Innovations in Low-Income Country Food Systems
MICHELSON
2024.11

Introduction

The food sector is a critical area of employment and economic activity in most low-income countries, especially for the rural poor, providing incomes and sustenance, employment and growth.

In many low and middle-income countries, two configurations, formal and informal, overlap in economically significant grey areas. This overlap between the formal and informal is particularly common and therefore relevant to research and policy in the food sector of low-income countries. This paper is concerned with identifying innovations in the informal sector of food systems in low-income countries, in particulåar innovations that improve participation and circumstances for those at the bottom: farmers, small traders. This focus requires some distinction between formal and informal; this distinction will abstract away from a lot of the overlap and the dynamism of the sector. We organize the definition of formal and informal primarily around the degree of compliance with official regulatory frameworks and financial systems, acknowledging that this definition has some limitations. For example, the nature of activities and actors in the informal sector—such as smaller firm size or transaction size—can in some cases mean that their operations are not subject to the regulations that apply to larger firms. Formality, in such economies and under such a definition, is then tightly correlated not just with regulatory compliance but also the economic scale of the operations (which may be endogenously determined as a means of avoiding regulation). While this framework helps to clarify the boundaries of what is considered formal or informal, is important to recognize that these boundaries can be fluid, and in many contexts, the distinction may not fully capture the nuanced realities of economic activity.

In this sense, then, the food sector is still largely informal in many countries and regions in that much of its operation takes place outside official regulatory frameworks: transactions are often unregistered and unlicensed, and participants may not be in compliance with whatever formal regulations do exist. In contrast, formal food networks tend to be structured and documented, involving institutions such as banks and government agencies. In the informal market, those institutions are frequently absent, with transactions relying instead on personal relationships, rather than written legally binding agreements or other official documentation.

For example, formal firms – food processors or large-scale wholesalers or exporters that pay taxes and comply with regulation – may purchase from unregulated informal actors including small traders and small farmers. The two sectors are dynamically linked as well: informal markets can offer opportunities for actors who face social, capital, or regulatory barriers to entry into the formal sector, and firms and actors who begin operations in the informal sector may eventually move into the formal. These sectors therefore are often interrelated and permeable. In national economies, informal food traders and retailers can play critical roles connecting local producers with both consumers and with buyers including wholesalers, exporters, and processors, thereby impacting food availability and accessibility, economic activity and development, and even structural transformation of the economy.

Heterogeneous in its actors and tasks, informal sectors can operate at an impressive pace, though configurations in the sector can appear quite static over a span of years. Much of the activity – farmgate purchasing, spot-market transactions, relational contracting, aggregating, storing, and transporting small units of agricultural production across space and time – often function in established ways consistent with what they have done for decades or longer. Even so, such

traditional systems of small transactions and many intermediaries are also characterized by dynamism and innovation (Reardon et al., 2009; Swinnen and Maertens, 2007).

Researchers distinguish between two primary kinds of innovation. Disruptive innovations from outside the sector (Christensen et al., 2013) have been incorporated by actors in the informal food sector with notable success, reducing transactions costs and creating new opportunities; cellular phones have dramatically lowered the cost of information for example and mobile payments have transformed the way that farmers and traders transact. A second class of innovations - sustaining innovations (Nagy et al., 2016) - have developed *within* the informal food sector to build on or optimize existing processes; these innovations might include adoption of new quality standards or ways of contracting.

As in the formal sector, such innovations among informal market actors in low-income countries are crucial for adapting to changing market dynamics and new regulations, improving efficiency, and sustaining livelihoods. However, the origin, adoption, and spread of innovations is likely to be distinct in the informal sector relative to the formal. While regulation, formal contracting, third-party quality grading, and market power in the formal sector may clearly and quickly communicate incentives and costs for adoption of innovations, the informal sector is often characterized by information frictions and asymmetries, small idiosyncratic transactions, and comparatively longer and slower supply chains, with more intermediaries between farmer and consumer. Informal actors can be numerous and diverse, as are their commercial relationships and vertical coordination mechanisms. This relative fragmentation and lack of centralization in the informal food sector means both that innovation adoption incentives and costs can be more uncertain, and that

innovation may be dispersed across a range of actors, rather than originate as a centralized or mandated strategy.

There are, therefore, at least two important reasons to study innovation patterns in the informal sector: to understand the dynamics of their adoption and implications for other actors as well as to gain a broader understanding of the overall functioning of the sector. Identifying and studying innovations in the informal sector may provide insight into policies adaptable to other cultures and geographies, either in combination with existing services or at a greater scale. Innovation in the informal sector often emerges from resourcefulness and adaptability. By studying patterns of innovation, we can uncover practices that are sustainable and cost-effective.

Yet despite both the intrinsic and instrumental value of understanding innovation in the informal food sector, policy makers and researchers currently have **insufficient information** to address the topic. Most recent studies of innovations in low- and middle-income country food systems have focused on what is often characterized as the "modern" sector - exporters or supermarkets, actors with more global (international) focus in their market engagement and strategies, with less attention paid to the informal sector. As Verhofstadt and Maertens (2013) write: "processes of modernization also takes place in domestic chains and…there is a gap in the literature on the innovations in these chains and their implications for rural development and poverty alleviation" (p. 273).

Reviewing evidence in published, peer-reviewed research articles, this paper identifies and discusses innovations that may be useful for informal market actors, though many have been developed (or at least documented and researched) in formal market contexts. Future research might explore their efficacy and their adaptation to the needs of informal market actors. This study also identifies key

knowledge gaps regarding informal food markets and value chains. We review the literature to identify innovations in inclusive business models, innovations with the potential to improve the economic impact of informal actors. Where possible given the evidence, we discuss the opportunities for innovation that help these systems perform better for those whose livelihoods and food security depend on them. We also discuss environmental outcomes and implications where relevant.

Conceptual Distinctions

We begin by defining and discussing two important organizing concepts that guide the selection and interpretation of evidence in our review. We first discuss "informality" and its definition and relevance to the food sector in low-income countries. We then consider what constitutes innovation in the informal food sector.[1]

Fafchamps (2003) argues that it "is our propensity to call "informal" anything that is not of Western inspiration". Most studies concerned with the informal sector define "informal" with reference to a range of characteristics assessed along a continuum (Steel and Snodgrass, 2008): firm size, registration status, management structure and contractual arrangements with employees, and tax payments related to operations. These characteristics are often used in combination to identify activity as informal, as many authors argue that no single characteristic is sufficient for classification. Dabla-Norris et al. (2008), for example, show that business size has a strong positive correlation with whether a firm is informal or formal; but identifying the same relationship, Benjamin and

[1] Incidentally, the place of agriculture in the broader literature on formal and informal economic sectors is itself somewhat ambiguous. Agriculture is sometimes left out of the calculations of informal sector economic activity in low-income countries entirely. While our focus here is on farmgate and post-farmgate activities, the confusion at sector-level serves as relevant context.

Mbaye (2012) argue that size is not enough. Researchers have also observed that registered firms may hide from tax authorities and that firms with legal and contractual standing may conduct "off-the books" transactions or employ workers informally.

Other scholars have considered why the informal sector exists and what function it performs (Loayza 1996; Kanbur 2017; Boly 2018; World Bank 2019a). One explanation: the composition and persistence of an informal sector is an outcome of sorting, with low productivity firms surviving in the informal sector (La Porta and Shleifer 2014) while relatively more productive firms sort into the formal sector. Another proposed distinction: regulation pushes firms into the informal sector as a means of hiding from high costs that can include licensing and taxation. de Mel, McKenzie, and Woodruff (2011) argue that profit-maximizing firms might choose informality as a means of avoiding such cost burdens. Studies of the informal non-agricultural sector, especially studies focused on small firms, find important heterogeneity within the informal sector – especially between the productivity of large vs small informal operations. Small informal-sector businesses in particular provide employment and incomes but incomes tend to be low, reflecting low productivity of informal sectors overall.

Obviously, distinctions between the formal and informal in the food sector of developing economies cannot avoid being imprecise in some dimensions. Like the markets themselves, classifications are untidy: small farmers will sell to both "formal" and informal markets; formal buyers may source through traditional markets or traders. Moreover, distinctions between formal and informal may not even be clear to participating farmers. Informal actors perform a range of roles in the food system. A range of intermediaries operate between the farmgate and the consumer: intermediaries who buy from farmers, intermediaries who sell to consumers, intermediaries who

transport production, who grade quality and clean and sort lots of production. All of these intermediating actors may influence how buying from farmers unfolds, even if these intermediaries are not directly involved in farmgate transactions.

In this review, therefore, we concentrate on informal actors buying from farmers. The reason for this is that evidence in the extant literature relates to farmgate actors and relationships. Even so, where possible we also identify and differentiate among actors who operate at different points in the chain of transactions, and review evidence about innovation specific to types of actors: field intermediaries, wholesalers in markets, retailers in markets and retailers in stand-alone stores, and street vendors.

