. Our recommendation is that PO policies that alleviate barriers to food safety adoption among farmers will be helpful in scaling up adoption.

Finally, although our study focuses on the POs that operate in the formal value chains, the food safety concerns can spill over to the informal sector, which has weak food safety enforcement and where consumers purchase raw milk. The importance of such spill over effects has been underscored in previous studies (Leksmono *et al.*, 2006; Roesel & Grace, 2014). Improving food safety in the formal chain may subsequently lead to food safety improvement in the informal chain as consumers' awareness of food safety increases. Higher compliance in the formal chain, however, will increase the supply of unsafe food in the informal chain as milk that is rejected in the formal chain ends up in the informal chain, on which the majority of the consumers depend (Kiambi *et al.*, 2018). We recommend, therefore, that policies promoting the adoption of food safety measures in both chains are important.

This study has some limitations. The propensity score matching method used only controls for selection bias based on observable factors but not on unobservable factors. A randomized control approach is recommended to address the unobservable issues, where one can assess farmers' adoption of food safety measures at the early stages of the formation of a PO and compare it with their adoption at later periods. We do not capture information on feed-related measures that can influence food safety —a gap that needs to be filled. Further research could assess the effect of the adoption of food safety measures on farmers' livelihoods.

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Appendix D

Appendix D.1: The Kenyan dairy value chain

Formal chain	Informal chain	
Producer organizations	Private service providers	Input supplier
Smallholder farmers	Smallholder farmers	Production
Bargaining PO	Traders	Trading
Processing PO/private and public processors		Processing
Supermarket	Milk bars and kiosks	Retail
Urban consumers	Rural/urban consumers	Consumption

➡ Chain with regulation on food safety

➡ Chain with minimal regulation on food safety

⇢ POs selling milk to traders

Source: Owner's conceptualization

Appendix D.2: List of experts interviewed

Name	Organization	Country
A	BIO Food Products Ltd,	Kenya
B	Wageningen University and Research	The Netherlands
C	New Kenya Cooperatives Creameries	Kenya
D	Wageningen University and Research	The Netherlands
E	SNV	Kenya
F	Egerton University	Kenya
G	Egerton University	Kenya
H	Ministry of Livestock and Fisheries Development	Kenya
I	Happy Cow	Kenya
J	Wageningen University and Research	The Netherlands
K	Ministry of Livestock and Fisheries Development	Kenya

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Appendix D.3: Average scores, out of 100, of the importance of the categories of food safety measures in ensuring milk safety

Categories	Expert interviewees											Total	Weight
	I	II	III	IV	V	VI	VII	VIII	IX	X	X1		
Milking	25	40	40	20	40	30	30	50	20	30	20	345	0.31
Milk storage	25	20	15	20	35	18	40	30	40	25	20	288	0.26
Animal health	10	30	35	40	10	30	20	15	20	30	30	270	0.25
Milking area	40	10	10	20	15	22	10	5	20	15	30	197	0.18
Total	100	100	100	100	100	100	100	100	100	100	100	1100	1.00

Appendix D.4: Matching quality

We measure the effectiveness of the matching quality between members and non-members using three techniques; (1) how well the key pre-treatment variables balance before and after matching, (2) the degree of the reduction of the overall bias after matching, and (3) how well the observations overlap across the common support. All three criteria show that matching is effectively achieved. As shown, members and non-members have statistically similar characteristics after matching in contrast to the unmatched sample. The test for equality of means shows that there are no statistically significant differences between members and non-members after matching. More so, the overall standardized differences (% bias reduction) for the mean values of almost all covariates between members and non-members are above 60 percent.

Appendix D.4: Balancing test results

Variable	Matched	Bargaining PO and non-members N=332 % |bias| reduction	t	Processing PO and non-members N=483 % |bias| reduction	t	Full sample N=595 % |bias| reduction	t
Age	U		0.014		0.042		0.010
	M	90.3	0.824	70.5	0.488	65.6	0.265
Age squared	U		0.033		0.144		0.045
	M	92.7	0.888	72.1	0.637	62.2	0.348
Male	U		0.030		0.064		0.022
	M	58.1	0.430	94.2	0.911	95.5	0.904
Education	U		0.464		0.001		0.006
	M	9.7	0.573	58.4	0.147	47.5	0.088
Household size	U		0.793		0.793		0.763
	M	-80.6	0.684	-105.1	0.585	-159.5	0.377
Labor	U		0.002		0.002		0.000
	M	86.2	0.716	64.7	0.265	61.5	0.113
Log of milk production	U		0.000		0.000		0.000
	M	86.1	0.523	86.9	0.269	84.1	0.153
Pure breed cows	U		0.350		0.004		0.011
	M	81.6	0.881	96.9	0.925	83.1	0.616
Farm size	U		0.921		0.413		0.469
	M	-478.3	0.352	76.5	0.862	6	0.457
Training on hygiene	U		0.000		0.000		0.000
	M	92.8	0.708	99.3	0.957	99.2	0.943
Distance to collection point	U		0.088		0.000		0.000
	M	84.9	0.663	96.9	0.816	97.3	0.813
Ownership of transport	U		0.297		0.169		0.145
	M	28.4	0.523	91.9	0.908	75.9	0.686
Nyandarua county	U		0.635		0.482		0.469
	M	-172.6	0.262	2.4	0.474	61.7	0.747

***, **, * denote significance at 1%, 5%, and 10% level, respectively;   Matching algorithm: kernel matching

**Appendix D.5: PSM quality indicators before and after matching**

The tests of the joint significance of covariates are presented in the table below. The likelihood ratio tests are statistically significant before matching and insignificant after matching for all three sets of matching. The low pseudo-R^2, low mean standardized bias and the insignificant p-values of the likelihood ratio test of variables after matching suggest that the proposed specification of the propensity score is successful balancing the distribution of covariates between the two groups.