To sum up: for the purposes of this study, "informal" food systems are understood to be structurally fragmented, largely un-regulated and un-registered, lacking in formal standards related to crop quality, dominated by micro-enterprises and spot-market exchanges, and labor intensive. These characteristics align with the definition of informal in Reardon and Liverpool-Taisie (2021).

For the purposes of this study, an "innovation" is an untraditional process adopted mechanism to solve one or more specific market failures by transacting parties in a supply chain. We focus on innovations in business relationships governing how farmers relate to their buyers and how those buyers relate to their consumers. An innovation can be locally and temporally specific, relevant to particular constraints of time and place. Moreover, as innovations focused upon in this study must show potential for application beyond the immediate context and potential for scale.

Regulatory policy changes and shifts in the overall business environment, such as inflation and changes in financial policies, may push innovation among small and medium enterprises (SMEs) operating in the informal food sector. These contextual changes alleviate structural constraints such as limited financial infrastructure, inadequate road networks, underdeveloped market infrastructure, unenforced or absent quality standards, and limited safety regulations. While these changes themselves may not constitute innovation in the traditional sense, they play a pivotal role in creating an environment conducive to innovation.

Rather than studying the informal market sector as a pre-modern market state with the objective of upgrading and transitioning it to "formal", the study of informal markets can provide new insights that might themselves be useful in the modern sector. For example, we might better understand how the informal sector operates and how it is changing and innovating over time to solve market failures in response to changes in global and domestic contexts (including changes in consumer demand), and to understand ways to invest in or strengthen the existing informal sector to improve functioning or conditions (food quality, labor, incomes, efficiency, reducing loss and waste, and environmental outcomes).

Current evidence: informal food markets

According to a recent World Bank Report (2019) on the future of work in Africa, around 89% of total employment between 2000 and 2016 in SSA was informal (either in the informal sector or informal employment in the formal sector) and 90 percent of all businesses were informal. Even so, studying the informal food sector can present structural difficulties to researchers working to establish a representative sample of actors, or to chart dynamics and operations over time. These challenges may compound if traders and wholesalers in the informal sectors see advantages in

keeping their operations discreet, thereby avoiding tax and regulation liabilities. Some segments of these sectors, especially smaller traders, tend to be characterized by considerable turnover (Fafchamps 2003), even as wholesalers and retailers in municipal markets may have longer term participants. This instability means that sampling-frames for some parts of the sector can be hard to establish. Informal firms may be especially hard to identify if they cluster in rural and remote locations or operate out of households. Given the scale and the scope of the sector, therefore, establishing a sample of sufficient scale and representativeness can be logistically difficult, administratively complex, and costly.

An additional factor related to the limited economics research in this area is that recent scholarship focused on causal inference and evidence in applied development economics is largely dominated by a focus on randomized controlled trials (RCTs). Even non-RCT studies often revolve around the causal identification of the adoption of new markets, standards, or practices. It may be relatively more difficult to evaluate aspects of the informal sector as innovation and adoption tend to be diffuse, enduring, endogenous.

The informal channel option is often present in these RCT studies as the condition and experience of the control group to which the new or the innovative is compared. The particulars of the status quo pre-intervention position are rarely characterized in detail however, with little to no information generally provided regarding transactions costs, prices, linkages, risks. RCTs and other studies focused on evaluating effects of small farmer engagement with the formal sector (implicitly) use "informal" as comparison; details provided about that comparison are typically very limited.

This methodological focus on evidence from RCTs contributes to recent evidence gaps on innovations in the informal sector: because the informal sector functioning and structure not generally conducive to the implementation of RCTs (nor of standard causal analysis methods not based on RCTs), there is not much direct evidence about the sector based on RCTs. But causal evidence/questions may not be the most important evidence/questions. Despite the fact that informal actors may not be conducive to RCT-based analysis, their importance in the food system suggests we should be doing research with these actors in whatever way we find and being creative methodologically if needed. Wholesalers or retailers in markets vs truck intermediaries or street or cart vendors are differently organized, identifiable, accessible but likely just take different strategies for sampling and gaining entry.

Transactions costs in low-income countries

The transactions costs – search, contracting, negotiation, transport, aggregation, coordination, quality assessment, payment – involved in purchasing from small farmers can be high, presenting challenges for **both** formal and informal actors. The informal food sector is fragmented and spatially disperse because of the fragmented and spatially diverse nature of agricultural production. Numerous crops, because of land tenure systems or the timing or quality of labor required, are not conducive to large scale, plantation-style production. In low- and middle-income countries, agricultural production is still largely dominated by many small farms and many small producers, often relying on rainfed production systems to grow crops.

Transactions costs provide a lens through which to understand the incentives and strategies for innovations developed and deployed by actors in the food sector (formal and informal): how to eliminate transactions costs, how to reduce them, how to redistribute them to other actors in the

supply chain. Researchers and policy makers tend to characterize the informal sector as one characterized by high transactions costs and the formal (modern) sector as one characterized by strategies to reduce these costs. Much innovation in the formal sector – logistics, infrastructure, aggregation, wholesalers – tends to revolve around reducing these transactions costs. Researchers (among others: Reardon et al. 2009; Vorley et al. 2009; Pritchard et al., 2010; Chand, 2012; Singh, 2012; Reardon and Minten, 201; Narayanan, 2014) have long worked to characterize these dynamics and in some cases focus on the degree to which innovations in the formal sector successfully reduce costs and the degree to which any cost savings are passed on to farmers in the form of higher prices for their crops or improved transaction terms (Bellemare and Bloem (2018) review the evidence on contract farming, a common method deployed to reduce search, coordination, and contracting costs). In some cases, innovations may serve to shift costs to other actors in the supply chain: i.e. the formation of a cooperative shifts transaction costs associated with grading and aggregating production from intermediaries or the exporter to the cooperative. Those costs do not disappear.[2] This redistribution of transactions costs along the supply chain as an outcome of innovation is an important area for research.

High transactions costs are also a challenge for actors operating in informal channels. Hidayati et al. (2021) describe strategies that traditional actors employ to effectively address transaction costs and ensure successful operations. These factors include collective action, support for off-farm businesses, and access to essential services such as inputs, finance, and information. They also involve opportunities for market development, infrastructure development, and capacity building—encompassing financial, technical, and human resources.

[2] We are grateful to Jenny Weigel for this example.

The formal *and* the informal sector source from small farmers because they can do so profitably; a primary objective of both sectors is profit. One importance difference is that formal actors may have pressures or opportunities related to brand reputation or regulatory pressures from shareholders that lead them to invest in corporate social responsibility efforts that manifest in small farmer sourcing practices and investments. Even so, those formal sector small farmer initiatives rarely endure unless they are profitable.

The informal sector has figured out how to work with small farmers; they are also driven by profit but at face value the informal sector seems to be better able to work with small farmers and tend to include more small farmers in their supply chains. What adaptations and local innovations exist in the informal sector to manage the considerable transactions costs associated with working with small farmers?

Methods

We used a systematic search strategy to identify relevant literature followed by purposive selection of case studies. A strategic search was conducted in September 2023, using the Web of Science database, which has extensive coverage of academic literature across various disciplines. A query was formulated, consisting of a targeted set of keywords, phrases, and related terms associated with the study's focus on innovations in agrifood value chains (see exact search strategy below). These terms were carefully selected to capture a wide range of relevant literature.

Our initial query generated 3,348 search results. To refine the pool of potential sources, it is important to note that the Web of Science database automatically sorts the top results by relevance. The top 200 results, which were thus identified as most relevant, were subjected to title and abstract screening. From the screening, multiple papers were purposively selected for full text review. To ensure a comprehensive exploration of the subject matter, additional papers were also incorporated based on the expertise of the authors. These additional papers were identified as valuable contributions to the topic. It is important to acknowledge a significant challenge in this methodology. When discussing innovations, the terminology of paper titles or abstracts may not always explicitly mention the term "innovation" or related keywords. This can make the identification of innovations more challenging, as the primary objective is to pinpoint the very same innovations within agrifood value chains. Without their explicit mention, targeted searches become more challenging. We acknowledge and are mindful of these limitations in our research approach.

1.	Topic	“value chain*" OR "valuechain*" OR "value-chain*"
2.	(AND) context	"agricultur*" OR "farm*" OR "small$holder*" OR "food$system*" OR "rural*" OR "informal" OR "food*" OR "agri$food" OR “food NEAR/5 processing” OR "agrarian" OR "crop production" OR "livestock*" OR "dairy" OR "poultry"
3.	AND) Innovation	“innovat*” OR "intervention*" OR "transformation*" OR "development*" OR "modern*" (includes innovate. Innovative, innovation”
4.	(AND) Year	> 1999

As we will discuss, our search identified a range of innovation examples from the formal sector and not much from the informal sector. This result may in part be a function of the search strategy; that is, the terms used (including value chain, agriculture and innovation) may have been more likely to identify studies focused on the formal sector. This will have been the case if research focused on the

informal sector employs different terms than that on formal markets. For example, value chain may already significantly bias results towards the formal sector; research focused on the informal may be more likely to use terms like markets or intermediaries. The use of the term innovation is subject to the same limitations and the same critique. Future research might employ the terms markets, intermediaries, trader, municipal markets, wholesalers, retailers, wholesale markets, and traditional.

The remainder of this paper reviews the evidence on innovations and supply chains, many through the lens of transactions costs. Much of this evidence is cross-sectional, partial, and with unknown sampling biases. This largely descriptive evidence is valuable to identify pervasive constraints in production, logistics, sourcing, financing, describing ways that these high transactions costs are addressed in the informal food sector, ways that the informal sector is evolving over time by restructuring, by incorporating new technologies (cell phones, mobile payments) and by responding (perhaps) to the growth of the "formal" market and to the evolution and implementation of new regulations and opportunities.[3]

Innovations

We review innovations by type below. As discussed above, apart from relational contracting, the majority of the innovations identified in our search are from the formal or "modernizing" sector; a function of the focus of current research and literature but perhaps also of our search strategy. Many of these innovations have potential relevance and adaptation for the informal sector.

[3] Barrett, Swinnen, Reardon, Zilberman (JEL 2020) review what they term structural changes in agri-food value chains.

Relational contracts

Relational contracts are agreements between parties that rely on trust, repeated interactions, and flexibility rather than strict, detailed terms typically found in formal contracts (Baker et al. 2002); they are a framework for understanding the way that parties operate in circumstances without legal contracting. These contracts focus on the ongoing relationship between the parties involved rather than solely on specific, measurable deliverables. Relational contracts often are used in situations where all possible states of the world cannot be specified in advance; relational contracts therefore allow for adaptation and negotiation as circumstances develop. These might include circumstances characterized by incomplete information, in which all potential eventualities and related details cannot be pre-specified.

Relational contracts represent an innovative approach to the costs and challenges of informal food value chains, fostering trust and cooperation among parties rather than relying on legal enforcement. The agreements are self-enforcing through repeated transaction; deviation from the agreement means that the party foregoes anticipated future gains from exchange. By emphasizing mutual understanding and long-term relationships, these contracts enhance flexibility and resilience, enabling smallholders and intermediaries to navigate market uncertainties and adapt to changing conditions. Relational contracts are, in fact, an old and established innovation, embedded in traditional economic practices and long-established in many informal markets.

Relational contracting has a special relevance to informal food markets in low-income countries where contractual enforcement capacity through formal means can be weak. Relational contracts can therefore provide a measure of stability and predictability for farmers and buyers in a context

characterized by a range of risks and uncertainties including volatile market prices, variable weather conditions, and unstable agricultural input prices. Establishing long-term relationships with buyers or suppliers through relational contracts can offer farmers stability, access to resources, technology, and expertise from more developed partners, can facilitate risk-sharing between farmers and other stakeholders in the supply chain and help farmers secure a market for their production. The long-term relationships fostered by relational contracts can also contribute to chain-specific investments by buyers and sellers including investments in quality standards or production standards.

Macchiavello (2022) describes a framework for understanding relational contracting in international and low-income country contexts. Opportunism represents a significant challenge to relational contracting; that is, circumstances in which a party defects from the contract to pursue another opportunity in the market. Considerable literature therefore has interrogated how trust develops between transacting parties, how trust impacts transactions, how relationships based on trust are established and function, and how trust influences markets (Casaburi et al. 2017; Casaburi and Reid 2022; Macchiavello and Morjaria 2015; Ghani and Reid 2017). Much of the work that we summarize in this report exists implicitly or explicitly through relational contracts but relational contracts themselves can be seen as an important innovation among informal market actors.

Financing

Credit and cash flow are crucial to supply chain functioning, allowing small-scale farmers to invest in their operations, acquire essential inputs, and navigate dynamic market conditions. Financial resource access is essential for the sustainability and growth of local food systems, contributing to food security and the well-being of rural communities. For example, traders in the informal sector may provide credit to farmers as a means of facilitating production and trade, providing credit or

inputs payable in harvest as a means of ensuring and securing sufficient volumes to source and sell at harvest.

Many innovative financing schemes are designed and overseen by donors, international financial institutions, and globally-reaching development organizations. Villalba et al. (2023) highlight key success factors for value chain financing innovations. They stress that such interventions should not solely focus on the production stage but should also encompass other segments beyond farmers. By leveraging the trust and local relationships inherent in a value chain and involving local aggregators, agribusinesses, and various actors in the financing scheme, transparency is enhanced, and the principal-agent problem within the value chain is mitigated.

Despite their significance, financial services for farmers and other market participants face underdevelopment due to various supply and demand challenges. Financial institutions grapple with information asymmetries, resulting in high costs and difficulties in assessing borrowers for potential defaults and enforcing repayment. On the farmers' side, obtaining formal credit is challenging due to a lack of formal financial history and limited access to typical forms of collateral. Repayment complexity is heightened by the stochastic nature of agricultural production and the unpredictable cash flow patterns associated with seasonal cultivation and incomes.

While traditional banking, microfinance, and cooperatives offer some financing options for small farmers in the informal sector, new financing innovations are emerging. These innovations center around leveraging social and trade capital to generate transaction records, providing farmers with a means to access credit and address the challenges posed by conventional financial systems.

Informal food value chains feature two primary types of credit providers: providers that are embedded within the chain and providers that are external to it (Villalba et al. 2023). Credit provided by actors operating within the value chain, for instance, credit from processors or traders to farmers, can emerge and dominate the market when traditional financing institutions fail to offer adequate or appropriate products for farmers. These actors often provide support in the form of trade credit as well as credit for production inputs. Trader credit typically involves credit extended by middlemen or traders who purchase agricultural produce from farmers. This credit is provided to farmers to encourage them to sell their produce to a particular trader or under specific conditions. It may or may not be directly related to the purchase of inputs. Input supplier credit, on the other hand, specifically pertains to credit extended by suppliers of agricultural inputs (such as seeds, fertilizers, pesticides, machinery, etc.) to farmers, effectively financing the production process.

Conversely, innovation from outside value chain actors such as banks can include the use of social and trade capital such as warehouse receipts and purchase agreements as acceptable collateral at banks; in these innovations, actors from outside the value chain address information asymmetries through collaborations with established chain actors.

Trade credit and input supply credit

In the presence of credit shortages, suppliers or other intermediaries may extend producers the flexibility to delay payment for inputs, a practice well-documented in the literature on trade credit and input supply credit (Hermes et al. 2016; Hermes et al. 2012; Miller and Jones 2010; Rahul and Suri 2013). For example, suppliers may establish credit arrangements, enabling producers to defer settling the cost of inputs, such as seeds, until after the harvest has been completed. Additionally, buyers may deviate from traditional payment timelines to enhance their cash flow, opting to expedite payment to producers. In certain scenarios, buyers may payments when an order is placed, before

the production or delivery of goods, providing producers with immediate access to additional funds for procuring inputs.

Social and Trade Capital as Collateral

Villalba et al. (2023) observe that in the context of agribusinesses in India, the approach to securing finance has evolved beyond relying solely on social capital to include trade capital. Trade capital involves farmers, aggregators, and traders vouching for each other's creditworthiness when seeking financing. Aggregators play a pivotal role in this process, often soliciting recommendations from community members to identify trustworthy borrowers. This reliance on trust and local social and trade networks enhances transparency and facilitates access to informal financing avenues for value chain actors.

Dris et al. (2009) identify instances of bank loan guarantees facilitated by buyers and processors. In Poland, five out of six examined dairies offer bank loan guarantees to farmers, often with favorable interest rates. Moreover, these companies frequently act as co-signers for bank loans when farmers lack adequate collateral. In Slovakia, three out of six companies extend guarantees for bank loans to farmers. Even in Bulgaria, a country with fewer advancements in value chain reforms, the majority of the 11 dairies interviewed provide support to their suppliers. Nine of these companies offer assistance through credit programs specifically targeting dairy-related investments, with two of them extending credit for general investments. Additionally, five out of the 11 companies offer bank loan guarantees. The primary motivation for these programs is to enhance milk quality and ensure the stability of the supply base.

Stone et al. (2012) emphasize the pivotal role played by institutional buyers in facilitating farmers' access to financial resources. In Central America, Hortifruti serves as one such institutional buyer, procuring products from local producers and supplying them to large institutions like hotels, hospitals, and restaurants. Although producers initially secure financing from informal sources in the early stages of their partnership

with Hortifruti, as the relationship matures, farmers establish a track record of production and sales. This allows them to leverage implicit purchase agreements to access formal financing, enhancing their creditworthiness. Stone et al. (2012) point out that repayment methods for credit are often integrated into non-financial relationships, simplifying the enforcement of credit agreements for lenders.

For example, in the Indian dairy value chain, BASIX, an organization dedicated to promoting livelihoods, has taken measures to address the limited availability of credit for village producers. BASIX established direct connections with credit and insurance providers, increased the frequency of milk collection, introduced advanced technology for testing milk quality, and improved logistical processes (Pastakia 2012).