Appendix D.5: PSM quality indicators before and after matching

	Bargaining PO and non-members	Processing PO and non-members	Full sample
	N=332	N=483	N=595
Pseudo R^2 before matching	0.17	0.194	0.178
Pseudo R^2 after matching	0.012	0.011	0.009
LR chi^2 (p-value) before matching	72.08 (0.000)	129.32 (0.000)	139.69 (0.000)
LR chi^2 (p-value) after matching	3.79 (0.993)	7.79 (0.857)	9.67 (0.721
Mean standardized bias before matching	24.1	25.6	25.1
Mean standardized bias after matching	6.4	4.4	5.5

Appendix D.6: Common support

The distribution of propensity scores for members and non-members is presented in Appendix D.6a, b and c. The substantial overlap is obtained except for the matching between processing PO members and non-members where 3 observations are out of the common support region. After dropping these three observations, the sample is used to estimate the effect of PO membership.
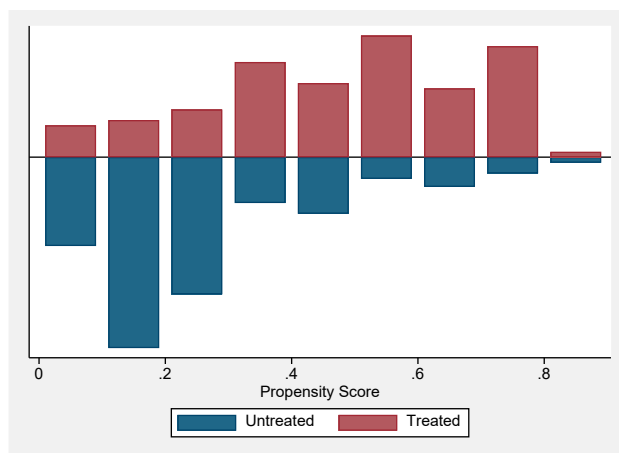
Appendix D.6a: The density of propensity scores for bargaining PO members and non-
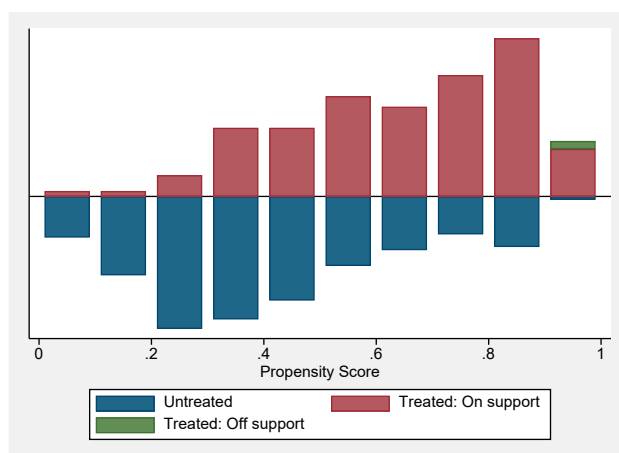
Appendix D.6b: The density of propensity scores for processing PO members and non-
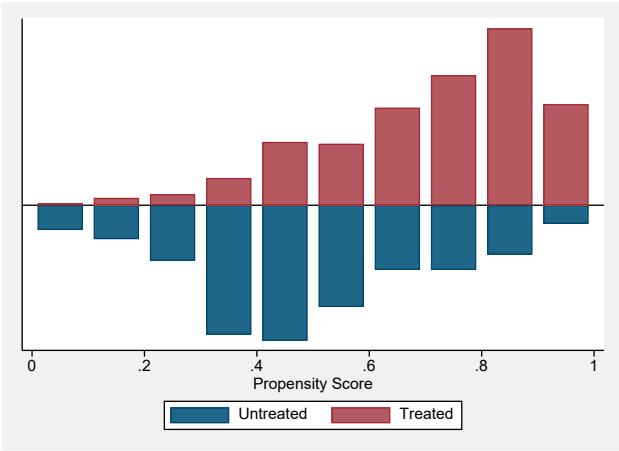
Appendix D.6c: The density of propensity scores for all members and non-

Chapter 6

General discussion and conclusion

6.1 Introduction

Smallholders continue to face constraints in meeting strict food safety requirements and participating in modern agri-food value chains because of asymmetric information, high transaction costs, low production, and lack of access to inputs (Poulton & Lyne, 2009). Collective action through POs is a mechanism adopted by smallholders for solving these challenges to improve coordination and upgrade in the modern agri-food value chains. Most research has been done on upgrading in the value chain (Trienekens, 2011; Lee *et al.*, 2012). However, previous research takes a chain-wide perspective while ignoring the role of specific actors such as POs. It is important to consider the role of POs in value chain coordination and upgrading especially in developing countries where smallholder farmers mostly participate in value chains through their POs. Additionally, previous studies focus on economic upgrading but little emphasis has been put on social upgrading. There is an ongoing debate on the relationship between economic and social upgrading. A question has been raised about whether economic upgrading necessarily leads to social upgrading (Kaminski *et al.*, 2020).

This study is aimed at filling this gap by gaining insights into the role of POs in the agri-food value chains, by analyzing upgrading and coordination in value chains through these organizations. By doing this, we generate information relevant to the development of sustainable value chains in the dairy sector. The overarching aim of the thesis is to examine the role of POs in value chain coordination and upgrading, and assess the relationship between economic upgrading and social upgrading.

The focus of the first part of this study has been on business models of POs in the dairy value chain in Kenya. This type of assessment is important to understand the types of business models used by POs, and thereby shed light on their role in value chain coordination and upgrading. The following research question was formulated:

RQ1: *What are the business model components of POs and what typology of PO business models can be derived?*

This first research question is answered using qualitative data collected from managers and board members of dairy POs in Meru and Nyandarua counties in Kenya, dairy experts in the government and NGO offices, and observational instances including attending PO meetings and PO tours. Using the framework of business model as proposed by Mazzarol *et al.* (2018), this study identifies nine business model components of POs; key activities, key resources, members, governance structure, cost structure and revenue streams, customer segments, legal form, and member and customer value propositions. Based on these components we classify POs in the Kenyan dairy value chain into four models: bargaining, cooling, hub, and processing. The business model of a bargaining PO is as follows. Operations are limited to one stage of the value chain i.e., collection and bulking, membership size is small, volume intake and investments are low, no food safety controls are provided unless through a third

party, decision rights reside with the members, and value proposition is low. POs adopting a processing business model vertically integrate into processing, leading to the production of different final dairy products. Membership size is large and volume intake is high as well as investment in physical and human assets. Tight food safety control measures are employed. Decisions are coordinated centrally, with managers gaining some rights to make decisions. In between bargaining and processing are cooling and hub business models that show intermediate levels of vertical integration, membership size, volume intake, food safety control, and allocation of decision rights. We show that POs respond to value chain coordination and upgrading needs in that as coordination and upgrading increase, POs shift from a bargaining business model to a processing business model.