Warehouse receipt systems for grains

Warehouse receipt systems (WRS) offer inventory credit to farmers, issuing tradable receipts against stored agricultural commodities. Farmers' crops stored in warehouses serve as collateral at harvest, providing farmers with liquidity between harvesting and selling and allowing farmers to delay sales until later in the year when prices tend to rise after their harvest-period lows. Vellema et al. (2013) describe a warehouse receipt system for grain in North-East Rwanda, where farmers had previously sold their crops during or even before harvest. The scheme is an example of an innovation supported by a 'maize value chain network' involving multiple stakeholders, including NGOs, development groups, cooperatives, traders, and input suppliers, to provide financial access and inputs. Some farmers had sold maize to intermediaries before harvest in exchange for credit to cover lean season expenses, while others sold during harvest to meet their immediate cash needs. The warehouse receipt in Vellema et al. (2013) was managed by a micro-finance institution (MFI) and a trading company. In the inventory credit scheme, farmers used their maize harvest as collateral to secure credit, receiving a voucher worth up to 60% of the maize's current market value. Farmers could then exchange this voucher for credit at a microfinance organization and the trading company and

microfinance organization worked together to market the stored maize. After the sale, farmers received the remaining proceeds, with the MFI and the trading company deducting storage costs and credit interest.

Similarly, a project in Ghana, supported by industry organizations in collaboration with external international organizations, implemented a warehouse receipt system (WRS) for grains (Kolavalli et al., 2015). In this initiative, cash-strapped producers were no longer compelled to sell their harvest immediately after harvest. The introduction of the WRS aimed to address challenges faced by producers, especially smallholders, such as the absence of grading and quality standards that could incentivize quality improvement, limited access to credit, and restricted availability of storage facilities. As a result, the system's potential advantages encompassed improved access to credit, better prices for producers, and reduced post-harvest losses through community warehouse storage. The project also improved farmers' market position as the community warehouse served to aggregate their production prior to sale.

A secondary effect of the warehouse receipt system studied in Kolavalli et al. (2015) was the establishment of grading standards, improving grain quality and, consequently, obtaining higher prices for producers, as well as access to new markets. A warehouse receipt in Ghana was an electronic document issued by a licensed warehouse operator, affirming the quantity and quality of a particular grain (such as maize, rice, soybeans, etc.) stored in a warehouse by various entities like farmers, traders, food processors, or financial institutions. Within this system, storage automatically involves a grading process, and the subsequent certification streamlines seamless and reliable transactions among stakeholders. Crucially, these receipts are purposely structured to be recognized as collateral by financial institutions, granting those who store the commodities the opportunity to secure credit access.

Warehouse receipt systems can also have general equilibrium on regional prices and market functioning, with welfare effects for consumers dependent on markets for food. For example, the introduction of tradable warehouse receipts can impact market liquidity and price discovery. In some cases, the introduction of a warehouse receipt system that induces sufficient quantities of grain to be stored after harvest may result in more stable and efficient price outcomes, contributing to the overall economic equilibrium within the agricultural sector. On the supply side, warehouse receipt systems enable farmers and other stakeholders to store their produce in certified facilities, reducing post-harvest losses and increasing the availability of commodities in the market. This can potentially stabilize or increase the overall supply of goods. On the demand side, the existence of a reliable warehouse receipt system may enhance the confidence of buyers in the quality and quantity of stored commodities, leading to increased demand.

Even so, sustaining long-term partnerships required for a WRS can prove challenging; farmers might be hesitant to store their produce when market prices are favorable at harvest for example or possible declines in crop prices after harvest can present real risks to the WRS system (Cardell and Michelson, 2023).

Records of Transaction history

Financial institutions need additional information to screen and rate their potential customers. However, obtaining financial information, particularly in digital format, is a challenging endeavor that often involves substantial costs. The mentioned examples demonstrate a noteworthy transition from relying solely on social capital to embracing the concept of trade capital within the realm of agricultural financing. This transition encompasses farmers, aggregators, and traders vouching for one another when seeking financial support. In practical terms, when an aggregator seeks potential borrowers, they reach out to fellow community members for recommendations regarding individuals with a strong creditworthiness.

Given the prominent role of transaction history in agricultural value chain financing highlighted above, it will be crucial to leverage technology to unlock its full potential and drive transformative changes within the sector. A recent innovation proposed involves creating data platforms where farmers, agribusinesses, and financial institutions collaborate to record transaction history. Digitizing this information will enable various stakeholders to build a credit history accessible to both internal and external participants in the value chain (Villalba et al. 2023, Benami and Carter, 2021; Mattern and Ramirez, 2017). By meticulously recording their financial transactions, including purchases, sales, and credit arrangements, a rich dataset emerges. This dataset becomes instrumental in assessing the creditworthiness of agricultural actors. It enables financial institutions to make more informed lending decisions, extending credit to those who need it the most but may have lacked formal credit histories; transforming the way information is collected, stored, and utilized within the agricultural value chain.

Aggregation - Collective Action

The collective action of small farmers within value chains allows them to combine resources, knowledge, and negotiating influence. Cooperatives, which are groups of farmers formed to collaborate on various aspects of agricultural production and marketing, represent a prevalent method of aggregation. The organization, formation, and maintenance of mechanisms of collective action carries costs and risks for small farmers. Cooperatives take a range of forms, however, and can be organized, facilitated, and subsidized by a range of actors that include governments, NGOs, private business, and the farmers themselves.

Cooperatives can offer small farmers a means of improving their position in the market, both as sellers of agricultural output and as buyers of inputs. Improving farmers' bargaining power can help them secure better terms when selling their production. Moreover, cooperatives facilitate farmers' access to modern

farming inputs and valuable market information. By consolidating resources and risks, these collaborative ventures also mitigate uncertainties associated with marketing agricultural products. In addition, cooperative efforts contribute to the maintenance of product quality, enabling farmers to meet evolving standards in certain crops and markets.

Enhancing social interaction among stakeholders within a value chain, even without the formation of cooperatives or formal groups, has been recognized as a crucial factor for the successful functioning of these chains. Establishing and maintaining effective collective action involves several key elements. First, participants emphasize the importance of ensuring equal participation, maintaining clear communication, defining common goals, exhibiting strong leadership, and engaging in both formal and informal social interactions as vital enabling conditions (Lowitt et al., 2015).

Tefera and Bijman (2019) present findings from the malt barley industry in Ethiopia, where, where farmer cooperatives serve as primary suppliers of malt barley to both brewers and malt factories. The research is an apt case study on the potential impacts of cooperatives as the role of the cooperative spans a range of input supply and marketing operations: the distribution of essential modern farming items like fertilizers and improved seeds, the aggregation of malt barley, coordination throughout the supply chain, and the management of product quality improvement. Through these collaborative initiatives, member farmers actively engage in enhancing product quality, resulting in price premiums that can sometimes reach as high as 20%. These premiums directly augment farm incomes, providing tangible benefits to the farmers.
In this section, we describe and discuss numerous studies highlighting the role of cooperatives in both input supply and marketing functions and the relevant innovation introduced by the cooperative.

Input side – input access

Producer cooperatives play a crucial role fostering increased intensification and market orientation among smallholder farmers (Verhofstadt and Maertens, 2013). They can also negotiate for better prices on inputs and services by operating at greater scale. An example from Rwanda demonstrates the way that cooperatives can contribute significantly to improving small farmer welfare on the input side, including land access and aggregation. A survey conducted in Rwanda in 2008 found that around one-third of sampled rural households actively participated in cooperatives, with half of these cooperatives specifically dedicated to horticultural production and marketing. Verhofstadt and Maertens explain that while smallholder farmers in Rwanda typically cultivate modest plots of land, usually less than 1 hectare in size, horticultural cooperatives often allocate jointly cultivated land to their members, with an average cooperative landholding size of approximately 38 hectares. The crops grown on cooperative land are collectively marketed through the cooperative. In addition to facilitating collective marketing, some cooperatives go beyond and provide support to their members by offering access to credit, technical assistance, and essential inputs such as improved seeds, fertilizers, and pesticides at the commencement of the agricultural season.

Output side – marketing

Cooperatives can benefit farmers and facilitate market participation on the output market side in at least three important ways. First, producer groups can reduce the transaction costs buyers incur by purchasing relatively small lots from many individual farmers: search costs, information gathering, negotiation, contract management, transportation, and contract enforcement. Second, by organizing farmers and representing them in coordination activities with agribusinesses, a cooperative can help spread some of the one-time fixed transaction costs that would otherwise burden each individual farmer. These costs encompass partner

searches, negotiation, and agreement enforcement. Finally, cooperatives and farmer groups can serve as a means for farmers to share information and opportunities.

Frequently, groups are established through development projects or with the assistance of NGOs to integrate smallholder farmers into value chains. In the case of the bay leaf value chain in Nepal, as observed by Chaudhary et al. (2014), the project introduced certifications along with sustainable harvesting practices. To secure higher prices by enhancing their negotiating leverage with traders, cooperatives were established to consolidate harvested bay leaves. Horton et al. (2010), in their study on the potato and vegetable value chain in Uganda, discovered that the project opted for farmer platforms for collaboration instead of traditional cooperatives. They also implemented branding strategies and facilitated the processing of products. The development of strong links was achieved through consistent collaboration among facilitators, producers, traders, and processors.

SAFAL is an initiative focused on value chain interventions in Bangladesh's aquaculture, horticulture, and dairy sectors, as outlined in Kuijpers (2020). The project's primary objectives include the formation of 1000 producer groups, farmer training, and support for small-scale entrepreneurs who provide essential services to the local farming community. These entrepreneurs receive both financial support, such as assistance with shop construction and product stocking, as well as technical training related to the products and services they offer. Furthermore, the project connects these entrepreneurs with farm input companies, allowing for negotiated prices. Kuijper (2020) shows that participation in SAFAL leads to increased farm income and a reduction in the period of food scarcity, with broader benefits to local farming communities.
Similarly, Ouma et al. (2018) show that a pig business hub model in Uganda effectively linked pig producer collectives with specialized input providers and output markets. This linkage improved farmer negotiations

with input suppliers and pig traders and farmers secured better prices for both inputs and their pigs sold due to the advantages of bulk sales and purchases.

The role of group organizations becomes even more crucial for the resilience of value chains in the face of natural disasters. For example, Andriesse and Lee (2017) identify the presence of horizontal coordination among fishermen and farmers in the Philippines, facilitated through associations. These associations are instrumental in supporting seaweed farmers, with the association presidents permitting them to cultivate in coastal areas. Notably, these agreements between the associations and farmers are informal in nature. Furthermore, the fisherfolk association has also established agreements with collectors to ensure equitable access to various seaweed farmers. In some instances, the association adopts a collective approach by pooling harvested seaweed and selling it jointly. This strategy aims to reduce transportation expenses and save time, although it doesn't necessarily result in higher output market prices. Marginalized communities, particularly in the aftermath of natural disasters such as typhoons, rely heavily on this horizontal coordination among fisherfolk and farmers through these associations. It helps these communities address the challenges posed by disasters and ensures fairer access to resources and markets.

Examining production- and market-oriented farmer groups within Kenya's banana sector, Fischer and Qaim (2012) discovered that the advantages of collective marketing in terms of prices are indeed present but relatively modest. Moreover, these groups have not fully exploited the potential of high-value markets. While collective marketing yields positive and statistically significant output price benefits, their magnitude is relatively small. As a result, many group members continue to opt for individual sales. This modest price advantage can be attributed to improved infrastructure conditions in central Kenya in recent years, which have made traditional banana markets more transparent and efficient without necessitating collective action. However, this doesn't negate the potential role of farmer groups in enhancing marketing performance,

especially concerning high-value markets. Cooperative organization lays the groundwork for better connecting smallholders to emerging value chains that demand standards and contractual relationships, although this potential remains largely untapped within the Kenyan banana sector.

Beyond price considerations, farmer groups also serve as vital catalysts for the adoption of innovations, such as higher rates of tissue culture technology adoption and increased usage of chemical inputs in banana production. They achieve this by facilitating efficient information flow. In terms of welfare impacts, the study revealed that group membership leads to a significant boost in household income, but this benefit is primarily realized by farmers engaged in collective marketing activities. This underscores the importance of active participation in specific group endeavors rather than mere membership itself.

The potential benefits of collective action are likely highly product and context-specific, contingent on the specific collective activities pursued. The literature includes evidence both supporting the positive impacts of collective action, especially in high-value chains as opposed to staple crops, and instances where it has not proven successful. Fischer and Qaim (2012) emphasize the need for a more complete understanding of the conditions favoring the benefits of collective action, with the context playing a pivotal role. Collective action becomes valuable when aimed at reducing external transaction costs by leveraging economies of scale in marketing. However, in situations where supply chains are relatively short, as seen in the case of bananas in central Kenya, the potential for significant efficiency gains through group marketing diminishes.

For example, Meagher (2019) describes the case of women producers in Argan forests in southwestern Morocco, where cooperatives were established to provide technology, market access, and price stability. Women were trained to meet the quality standards of global cosmetics companies, ensuring a consistent supply of argan oil through cooperative structures linked to international buyers. However, despite initial

appearances, the formation of cooperatives also granted global firms greater control over women's labor without significantly improving their economic situation. Cooperatives centralized nut cracking, a process global firms could not mechanize, and oil extraction, which had been mechanized. While helping women pool resources for machinery, the costs were borne by local women, and long working hours persisted. Ultimately, cooperative pricing failed to prevent higher-up firms from capturing most argan oil price benefits, highlighting how global value chains can restructure labor control (Meagher, K. 2019).

Internal governance challenges represent an additional obstacle for cooperatives. Research on the selection of cooperative members and the advantages derived from value chain development yields inconclusive results. Certain studies propose that farm characteristics, including landholding and livestock holdings, have a positive influence on cooperative membership, while other research indicates that farm size significantly negatively affects cooperative participation (Fischer and Qiam, 2012). Further research is needed to achieve a more comprehensive understanding of both the involvement in and the comparative benefits of cooperative membership in informal food value chain initiatives.

Digital innovation

Digital Platforms for payment

The adoption of digital financial services (DFS) has played a crucial role in addressing the obstacles faced by smallholder farmers in remote rural areas of developing countries. The digitization of financial processes emerges as a promising avenue to engage smallholder farmers and enhance the efficiency of agricultural value chains. In these regions, traditional financial service providers often lack the incentives to meet the financing and payment needs of farmers. The examples below

showcase the diverse applications of DFS across various agricultural value chains, effectively overcoming barriers such as high transaction costs, the seasonality of agricultural production, and limited financial capabilities of farmers. Digital financial services have demonstrated their utility in diverse settings and agricultural commodity value chains to address and, at times, overcome challenges prevalent in the informal sector. Deichmann et al. (2016) discuss the effects of digitization in agriculture, especially on transactions costs. Grossman and Tarazi (2014) discuss several pertinent examples in their review:

In Nigeria, the federal government employed digital financial services to reduce the cost of administering subsidies to small farmers. The government used digital disbursals to streamline subsidy administration, resulting in an over 80% reduction in costs. Eligible smallholder farmers, irrespective of mobile phone ownership, were registered. Through SMS messages, farmers received pertinent information and could redeem subsidies at designated local points, minimizing the necessity for direct state government involvement in subsidy disbursement.

Cash payment can present risk to supply chain participants; in particular, to buyers who have to carry considerable cash in rural areas. In Ghana, Tigo Cash mobile wallets were introduced across four value chains—cocoa, rice, rubber, and maize. Tigo – a private mobile network operator – worked with commodity buyers and nonprofits. Tigo charged a small fee to commodity buyers for fund transfers to farmers, who could then withdraw cash from nearby Tigo agents. According to Grossman and Tarazi, the approach not only minimized the cost and risk associated with cash payments but also promoted efficiency in financial transactions.

In Kenya, the Grameen Foundation, in collaboration with Farm Concern International, implemented what is known as an e-Warehouse pilot program for maize farmers to reduce the costs of warehousing grains; farmers store grains at home or with other farmers. The initiative leverages mobile-based data collection tools, allowing trained village workers to gather and upload essential

information about stored grain including the storage method, the quantity, and the moisture content. The data entries are GPS-located, and time stamped. This digitized approach not only streamlines the loan eligibility process but also helps reduce risks related to storage and side-selling. Farmers can store grain at home or in village-level warehouses, with loans acting as a safeguard against side-selling. The e-Warehouse project suggests the potential of digital innovation to connect farmers with finance, with challenges related to finding partner financial institutions and addressing time sensitivity addressed through continuous training and improvement efforts by the implementers.

In Kenya, the Syngenta Foundation for Sustainable Agriculture and UAP Insurance introduced Kilimo Salama, a digital agricultural insurance product designed to mitigate risks for smallholder farmers by reducing the costs of crop insurance. This index-based weather insurance allows farmers to insure inputs purchased at participating agricultural dealers by paying a premium of approximately 5 percent of the required inputs' value. Kilimo Salama uses remote monitoring technology, M-PESA for payouts, and a mobile application for registration, streamlining the insurance process. The product facilitated coverage for nearly 185,000 smallholder farmers, leading to increased investments and earnings compared to uninsured neighbors. Despite challenges related to trust and profitability, Kilimo Salama's opt-out approach and digital solutions suggest the potential of digital financial innovations in transforming agricultural insurance. Similar initiatives, such as EcoFarmer in Zimbabwe and Juhudi Kilimo's livestock insurance in Kenya, further illustrate the expansion of digital agricultural insurance products aimed at providing comprehensive coverage for smallholders.

Reducing the costs of aggregation using digital tools

Iacovone et al. (2019) examine a project that leverages digital technology to aggregate fresh fruit and vegetable orders from small retailers in Bogota, Colombia. Fruit and vegetable vendors in the city face significant challenges, primarily due to the time-consuming and costly daily trips they must

make to the central market, Corabastos. Store owners typically begin their day at 4:30 am, spending over two hours commuting and dedicating around 30 percent of their daily profits to transportation. One potential solution is for these vendors to form buyer cooperatives, allowing them to collectively purchase in bulk directly from the market or even from farmers, thereby reducing costs. However, the fragmentation of small, independent businesses, each working long hours and lacking strong connections with one another, creates a coordination problem that hinders the formation of such cooperatives.