The second part of this research extends the scope of the initial study by including a survey of smallholders in PO adopting bargaining and processing business models, which we refer here as baragining and processing POs. The second part is done in two steps. The main focus of the first step is to analyze inclusion dynamics in bargaining and processing POs and the second step is to analyze whether membership of smallholders affects their adoption of food safety measures.

Regarding inclusion, the study began with assessing the determinants of smallholders' membership and participation in decision-making processes in POs by answering the following research question:

RQ2: *What factors determine farmers' membership and their participation in decision-making in POs?*

Using the cost and benefit theory and multinomial logit analysis of quantitative data from the 595 smallholder dairy farmers, results show that membership in bargaining POs favors farmers with hired labor and those in remote locations. Farmers who are more educated, own pure breeds, and have a large number of cows are likely to belong to processing POs compared to non-membership. Furthermore, farmers who are located in less remote areas are more likely to be members of processing POs versus non-membership. The sequential logit model is employed to analyze smallholder participation in three decision-making stages: attending the annual general meeting, speaking up in the annual general meeting, and serving on the board. The relationship between membership in processing POs and participation is negative. Membership in processing POs reduces the likelihood to speak up in the annual general meeting and to serve on the board. We find that farm assets such as ownership of pure breed cows, number of cows, and farm size are positively associated with attending the annual general meeting of bargaining POs while young farmers and women are excluded from the decision-making process in processing POs. Likewise, the probability of small farmers and those with low social capital to participate in decision-making in the processing POs is low.

To further understand inclusion in POs, the study proceeded with examining the impact of membership on women empowerment. The following research question was answered.

RQ3: *What is the effect of household and woman membership in POs on women empowerment?*

In this third research question, we analyze the effect of PO membership on women empowerment and distinguish the membership effects by the type of PO and the type of membership (household member i.e, either man or a woman is a member, and woman member). Quantitative data from 267 men and 207 women in member and non-member married households are used, and an entropy balancing technique and regression models employed to assess the membership effect. Empowerment indicators, drawn from the Women Empowerment Livestock Index (WELI) tool, include (1) decisions about agricultural production; (2) decisions related to nutrition; (3) access to and control over resources; (4) control over and use of income; (5) access to and control over opportunities; and (6) workload. We find that household membership in a bargaining PO (i.e., either man or woman in a household is a member versus household non-membership) increases women's ownership of cows, access to income, control over decisions on dairy production, and decisions on buying and selling of cows. Further, comparing women members versus men members, woman membership in a bargaining PO increases her ownership of cows and control over decisions on production and income. Household membership in processing POs does not significantly affect women's ownership of cows but compared to man membership, woman membership increases women's access to income and control over decisions on the use of this income.

Finally, the second step of part two of the study involved a survey of smallholders to validate the results on Chapter 2 concerning upgrading through POs. Specifically, the study focused on process upgrading by assessing members' adoption of food safety measures. Compliance with food safety requirements is key factor for inclusion and is highly linked to upgrading and coordination in value chains. The research question asked is as follows:

RQ4: *What is the effect of household membership in POs on the adoption of food safety measures?*

Research question 4 examines whether and to what extent membership in a PO affects a farmer's adoption of food safety measures, and explores the difference in membership effects across POs. Using a literature review and 11 expert interviews, we identify four categories of food safety measures related to production; milking, milk storage, milking area, and animal health. The expert interviews aided in rating the importance of each category on milk safety and in generating food safety indexes for the categories. We then use food safety indexes to empirically evaluate the effect of membership on the adoption of the food safety measures across the four categories. A quantitative survey with 595 smallholder dairy farmers in Kenya

was employed. Using the propensity score matching technique to control for selection bias, our results show that membership improves smallholders' adoption of food safety measures related to milk storage and the milking area. Notably, the estimation of the membership effects across POs reveals that members of processing POs achieve higher adoption levels of food safety measures than members of bargaining POs. The effect size of membership in processing POs is larger and stronger in significance than that of membership in bargaining POs.

The rest of this chapter is structured as follows. Section 6.2 presents the research findings from a broader perspective; contribution to the literature is presented in section 6.3; followed by policy and managerial implications; then limitations and further research in sections 6.4 and 6.5 respectively.

6.2 Research findings from a broader perspective

Using the global value chain theory and business model framework, this thesis discusses coordination and upgrading strategies in value chains through POs. Increasing urbanization and international trade have led to the transformation of agri-food value chains as different coordination and upgrading strategies are adopted by actors to cope with food safety and volume demands of urban and international markets. In this thesis, we focus on a specific actor, i.e., PO. Examining POs is important given that it is the main channel through which smallholders, who are the main suppliers of food to urban and rural markets in developing countries, engage in modern agri-food value chains (Abdul-Rahaman & Abdulai, 2020; Gerard *et al.*, 2020). As upgrading and coordination strategies evolve in value chains, POs are likely to adopt different patterns of operations to remain competitive or viable businesses. However, not much is understood on the differences of POs. Using a business model framework, we explore the business models of POs associated with different upgrading and coordination strategies in value chains. The main aim of this thesis is to examine the role of POs in value chain coordination and upgrading, and assess the relationship between economic upgrading and social upgrading, thus we provide insights for developing sustainable value chains.