In response to this challenge, the social enterprise Agruppa was established with the objective of utilizing new technologies to address this coordination issue. Agruppa's innovative approach involves using mobile phones to create virtual buyer groups, consolidating daily orders from store owners, procuring produce in bulk from farmers, and directly delivering these products to the stores. This approach resulted in a 6%–8% reduction in purchase costs (with incomplete pass-through into lower prices for consumers, and markups rose). Frubana in Colombia, and Twiga in Kenya are pursuing similar models.

Information frictions: Prices

Access to accurate, timely, and low-cost market information at the farmer level has potential to increase market participation of farmers. The information flow through mobile phones can help traders to transport and market within short time frames and avoid the risk of spoilage. Farmers can benefit from price information obtained from different markets when they bargain with traders. Even so, the introduction of this information is most impactful when information is the primary constraining factor. Aker (2016) discusses this point. For example, Futch and McIntosh (2009) show that the introduction of village phones in Rwanda had a positive impact on the transmission of news

and on farmers' transportation arrangements but showed no effect on trading activity or goods' availability in local markets. Local entrepreneurs with access to village phones were more likely to pass news via cell phones. There was no impact on profit, labor input, sales of the enterprises. The village phone project was neither highly profitable nor a driver of local business because in Rwanda, the access to phones was not a constraining factor; there was already a moderate phone coverage through non-village phones and the actual village phone usage turned out to be low.'

Research does indicate that buyers may not always faithfully represent market prices to small farmers. Mitchell (2014) studied heterogeneous middlemen types and information to farmers in India, assessing the honesty of middlemen providing price information to farmers. The study found that the variation in middlemen's attitudes towards fairness influenced the benefits farmers could derive from the information they received. The results suggest the importance of information in protecting farmers against potential exploitation by middlemen.

We describe a few illustrative examples of the effects of providing price information to farmers. Some of these leverage the rollout of mobile phone networks. Others are assessments of more deliberate price information interventions implemented by the government or a third-party (that is, not a direct participant in the transaction) actor.

In Kerala, India, Jensen's study in 2007 demonstrated that the implementation of a mobile network led to a reduction in price dispersion and waste elimination for fishermen. The expanded mobile network not only boosted profits but also enhanced the consumption patterns of the fishermen. The gap between the maximum and minimum prices decreased from 7 Rupees/Kilogram to 5 Rupees/Kilogram, marking a 38 percent reduction in the coefficient of price variation. Waste witnessed a notable decrease of 4.8 percent post the introduction of mobile networks. Furthermore,

there was a significant uptick in the quantity sold, with an increase of 23 kilograms per day. Fishermen experienced a substantial rise in revenue by 205 Rupees, while costs only saw a marginal increase of 72 Rupees. Overall, the profit surged by 9 percent compared to the comparison group. The introduction of the mobile phone network contributed to a 6 percent increase in consumer surplus compared to the pre-network situation.

Svenson, and Yanagizawa (2009) conducted a study on the dissemination of price information in Uganda through local radio. Leveraging a natural experiment that involved spatial and temporal variations in the radio network, the Market Information Service (MIS) project gathered weekly data on the district firm-gate price of maize. This information was then communicated to farmers through local FM radio. The study compared farmers in districts where the information was disseminated with those in districts where it was not. Through a difference-in-difference estimation, it was found that farmers with access to a radio in the districts where the information was disseminated could negotiate a 15 percent increase in their farm-gate price compared to the comparison group.

Aker (2010) studies the increase in mobile phone coverage and its impact on grain price dispersion in Niger and shows that the introduction of mobile networks significantly reduced price dispersion and enhanced efficiency for farmers. Following the expansion of mobile phone networks in Niger from 2001 to 2006, farmers gained the ability to quickly and inexpensively access grain prices across numerous markets. Utilizing the exogenous variation in the mobile network expansion, the study employed a difference-in-difference method and found that mobile phone access reduced grain price dispersion by 10 percent. Muto and Yamano (2009) focus on the impact of mobile phone coverage on farmer market participation in Uganda and show that the expansion of mobile phone coverage

increased market participation for banana farmers, particularly in remote areas. The study finds no effects on maize market participation.

Focusing on internet kiosks, middlemen, and the soybean market in India, Goyal (2010) explores the role of middlemen in the soybean market between farmers and processing companies. Traders, acting as middlemen, have market power and can collude to extract profits. A soybean buyer company introduced an internet kiosk initiative to provide price information directly to farmers, bypassing traders. The study found evidence of an immediate increase in soybean prices in districts with internet kiosks, resulting in a 1-3 percent price increase and reduced price dispersion. In contrast, Fafchamps and Minten (2012) presented the findings of an RCT assessing the impact of SMS-based agricultural information on farmers' ability to negotiate higher crop prices, reduce losses associated with weather events, and adopt new crop varieties. The study found no statistically significant effects on prices received by farmers, losses from storms, or the likelihood of changing crop varieties.

Mitra et al. (2015)'s study of the potato supply chain in West Bengal, which is characterized by the strong presence of middlemen. The authors describe and evaluate an intervention providing daily price information to farmers through phone calls and public announcements. While the intervention had a positive impact on the pass-through from wholesale to farmgate prices, it had no effect on farmgate prices and sales, suggesting limited ex-ante impact on farmer welfare and negative effects on trader welfare.

Product Quality and product differentiation

Product differentiation creates new market opportunities for small-scale farmers, and certification plays a potentially crucial role in establishing and preserving buyer trust and farmer market access. Differentiation can include quality improvements such as product size, variety, and appearance (unblemished fruit for example), but also the provision of credence attributes related to production and harvesting processes including agri-chemical use, labor practices, and preserving forest.

The prevalence of standards and certification varies depending on the type of value chain. For instance, in the 'wet market chain', where small-scale traders or producers predominantly sell produce to local and urban wet markets, standards and certificates are not common. Similarly, in 'domestic store chains', characterized by direct sales from producers to retail outlets like local shops, kiosks, and domestic supermarkets, as well as the hotel and catering industry, standards and certificates are not widely adopted. In contrast, within the 'processed produce chain', centered around processing companies, certification is common, but there is no differentiation based on quality. Finally, in the 'export chain', which revolves around exporters who primarily sell their produce to overseas buyers, the use of standards and certificates is limited to national standards, and certification to international standards has not yet become prevalent.

Certification and standards can be pivotal in food value chains, providing in some cases guarantees of fair or more transparent pricing and quality assurance. Certifications guaranteeing minimum floor prices or quality premia to farmers can contribute to stable or higher farm gate prices, potentially increasing agricultural producers' net profits. Standards can also improve product quality through incentivizing the farmer implementation of better farming practices, opening doors to higher-paying

market segments and boosting the incomes of beneficiaries. Additionally, standards support producer organization and cooperative improvements, strengthening governance and empowering cooperative members. This enhances their negotiating capacity, provides better market access, and improves services, benefiting the entire value chain (Ruben 2017). Governance and food safety considerations are equally vital, but small-scale farmers face challenges in meeting required standards for product quality and quantity, leading to higher costs. Certification becomes particularly crucial within food value chains, especially in high-value commodities such as horticulture, and when farmers, intermediaries, or wholesalers engage in export activities to different countries.

However, small-scale farmers face challenges in meeting the requisite standards for both product quality and quantity, which are crucial to fully seize these opportunities. Complying with private standards often demands significant financial, informational, and networking resources. Further research is needed to assess whether certification and standards act as barriers for smallholders, potentially hindering poverty reduction efforts in developing nations. Informal market traders can innovate to reduce these transactions costs. For example, considering the transaction costs associated with individual, farmer-level certification, traders may guide their suppliers to adopt third-party and multistakeholder sustainability certifications. In some cases, traders invest in and hold the certification and act as group managers for certified smallholder producers. Smallholder producers may rely on these traders for access to certified markets. Traders may also cover certification and implementation expenses for suppliers lacking financial resources for independent certification, organizing training initiatives on good agricultural practices. In return, traders retain a portion, or in some cases, the entirety of the certification premium obtained through market transactions (Grabs, J., & Carodenuto, S. L., 2021).

Product Quality – organic certification

Mohan (2016) describes the case of small-scale farmers in the Nepalese tea sector transitioning from conventional to organic certified production. While quality upgrading led to positive impacts, primarily price improvements, negative changes including increased risk led to overall adverse effects on farmer livelihoods. The Conventional Code of Conduct (CoC), is a self-enforcing and voluntary code, with an emphasis on reducing pesticide and chemical usage over three years (25% in the first year of participation, by 50% in the second year, and zero use by the third year). In contrast, organic certification adhered to international organic standards, necessitating a chemical-free farming history spanning three consecutive years. This shift was made to address challenges in marketing CoC tea to foreign buyers unfamiliar with the national scheme, resulting in the failure to deliver promised price premiums to farmers in most cases. In contrast, the organic certification yielded consistently high and stable prices, benefiting farmers' livelihoods. However, despite earning a higher average profit per kilogram of tea grown, organic farmers' lower productivity (due to not using pesticides and chemicals) led to lower total average profits per year.