6.2.1 Relationship between coordination and upgrading, and business models of POs

Our thesis sheds some light on how coordination and economic upgrading in value chains is related to the business model of POs. Traditionally, horizontal coordination is the main objective of a PO where members come together to improve economies of scale and bargaining power (Michalek *et al.*, 2018). In Chapter 2, we find that such POs exist in Kenya and perform minimal functions in the value chain, mainly coordinating collection and bulking of members products and selling the products. No investment in food safety control and physical assets is undertaken and membership is small. POs using this business model face problems inherent in traditional POs in Africa including limited access to financing, weak management capacity, competition from other buyers, lack of access to inputs, and lack of information on new technologies (Latynskiy & Berger, 2016).

As the need to increase vertical coordination and upgrading in value chains rises, POs have to change their business models. First, a functional upgrading trajectory is adopted where POs vertically integrate into other activities in the value chain. Additional services such as access to inputs, credit, and technical training are incorporated that contribute to reducing smallholder's transaction costs. Vertical integration calls for investment in physical assets, meaning that capital requirement is high. We find that POs meet the need for capital financing by increasing membership size, membership fees, introducing shares, and sometimes partnering with an external investor (Chapter 2). Large membership size, however, means that it is difficult to control the PO in a democratic way which can lead to a loss of trust and member commitment (Nilsson, 2001). Vroegindewey *et al.* (2018) note that it is difficult to monitor and manage large and heterogeneous membership base in cereal POs in Mali. This monitoring can be on food safety issues. Moreover, inefficiencies arise when members' interests conflict with those of non-member investors who are focused on maximizing profits.

Second, POs adopt a process upgrading trajectory focusing on improving compliance with food safety standards. Vertical coordination becomes key to ensure the efficient flow of information and technologies related to food safety between the organization and the farmers. Information flow is enhanced by managing decisions centrally through professional staff hired by members (Chapter 2). Our findings are consistent with Mishra and Dey (2018) who show that Gujarat cooperative, a processing dairy PO in India, adopts a decision-making system whereby decisions on price, technology, products, and practices are centrally managed. The downside of hiring professional staff is that members shift some decisions to professional staff, which can cause a principal-agent problem (Fama & Jensen, 1983).

Still, on process upgrading, we show that POs adopt strict food safety measures. Adoption is supported by process control measures involve farm inspection, provision of access to technical training and credit for investing in food safety-related assets such as milk cans, concrete milking floors, e.t.c, as well as output control measures that involve subjecting milk into laboratory tests for quality (Chapter 2). In POs with a large membership size where a lack of trust and commitment may arise, these measures have been emphasized in literature as key in improving commitment to food safety compliance among members (Zhou *et al.*, 2019). We indicate that members of processing POs achieve higher adoption levels of food safety measures than members of bargaining POs (Chapter 5). High adoption of food safety measures among members is particularly necessary for vertical integration (Bijman *et al.*, 2011). Tighter food safety measures improve competitiveness and profitability of POs but can be costly for poor farmers who cannot invest in meeting the required standards (Moustier *et al.*, 2010; Hoffmann *et al.*, 2019). Self-selection may arise where better-off farmers that can invest in meeting the food safety requirements of buyers join POs. The literature indicates that poor farmers are excluded from agri-food value chains with tight food safety measures (Reardon *et al.*, 2019).

Third, a product upgrading trajectory involving the processing of various final products, improving product quality, packaging, and branding is undertaken in POs as the need for economic upgrading increases in value chains (Chapter 2). Processing, product differentiation, and quality improvement increase prices potentially leading to a high member value proposition. Customer value proposition is also increased through availability of products of improved shelf-life. More value for customers increases customer satisfaction which can lead to long-term relationships. However, while processing can add value, it is costly and needs advanced technology.

In this thesis, a processing PO is associated with the highest level of vertical integration and economic upgrading, while a bargaining PO is associated with low economic upgrading and vertical integration in value chains. Cooling and hub POs facilitate intermediate levels. Because of its focus on improving competitiveness in value chains, we consider a processing PO as more business-oriented than bargaining, cooling, and hub POs. A bargaining PO is a typical example of a traditional organization or, in other words, a less business-oriented organization.

6.2.2 Relationship between economic upgrading and social upgrading

The extensive literature on global value chains shows that value chain actors in developing countries adopt different economic upgrading strategies (Kilelu *et al.*, 2017b; Soullier *et al.*, 2020), and these studies have recently expanded into examining the social impact of economic upgrading (Rossi, 2013; Yamin *et al.*, 2015). While economic upgrading is considered as a move to achieving social upgrading, this is not always the case and economic upgrading can actually lead to social downgrading (Barrientos *et al.*, 2011). In this thesis, we provide further input into this debate by analyzing whether social upgrading differs with different economic upgrading strategies. Specifically, we compare social upgrading between bargaining POs that are associated with low economic upgrading and processing POs associated with high economic upgrading.

We focus on social inclusion, a form of social upgrading, to answer this question. Smallholders are often included in value chains through POs in a multifaceted process consisting of membership, participation in decision making, and benefitting from services and value created. Whether smallholders benefit from economic upgrading in value chains is dependent on whether they are included in those processes. This thesis provides various findings regarding social inclusion and economic upgrading.

First, we assess membership in POs. On one hand, a bargaining PO has no physical assets and food safety control measures meaning that the cost of membership and investment required is low (Chapter 2). Low membership cost favors poor farmers. Indeed, bargaining POs in Kenya appear to be relatively more inclusive in membership, i.e., there is no discrimination in terms

of gender, education, ownership of improved cow breeds, and geographical location (Chapter 3). On the other hand, processing POs adopt high vertical integration strategies and tight food safety controls meaning that members have to carry out specific investments. However, processing POs offer several economic benefits to farmers including access to inputs, technical training, and credit (Chapter 2). While these benefits are expected to offer incentives for membership of poor farmers, we find that farmers that are better off join processing POs while less educated and poor farmers, and farmers in remote locations, are excluded (Chapter 3). This means that the cost of membership in processing POs is higher than the expected benefits for poor farmers. Self-selection of members happens; only better-off farmers who can invest in producing according to the safety requirements will join. High costs of investing in producing safe food in modern agri-food value chains is widely acknowledged in literature as the main reason for exclusion of smallholders who cannot comply (Hoffmann *et al.*, 2019; Nguyen & Jolly, 2020). The wider implications are that poor farmers do not benefit from high economic upgrading and do not access remunerative markets.