In conjunction with Mandatory Certification, which is contingent upon factors such as variety and actors' registration or regulatory prerequisites, Kuhlmann and Dey (2021) introduce a framework and provide case studies that highlight the incorporation of regulatory flexibility into seed systems to engage farmers of varying scales. They specifically emphasize the liberalization of seed quality control mechanisms and propose several alternative approaches. One such alternative is the utilization of Quality Declared Seeds (QDS), which offers greater flexibility for ensuring seed quality compared to mandatory seed certification, especially when dealing with local and farmers' varieties. Additionally, the Truth-in-Labeling approach relies on self-regulation by seed producers. Another alternative involves the establishment of seed clubs and associations, which can streamline

procedures and reduce costs for smallholder farmers. For instance, Peru has implemented a seed certification system, wherein commercial seed can achieve certification through a third-party process. In Zimbabwe, a seed cooperative model is operational, primarily benefiting marginalized farmers in the Zaka District. This initiative focuses on establishing cooperatives to facilitate market access, increase seed availability, and support farmers. In India, a mixed system for seed quality control is in place, which accommodates truthfully-labeled seed, voluntary certification of seed, and some mandatory quality control measures. This approach allows for a degree of self-regulation based on minimum standards, enabling small-scale producers to opt for voluntary certification and thereby reducing the associated costs related to seed certification through a government agency. Saenger et al. (2014) find that within the Vietnamese dairy industry, which lacks essential institutions for facilitating contract enforcement, the introduction of third-party quality enforcement measures for milk led to a notable increase in farmers' utilization of inputs, totaling a 12% increment. Additionally, this intervention resulted in a significant boost in their overall output.

Export oriented quality upgrading

In the context of small-scale fruit and vegetable farmers in Thailand, Kersting and Wollni (2012) examine group certification for cash crops, exploring three models: farmer-run, donor-run, and exporter-run Quality Management Systems (QMS), where the third model involves standard adoption facilitated by buyer support. Farmer groups independently managed the QMS, while donor-run groups involved donors in linking farmers and overseeing the QMS on their behalf. Additionally, the study delved into public-private partnerships with six exporters aiming to attain certification but requiring support to do so. The exporters played a pivotal role by facilitating the establishment of certification groups, shouldering the majority of investment costs, and assuming responsibility for managing the QMS. The study underscores the crucial importance of support from

donors, exporters, and public-private partnerships in enabling small-scale farmers to adhere to these standards. Both exporters and donors offer essential assistance, including training, financial and managerial support, covering compliance expenses, providing technical guidance, and overseeing QMS management to ensure compliance with international food safety and quality standards. Additionally, the long-term sustainability of standard adoption is anticipated to be significantly greater for farmers connected to exporters in comparison to those who adopt the standard independently. Typically, donors extend support only until the certification is acquired, whereas exporters maintain a vested interest in the certification and, consequently, provide ongoing assistance to farmers. Based on anecdotal evidence from Kersting and Wollni (2012), it appears that the majority of farmers organized within donor-managed groups discontinued their certification efforts once donor support ceased. In contrast, many farmers in exporter-managed groups received assistance to renew their certification, highlighting the enduring commitment of exporters to the process.

In another example from Colombia, despite the inherent challenges in enhancing the quality of coffee production, there was a remarkable improvement in the export of high-quality "supremo" coffee between 2006 and 2012, rising from 9% to 17%. This significant increase coincided with the introduction of the Sustainable Quality Program in the country, implemented on behalf of a multinational coffee buyer. This program comprises a comprehensive set of contractual arrangements involving all stakeholders in the supply chain, including farmers, intermediaries, exporters, and the multinational buyer. At the farm level, the Sustainable Quality Program combines interventions from both the supply and demand sides. On the supply side, it offers training, extension services, and access to inputs aimed at supporting the enhancement of coffee quality. On the demand side, the Program commits to purchasing all the production meeting its quality

standards from participating farmers at a predetermined premium price. While Program farmers have the option to supply their coffee to the multinational buyer, it is not obligatory.

Quality improvements are the result of a dual influence, arising from both strong local demand and export potential. In the context of the lychee value chain in Vietnam, Anh et al. (2007) noted a pronounced focus on augmenting the value links. The core objectives of the project encompassed enhancing the competencies of existing cooperatives in the grading, sorting, and delivery of lychee products. Simultaneously, the initiative aimed to create a distinctive local brand for product differentiation as well as direct partnerships with prominent traders in urban markets.

According to the findings of Macchiavello and Miquel-Florensa (2019), the Sustainable Quality Program had a substantial impact on elevating coffee quality. Their analysis suggests that in regions where the Program was implemented, there was an approximately 30% increase in surplus throughout the supply chain. Farmers were able to retain at least half of this surplus increase. The analysis attributes success to contractual agreements at the export gate in driving quality enhancements and improving the overall welfare in rural areas. This case illustrates how multinational buyers can effectively assist farmers in developing countries in overcoming barriers to their participation in Global Value Chains (GVCs).

Verhofstaddt and Maertens (2013) observe that the adoption of standards and certification is increasingly prevalent within Rwanda's horticultural sector. However, certification is not widely practiced during the production stage of horticultural supply chains, primarily because the Rwandan Bureau of Standards (RBS) primarily focuses on food processing and export-oriented businesses. RBS provides various certifications, including organic certificates, export certificates, and

government-established RBS certifications, encompassing system certificates for quality management, environmental management, and food safety management, as well as product certificates for standardized marks and excellence marks.

Sustainability standards

The certification landscape has evolved to encompass a new sustainable dimension. For agrifood value chains in developing nations, particularly smallholders, adapting to stringent quality, safety, and sustainability standards for high-value international markets has become a complex challenge; the costs associated with meeting the evolving sustainability criteria is a significant hurdle. armers face both fixed costs, such as expenses for protective gear needed for pesticide application, and variable costs, like labor wages when seeking and upkeeping certification. Many smallholder farmers find it challenging to fulfill these certification prerequisites independently, often requiring financial support, technical assistance, and group-based certification to meet these requirements (Meemken et al, 2021)

Innovations in infrastructure, transportation and logistics

Public roads and market infrastructure, including physical buildings and facilities for markets but also sanitary and safety measures, influence the operation of the formal and informal sectors. Transport innovations within food value chains depend on the existence of these public goods but also play a critical role on their own in enhancing efficiency and access to markets. Three notable examples of these innovations:

Diverse Sourcing and Transport Methods for Guava Traders in Mexico City and Michoacán

Hernandez et al. (2015) document Wholesale guava traders in Mexico City and Michoacán demonstrate-ing adaptability in their sourcing and transportation methods. Traders serve a wide clientele, including traditional and modern channels, and acquire guava through a range of means. Some traders obtain guava directly from producers using their transportation, while others rely on

transporters who charge fees for collection services. Additionally, field brokers, known as "coyotes," are employed to acquire guava from farmers or smaller brokers. This flexibility in sourcing and transportation contributes to the efficiency of guava distribution within the region.

Public Wholesale Markets and Roads as Enabling Factors

Public wholesale markets and road infrastructure are essential components of the transport and distribution system within food value chains (Reardon et al. (2021)). While these are not farmer-initiated innovations, they play a crucial role in enabling efficient transportation. These public goods, often implemented by the government, provide a foundation for the smooth flow of agricultural products to markets, benefiting both producers and consumers. Public infrastructure investment supports the development of robust value chains.

Collective Action for Transportation in Peri-Urban Areas

While rural areas may lack horizontal coordination or collective action, peri-urban regions sometimes witness initiatives among farmer groups to improve transportation logistics (Abel et al., 2019). For instance, in Kabete sub-county, a farmer group successfully negotiated with Wangige market authorities to reduce market access fees and secure a designated space for direct wholesaling. These efforts primarily focus on sharing transportation and market access costs. Although the scope of collective action is often limited to specific aspects, it demonstrates the potential for farmers to collaborate and enhance their transportation efficiency in peri-urban settings.

Conclusion

The informal food sector remains an essential source of economic activity in many low- and middle-income countries, a source of employment and incomes and a critical determinant to local and

regional food security. However, despite its importance, there is a significant gap in the research on innovations within this sector. While much of the existing literature focuses on the formal food markets, such as large-scale exporters, supermarkets, and formally regulated actors, more limited attention has been paid to dynamic change and innovations emerging in the informal space.

Innovations in the informal food sector, such as the use of mobile phones for information sharing or new ways of contracting between small farmers and traders, have the potential to significantly improve efficiency, reduce transaction costs, and increase the inclusivity of food systems. Yet, understanding how these innovations emerge, spread, and impact the broader food ecosystem requires more detailed and focused research. Filling this research gap is crucial not only for understanding how informal food markets function but also for understanding how such innovations can address critical challenges in food systems, such as low productivity, limited access to finance, and inefficiencies. By identifying successful innovations within the informal sector, policymakers and development practitioners can better design interventions that build on these innovations, enhancing their impact and scalability. Further exploration into the informal food sector can also provide valuable insights into how informal market actors adapt to changing market dynamics, consumer demands, and regulatory shifts but also how these actors drive some of these changes. As informal actors often operate in environments marked by resource constraints, studying their innovations offers an opportunity to improve the functioning and resilience of the sector, with implications for poverty alleviation, rural development, and food security.