Second, when farmers join POs they are required to participate in decision-making processes. Bargaining POs have a small membership size, low investment, small volume intake, and often lack food safety controls (Chapter 2). For bargaining POs, low costs of investing in complying with food safety requirements imply that members expect higher marginal returns, which can increase participation in decision-making. Additionally, small membership size is linked to low transaction costs in making collective decisions, an important factor for inclusion of poor farmers (Bernard & Spielman, 2009a). However, our findings in Chapter 3 contradict these views by showing that bargaining POs exclude poor farmers from participating in decision-making. When farmers do not participate in decision-making in POs, they lack opportunities to influence the decisions of other actors in the chain, e.g. buyer's decisions on volume, price, and safety requirements. The broader implication of our results is that even in value chains with low economic upgrading, it is difficult for poor farmers to influence decisions of other actors. Women, though, have an equal chance to participate in decision-making as men in bargaining POs. We argue that the participation of women in decision-making in bargaining POs improves the representation of women's interests in value chains with low economic upgrading strategies. This is important particularly in solving resource constraints of women.

Members of processing POs in Kenya are less likely to participate in decision-making (Chapter 3). Further, poor and women farmers are also excluded from decision-making processes of processing POs (Chapter 3). The results can be explained as follows. Processing POs vertically integrate into processing, invest in food safety control, and professionalize their activities. With professionalization comes separation of decision rights between members and professional staff, which can result in lower trust. In the long run, members may feel disconnected to the processing PO, leading to low commitment to decision-making.

Additionally, high cost of membership and investing in processing facilities and food safety reduces participation in decision-making by poor farmers, whose expected returns are low. Finally, gender inequalities existing in formal institutions (e.g. laws, regulations) and informal institutions (e.g. norms and attitudes) could be limiting women's ability to participate in an organization (Said-Allsopp & Tallontire, 2015; Ros-Tonen *et al.*, 2019). Our findings are in line with those of Bonnan-White *et al.* (2013), who find tensions between the need to improve food safety and increase integration of vulnerable groups among women-led POs in Palestine. We conclude that economic upgrading in value chains through processing POs contributes to social downgrading. The exclusion of poor and vulnerable farmers, especially in decision-making implies that organizations will not integrate the interests of excluded groups in designing value chain policies. PO and value chain supported development will be biased towards the wealthy groups in communities.

Third, we assess distribution of benefits from economic upgrading in value chains using the women empowerment in livestock index tool (Chapter 4). In sub-Saharan Africa, women face greater barriers than men in agricultural development. Women control fewer resources, have less decision-making power over household income, and face time constraints because of their triple burden of productive, domestic, and community responsibilities (IFPRI, 2020). This creates barriers to women's participation in agri-food value chains. POs have been recognized as promising channels for women smallholders to overcome agricultural production and marketing challenges by facilitating access to markets, information, training, and inputs, and increasing women empowerment.

Does membership in POs imply that women benefit? In Chapter 5, we examine the effect of household and woman membership on women empowerment. We distinguish women empowerment effects between bargaining and processing POs. We find that household membership in a bargaining PO (i.e., either man or woman in a household is a member versus household non-membership) increases women's ownership of cows, access to income, control over decisions on dairy production, and decisions on buying and selling of cows. Further, comparing women members versus men members, woman membership in bargaining POs increases their ownership of cows and control over decisions on production and income. This means that when households join value chains with minimal economic upgrading, women empowerment increases contributing positively to social upgrading.

Household membership in processing POs does not significantly affect women's ownership of cows but compared to man membership, woman membership increases women's access to income and control over decisions about the use of this income. Compared to bargaining POs, we see that household membership in value chains with high economic upgrading strategies results in low women empowerment. This validates our initial findings in Chapter 3 that vertical integration contributes to social downgrading. However, supporting women membership in value chains with high economic upgrading strategies is a good move towards

improving social upgrading in competitive value chains. Since we did not come across studies comparing women empowerment in bargaining and processing POs, we use the broad literature on women participation in value chain to support our findings. For instance, Masamha *et al.* (2018) note that the introduction of processing facilities in cassava value chains in Tanzania, leads to women disempowerment as men take over the control of production and benefit thereof. Similarly, as the avocado value chain in Kenya upgrades into strict food safety compliance, women become disempowered as men take over control of production because of expected higher incomes associated with improving product safety (Oduol *et al.*, 2017).

6.3 Contribution to the literature

The thesis contributes to the literature, particularly from the perspective of the business models of POs and value chain upgrading.

6.3.1 Business models of POs

The thesis gives insights into the business models of POs and their role in value chain coordination and upgrading. POs are considered as organizations that focus on social functions. One question that is overlooked is how POs conduct business in increasingly competitive value chains. To answer this question, this thesis examines business models of POs in relation to coordination and upgrading strategies in value chain. We show that where low coordination and economic upgrading exist in value chains, POs adopt a bargaining business model, which facilitates traditional functions of collection and bulking to improve economies of scale. However, as the need for coordination and economic upgrading increases, POs adopt a processing business models. Such POs vertically integrate into processing, provide additional services such as inputs and technical training, hire professional staff, improve value proposition for members and customers, and adopt strict food safety control measures. This thesis complements the study of Bijman *et al.* (2016) by showing the importance of adopting business strategies, particularly professionalization and vertical integration, in POs in competitive value chains. We indicate that POs are responsive to value chain coordination and upgrading needs.

Although we focus on POs in the Kenyan dairy value chain, the business model classification is relevant for organizations in other countries of the developing world. Dairy POs in India, for instance, employ similar business model characteristics as dairy POs in Kenya (Trebbin & Hassler, 2012; Trebbin, 2014). The typology derived in this thesis could also be extended to POs in non-dairy value chains. Previous literature has suggested that POs in tea, coffee, and cereals value chains have similar characteristics in terms of governance, legal forms, and functions as dairy POs (Rondot & Collion, 2001; Shiferaw *et al.*, 2011). Like in dairy POs, non-dairy POs are formed by members and engage in different functions along the value chain including collection, bulking, cooling, and processing.

6.3.2 Economic and social upgrading in value chains through POs

Although examining value chain upgrading is not a new phenomenon (Trienekens, 2011), little research has been done in analyzing the relationship between economic and social upgrading. So far, it is not clear whether economic upgrading results in social upgrading or social downgrading (Rossi, 2013). This thesis has provided further arguments on this debate by analyzing the relationship between different economic upgrading strategies and social upgrading. We make two contributions to this literature. First, we conceptualize value chain upgrading as a complex process that requires smallholders to be included in POs. Most past research adopted a value chain-wide perspective in examining social upgrading, yet the majority of smallholder farmers in developing countries participate in modern agri-food value chains through POs. This research goes further to examine social upgrading in value chains in terms of social inclusion of smallholders in membership and participating in decision-making processes in POs as well as benefiting. Second, we the distinguish upgrading by type of POs. We find that bargaining POs are associated with low economic upgrading, but with social upgrading in terms of inclusion of poor in value chains and women empowerment. Processing POs are associated with high economic upgrading, i.e., high food safety compliance, access to technical services, and vertical integration. However, this results in a trade-off where poor and women farmers are excluded in value chains. The thesis makes a contribution to the bulging literature on the significance of economic upgrading in value chains for social upgrading.

6.3.3 Women empowerment

Scholars of women empowerment argue that membership of women in development programs does not ensure that they benefit, for instance by increasing income, and if they accrue benefits such as increased income, that does not ensure they are empowered to control that income (Johnson *et al.*, 2018). In this thesis, the differences regarding women's ownership of cows and their control and benefits contribute to the debate on who owns and who controls or benefits from assets. Sanginga *et al.* (2013) emphasize that in livestock systems, the concept of ownership cannot be taken in isolation from control over livestock and benefits. It cannot be assumed that women who own cows have all decision-making rights on access, use, and control of benefits. Our results are in line with Njuki *et al.* (2013)'s claim that in Kenya and Tanzania women's ownership of livestock does not always imply that they have control over them. Women may own livestock, acquired through the market or inheritance before or during marriage, but may not have decision-making authority over such livestock. However, in other contexts ownership has been defined differently as using an asset, selling or inheriting an asset, deriving benefits from the asset, or investing in the asset (Galiè *et al.*, 2015; Quisumbing *et al.*, 2015; Basu *et al.*, 2019). The issue of who owns, who controls, and who benefits from livestock has been a longstanding debate among gender scholars and our results depict the complexity of defining the ownership concept.

6.3.4 Methodological contribution

We contribute to the methodology of evaluating smallholders' inclusion in decision-making processes in POs. Most studies analyzing determinants of participation in decision-making use several alternative modeling techniques such as ordered, multinomial, and nested logit models. However, these models are not always appropriate. For example, the multinomial and nested logit models do not account for the ordering of the decision-making process. The conventional approach would be to apply an ordered probit/logit model. However, the decisions studied are not only ordered but also sequential. Attending the annual general meeting (passive) is conditional on being a member (nominal), speaking up in the annual general meeting (active) is conditional to attending the annual general meeting (passive), and serving on the board (pro-active) is conditional on speaking up in the annual general meeting (active). There is self-selection for each higher level of participation in the decision-making process. An ordered probit estimate would be biased since it does not take the conditional sequence or the self-selection involved in these decisions into account.

This thesis adopts a sequential logit model as proposed by Fullerton (2009). The model explores the association between household characteristics and the PO type on the decision to move from one stage to the next. The decision to move to the next higher stage is correlated with the previous decision, and the subsequent decisions are subject to selectivity with respect to earlier decisions. A key advantage of the sequential logit model is that it clarifies previous empirical and theoretical explanations for participation by considering that decisions are driven by household characteristics and PO type at each stage. Knowing the influence of household characteristics and PO type on each stage gives a complete picture of how inequalities in participation come about, describing the disparities in the process, rather than in the outcome. For instance, the thesis shows that while membership in processing POs does not discriminate by gender, women farmers are excluded from participating in the next stages of attending meetings and serving on the board.

6.4 Practical implications

We draw several practical implications, primarily managerial, societal, and policy.

6.4.1 Societal implications

We show that a bargaining PO is more inclusive in membership and participation in decision-making processes than a processing PO. In other words, economic upgrading in value chains is associated with social downgrading. If development practitioners aim to promote inclusive growth, supporting bargaining POs is recommended. For highly upgraded value chains, provision of additional services such as financial and technical training to the poorest farmers would be needed to improve inclusion (Mishra & Dey, 2018). Previous studies confirm that inclusion develops in POs that provide financial services to vulnerable members or compensate disadvantaged members for not being able to access subsidized inputs (Minah &

Malvido Perez Carletti, 2019). Where possible, decision-makers could pay attention to the needs and interests of the farmers that may not be able to participate adequately in POs.

Household membership in POs increases women empowerment. The observed increase in women's independent control over resources at the household reflects increased independent responsibilities among member households in the allocation of resources. This raises the question of whether increased women's independent control over resources is beneficial for women empowerment or that maybe women take over the role of controlling economic resources, and by extension providing for the household while men become less involved in this role. More so, increased women's independent control over resources may lead to intra-household conflicts and gender-based violence (Haile *et al.*, 2012; Johnson *et al.*, 2016). We suggest that development practitioners create awareness among men to avoid these problems occurring in member households.

6.4.2 Policy implications

Our other contribution relates to development policy regarding women empowerment in different types of POs. We argue that while women membership in a bargaining PO improves women empowerment, membership in a processing PO fails to challenge traditional gender inequalities in ownership of cows. In these POs, women membership alone cannot eliminate gender disparities but should be complemented with other interventions that improve men's and women's awareness of women empowerment. There is a need for PO leaders to incorporate measures for improving social inclusion in (re)designing and establishing processing POs, for instance, regarding how men and women share the benefits received through membership.

We also provide a recommendation regarding policies for food safety. POs improve farmer's adoption of food safety measures. We focus on POs that operate in the formal dairy value chains and show that members of POs are better adopters compared to non-members who dominate the informal chain. Through increased adoption of food safety measures in the formal value chain, consumer awareness of food safety issues may increase causing a spillover of food safety concerns to the informal sector, which has weak food safety enforcement and where consumers purchase raw milk. The importance of such spillover effects has been shown in previous studies suggesting that improving food safety in the formal chain may subsequently lead to food safety improvement in the informal chain (Leksmono *et al.*, 2006; Roesel & Grace, 2014). Strict food safety requirements in the formal chain, however, will increase the supply of unsafe food in the informal chain as milk that is rejected in the formal chain ends up in the informal chain, on which the majority of the consumers depend (Kiambi *et al.*, 2018). We recommend, therefore, that governments develop policies that promote the adoption of food safety measures in both chains.

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6.4.3 Managerial and academic implications

The typology of PO business models derived, that is, bargaining, cooling, hub, and processing can be used by managers, board members, and development practitioners to re-design POs. The typology is also useful in formulating a business model design when establishing a new PO. For researchers, the typology is important for analyzing the impact of different POs on smallholder livelihoods and the performance of the organizations.

6.5 Limitations and further research

This thesis uses a cross-sectional survey approach which provides limitations to our estimation. A randomized control trial of PO membership would allow a more rigorous and unbiased evaluation of the impact of PO membership. Perhaps even better, to minimize the bias of using recalled data, a baseline and end-line data can be collected from the treatment group and the control group to allow establishing the impact.

Our analysis of inclusion does not capture the role of farmers' motives, like political ambitions, in influencing decisions to join POs and participate in the decision-making process. These factors have been considered important in participation in cooperatives in Europe (Kronholm & Wästerlund, 2013; Morfi *et al.*, 2018). Regarding the analysis of women empowerment, focus group discussions could help explain the gender dynamics observed and to further nuance the concept of ownership. We collected data from one member of the household. Probably men and women have different perceptions of decision-making and intra-household allocation of resources. The study collected data on key livestock assets, not the entire asset portfolio, and did not collect information on the value or share of the assets or income owned by gender. Future studies should collect more detailed asset and income data to be able to grasp a full understanding of control over assets and income by gender.

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Summary

Agri-food value chains in developing countries are experiencing rapid transformations because of increased urbanization, incomes, and supermarket retail chains, which have led to tighter food safety requirements. These changes call for upgrading and coordination of activities and decisions by actors in the chain to ensure value chain efficiency and to meet customer's demands. Although wide literature is available on value chain upgrading and coordination, most research adopts a chain-wide perspective. Little has been done to understand the role of specific actors like POs. Yet, POs form the main channel through which smallholders are included in agri-food value chains in developing countries. More so, previous studies focus on economic upgrading while little attention has been given to social upgrading. Scholars are beginning to question whether economic upgrading leads to social upgrading.

The present thesis aims to gain insights into the role of POs in value chain coordination and upgrading in agri-food value chains, and assess the relationship between economic upgrading and social upgrading.

The thesis addresses this general aim using four research questions and by using both qualitative and quantitative methods. Chapter 2 takes a first step in answering the general aim by focusing on the business models of POs. With the changing coordination and upgrading strategies of value chains, POs are expected to change their business models as they adopt coping strategies. However, not much is known about the business models of POs. Thus, Chapter 2 fill this gap by answering the following question:

RQ1: *What are the business model components of POs and what typology of PO business models can be derived?*

Based on key informant interviews with managers and members of the board of 22 POs, experts from the government, and NGOs together with observations of PO activities and meetings, qualitative data was obtained to explore business models of POs. The study finds that key activities, key resources, members, governance structure, cost structure, and revenue streams, customer segments, legal form, and member and customer value propositions are important business model components of POs. Four types of business models of POs were derived including bargaining, cooling, hub, and processing. A processing PO is associated with the highest level of vertical integration and economic upgrading, while a bargaining PO is associated with low economic upgrading and vertical coordination in value chains. Cooling and hub POs facilitate intermediate levels. Because of its focus on improving competitiveness in value chains, we consider a processing PO as more business-oriented than bargaining, cooling, and hub POs. A bargaining PO is a typical example of a traditional organization or in other words, a less business-oriented organization.

Chapter 3 extends the scope of the initial study by including a survey of smallholders in bargaining and processing POs to examine social inclusion. The purpose of this study is to assess the determinants of smallholders' membership and participation in decision-making processes in POs. This will help in explaining social inclusion in POs, thus contributing to understanding social upgradining in value chains. The following research question was addressed:

RQ2: *What factors determine farmers' membership and their participation in decision-making in POs?*

Using the economic utility theory and multinomial logit analysis of quantitative data from the 595 smallholder dairy farmers, results show that membership in bargaining POs favors farmers with hired labor and those in remote locations. Farmers who are more educated, own pure breeds, and have a large number of cows are likely to belong to processing POs compared to non-membership. Furthermore, farmers who are located in less remote areas are more likely to be members of processing POs versus non-membership. A sequential logit model was employed to analyze smallholder participation in three decision-making stages: attending the annual general meeting, speaking up in the annual general meeting, and serving on the board. The relationship between membership in processing POs and participation is negative. Membership in processing POs reduces the likelihood to speak up in the annual general meeting and to serve on the board. We find that farm assets such as ownership of pure breed cows, number of cows, and farm size are positively associated with attending the annual general meeting of bargaining POs while young farmers and women are excluded from the decision-making process in processing POs. Likewise, the probability of small farmers and those with low social capital to participate in the processing POs is low. The study provides insights into the role of POs in social upgrading in value chains.

Chapter 4 offers further insights into the role of POs in social upgrading by examining who benefits from inclusion. It is argued that women control fewer resources, have less decision-making power over household income, and face time constraints because of their triple burden of productive, domestic, and community responsibilities (IFPRI, 2020). This creates barriers to women's participation in agri-food value chains. POs have been recognized as promising channels for women smallholders to overcome agricultural production and marketing challenges by facilitating access to markets, information, training, and inputs, and increasing women empowerment. Chapter 4 examines the effect of membership in POs on women empowerment by answering the following question:

RQ3: *What is the effect of household and woman membership in POs on women empowerment?*

The effect of PO membership is distinguished by the type of PO and the gender of a member. Quantitative data was used from 267 men and 207 women in member and non-member married households, and an entropy balancing technique and regression models were employed to assess the membership effect. Empowerment indicators are drawn from the Women Empowerment Livestock Index (WELI) tool and include (1) decisions about agricultural production; (2) decisions related to nutrition; (3) access to and control over resources; (4) control over and use of income; (5) access to and control over opportunities; and (6) workload. We find that household membership in a bargaining PO, that is, regardless of whether the man or the woman in the household is the member, increases women's ownership of cows, their control over decisions on buying and selling of cows and dairy production while household membership in processing POs increases women's control over dairy production decisions. Distinguishing the membership effect by the gender of the member, we find that woman membership in bargaining POs increases women's ownership of cows but woman membership in processing POs has no significant effect on this outcome. The paper suggests that the type of PO has implications for women empowerment with bargaining POs appearing to be more empowering than processing POs.

In Chapter 5, we gather empirical evidence from smallholders on economic upgrading through POs. The study focuses on process upgrading regarding improvement of food safety control measures. Food safety is the main determinant for coordination and upgrading in value chains and for inclusion of smallholders. The study examines the effect of membership in POs on the adoption of food safety measures. The research question asked is as follows:

RQ4: *What is the effect of household membership in POs on the adoption of food safety measures?*

We assess whether and to what extent membership in POs affects farmers' adoption of food safety measures, and explore the differences in membership effects across POs. Using a literature review and 11 expert interviews, we identify four categories of food safety measures related to production: milking, milk storage, milking area, and animal health. The expert interviews aided in rating the importance of each category on milk safety and in generating food safety indexes for the categories. We then used food safety indexes to empirically evaluate the effect of membership on the adoption of the food safety measures across the four categories. For this empirical estimation, a quantitative survey with 595 smallholder dairy farmers in Kenya was employed. Using the propensity score matching technique to control for selection bias, our results show that membership positively and significantly improves smallholders' adoption of food safety measures related to milk storage and the cleaning of the milking area. Notably, the estimation of the membership effects across POs reveals that members of processing POs achieve higher adoption levels of food safety measures than members of bargaining POs. The effect size of membership in processing POs is larger than

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that of membership in bargaining POs. We confirm that adopting vertical integration entails following strict food safety control measures.

In sum, the four research questions have contributed to understanding value chain coordination and upgrading through POs. Regarding business models of POs, we show that where low coordination and economic upgrading exist in value chains, POs perform traditional functions of collection and bulking to improve economies of scale. However, as the need for coordination and economic upgrading increases, POs vertically integrate into processing, provide additional services such as inputs and technical training, hire professional staff, improve value proposition for members and customers and adopt strict food safety control measures. The typology is useful in formulating a business model design when establishing a new PO. For researchers, the typology is important for analyzing the impact of different POs on smallholder livelihoods and the performance of the organizations.

In terms of the relationship between economic upgrading and social upgrading, bargaining POs are associated with low economic upgrading, but high social upgrading. Processing POs are associated with high economic upgrading, i.e., high food safety compliance, access to technical services, and vertical integration. However, this results in a trade-off where poor and women farmers are excluded from value chains. If development practitioners aim to promote inclusive growth, supporting bargaining POs is recommended. For processing POs, provision of additional services such as financial and technical training to the poorest farmers would be needed to improve inclusion in highly upgraded value chains.

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Mercy Mwambi

Mercy Maiwa Mwambi

Wageningen School of Social Sciences (WASS)

Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
Organization of agribusiness, BEC-31306	Wageningen University	2016	6
Quantitative Data Analysis: Multivariate Techniques, YRM-50806	Wageningen University	2016	6
Questionnaire construction, YRM-65300	Wageningen University	2018	1.5
Writing Research proposal	Wageningen University	2016	6
B) General research related competences			
WASS Introduction course	Wageningen School of Social Sciences	2015	1
'Towards a Typology of Collaborative Business Models in the Dairy Value Chain in Kenya'	ICA Research Conference, Wageningen	2018	1
Institutional and Organizational Economics Academy	Institutional and Organizational Economics Academy, Corsica	2017	1.8
'Collaborative models in the Dairy Value Chain in Kenya'	PhD day, Wageningen School of Social Sciences	2017	1
'Farmer participation in Bargaining and Processing Producer Organisations: Evidence from Kenya'	PhD day, Wageningen School of Social Sciences	2019	1
Research data management	Wageningen University Library	2018	0.45
LIQUID educational workshops	Local and International business collaboration for productivity and Quality Improvement in Dairy chains in Southeast Asia and East Africa (LIQUID), Tanzania	2018	2
C) Career related competences/personal development			
Information Literacy including EndNote Introduction	Wageningen University library	2015	0.6
Multidisciplinary perspectives on quality improvement in value chains	Wageningen School of Social Sciences	2016	1
Scientific writing	In'to Languages, Wageningen	2018	1.8
Presenting with Impact	In'to Languages, Wageningen	2018	1
Scientific publishing	Wageningen Graduate School	2019	0.3
Total			**32.45**

*One credit according to ECTS is on average equivalent to 28 hours of study load

Propositions

1. Women's presence is not women's empowerment (this thesis)

2. The inclusion versus efficiency debate excludes poor farmers (this thesis)

3. Food safety is a health as well as a political issue

4. Women empowerment is not only women's affair but also men's affair

5. The question "when will you finish your PhD?" feels worse than "when will you have your next baby?"

6. The ability to quickly adapt to different social, cultural and physical environments is critical for the success of sandwich PhDs

Propositions belonging to the thesis, entitled

Essays on Producer Organizations: Business Models, Social Inclusion and Food Safety

Mercy Maiwa Mwambi

Wageningen, 10 November 2020