The informal food sectors of many low-income countries accomplish impressive outcomes -- sourcing and providing food from/to spatially distant markets -- without much coordination and centralization, though with, at times, considerable social and environmental externalities. The

pervasive and persistent poverty of small farmers in rural areas may suggest inherent limitations to the equity and efficiency of the traditional system. One possibility is that we observe the outcome of a food system characterized by a separating equilibrium, with the traditional sector less efficient on average because it serves everyone - buys from everyone for example and purchases nearly all quality levels of production. To some extent, the informal sector provides an absorptive function that allows for the modern sector to exist – to only buy from larger farmers and/or to only source produce that meets its more narrowly defined quality and process characteristic requirements. In that scenario, the informal sector plays a critical role vis a vis the formal sector in that it absorbs the products and clients (producers, buyers) that the formal sector does not serve.[4]

The results of our review emphasize that middlemen play a crucial, yet often overlooked, role in informal food supply chains, particularly in low-income countries. Despite their importance, these intermediaries are frequently understudied, and their impact on market dynamics is not always fully understood or appreciated in policy-making. An example from the literature is instructive. Emran et al. (2021) find banning a particular layer of middlemen in the palm oil supply chain in Bangladesh had unintended consequences, increasing wholesale prices and mark-ups. These outcomes were contrary to policymakers' intentions, leading to the subsequent lifting of the ban. The ban had the effect of depriving downstream traders of access to trade credit from middlemen, forcing them to seek financial support from banks. This credit squeeze constrained

[4] Quality is a fuzzy term here and quality differences across the formal and informal sectors can be context-specific depending on the opportunities and economic and environmental pressures in the area (labor costs for example). The formal sector's reliance on pesticides and modern agricultural practices can sometimes result in higher pesticide residues on produce. While these practices may increase yield and help producers meet certain observable characteristic quality standards (no blemishes or insect damage for example), they can also raise concerns about the safety of the food -- excessive pesticide residues can have health implications for consumers. The formal sector often emphasizes appearance and uniformity of produce, but this doesn't necessarily translate to superior taste or nutritional value. Some consumers may prefer locally grown, organic produce from the informal sector for its perceived better taste and nutritional content.

traders' ability to purchase and distribute oil to retailers and consumers, resulting in higher downstream prices that became less responsive to fluctuations in oil import costs.

The World Bank 2019 World Development Report focused on the future of work, arguing that policies trying to formalize the informal have not been effective (in terms of achieving formality) and more promising policies might focus on increasing the productivity of informal firms, farms, and labor (Stromquist 2019). This shift in focus opens up a range of research questions that could deepen our understanding of the informal food economy. For example, why do some individuals and firms choose to leave the formal sector, and what advantages do they perceive in remaining informal? Which specific strategies—such as innovative financing, negotiation practices, aggregation models, and logistical improvements—are enabling certain informal firms to thrive? Furthermore, how do these innovations impact market dynamics, including prices, risk distribution, and overall participation in the food economy? If these strategies were to scale, what would be the broader implications for food security, labor conditions, and economic development? Exploring these questions could provide valuable insights into how informal food systems operate, adapt, and innovate, as well as how policies can support their growth and integration into broader economic frameworks without necessarily imposing formalization.

References

Abel, Otieno Benard, Cristopher Obel Gor, Samwel Ongwen Okuro, Paul Abuto Omanga, and Wolfgang Bokelmann. "The African indigenous vegetables value chain governance in Kenya." (2019).

Aker, J. C. (2010). Information from markets near and far: Mobile phones and agricultural markets in Niger. *American Economic Journal: Applied Economics*, *2*(3), 46-59.

Andriesse, E., & Lee, Z. (2017). Viable insertion in agribusiness value chains? Seaweed farming after Typhoon Yolanda (Haiyan) in Iloilo Province, the Philippines. *Singapore Journal of Tropical Geography*, *38*(1), 25-40.

Baker, George, Robert Gibbons, and Kevin J Murphy, "Relational Contracts and the Theory of the Firm," Quarterly Journal of Economics, 2002, pp. 39–84.

Benami, E., & Carter, M. R. (2021). Can digital technologies reshape rural microfinance? Implications for savings, credit, & insurance. Applied Economic Perspectives and Policy, 43(4), 1196-1220.

Casaburi, Lorenzo and Tristan Reed, "Competition in Agricultural Markets: An Experimental Approach," BREAD Working Paper No. 508, 2017.

Choudhary, D., Pandit, B. H., Kala, S. P., Todaria, N. P., Dasgupta, S., & Kollmair, M. (2014). Upgrading bay leaf farmers in value chains—Strategies for improving livelihoods and poverty reduction from Udayapur district of Nepal. Society & Natural Resources, 27(10), 1057-1073.

Christensen, C., Raynor, M. E., & McDonald, R. (2013). *Disruptive innovation*. Brighton, MA, USA: Harvard Business Review.

Deb, Rahul & Suri, Tavneet, (2013). "**Endogenous emergence of credit markets: Contracting in response to a new technology in Ghana**," Journal of Development Economics, 101(C), pp 268-283.

Deichmann, U., Goyal, A., & Mishra, D. (2016). Will digital technologies transform agriculture in developing countries?. *Agricultural Economics*, *47*(S1), 21-33.

Emran, M. S., Mookherjee, D., Shilpi, F., & Uddin, M. H. (2021). Credit rationing and pass-through in supply chains: theory and evidence from Bangladesh. American Economic Journal: Applied Economics, 13(3), 202-236.

Fafchamps, M. (2003). *Market institutions in sub-Saharan Africa: Theory and evidence*. MIT press.

Fafchamps, M., & Minten, B. (2012). Impact of SMS-based agricultural information on Indian farmers. *The World Bank Economic Review*, *26*(3), 383-414.

Fischer, E., & Qaim, M. (2012). Linking smallholders to markets: determinants and impacts of farmer collective action in Kenya. World development, 40(6), 1255-1268.

Futch, M. D., & McIntosh, C. T. (2009). Tracking the introduction of the village phone product in Rwanda. *Information Technologies & International Development*, *5*(3), pp-54.

Goyal, A. (2010). Information, direct access to farmers, and rural market performance in central India. *American Economic Journal: Applied Economics*, *2*(3), 22-45.

Grossman, J., & Tarazi, M. (2014). Serving smallholder farmers: Recent developments in digital finance.

Hermes, N., Lensink, R., Lutz, C., & Thu, U. N. L. (2016). Trade credit use and competition in the value chain: Evidence from Vietnam. *Economics of transition*, *24*(4), 765-795.

Hermes, N., Kihanga, E., Lensink, R. and Lutz, C. (2012). 'The impact of trade credit on customer switching behaviour: Evidence from the Tanzanian rice market', Journal of Development Studies, 48, pp. 363–376.

Hernandez, R., Berdegué, J. A., & Reardon, T. (2015). Modernizing wholesalers and guava farmers in Mexico. Agricultural Economics, 46(S1), 41-52.

Hidayati, D. R., Garnevska, E., & Childerhouse, P. (2021). Sustainable agrifood value chain—transformation in developing countries. Sustainability, 13(22), 12358.

Horton, D., Akello, B., Aliguma, L., Bernet, T., Devaux, A., Lemaga, B., … & Velasco, C. (2010). Developing capacity for agricultural market chain innovation: experience with the 'PMCA'in Uganda. Journal of International Development: The Journal of the Development Studies Association, 22(3), 367-389.

Iacovone, Leonardo, and David McKenzie. 2019. "Shortening Supply Chains: Experimental Evidence from Fruit and Vegetable Vendors in Bogota." World Bank Policy Research Working Papers

Jack, W., & Suri, T. (2014). Risk sharing and transactions costs: Evidence from Ke'ya's mobile money revolution. *American Economic Review*, *104*(1), 183-223.

Jensen, R. (2007). The digital provide: Information (technology), market performance, and welfare in the South Indian fisheries sector. *The quarterly journal of economics*, *122*(3), 879-924.

Kersting, S., & Wollni, M. (2012). New institutional arrangements and standard adoption: Evidence from small-scale fruit and vegetable farmers in Thailand. Food policy, 37(4), 452-462.

Kuijpers, R. (2020). Integrated value chain development: Evidence from Bangladesh. Food Policy, 97, 101916.

Kuhlmann, K., & Dey, B. (2021). Using regulatory flexibility to address market informality in seed systems: A global study. Agronomy, 11(2), 377.

Kolavalli, S., Mensah-Bonsu, A. and Zaman, S. (2015), "Agricultural value chain development in practice: private sector-led smallholder development", IFPRI Discussion Paper No. 01460, The International Food Policy Research Institute (IFPRI), Washington, DC.

Lowitt, K., Hickey, G. M., Ganpat, W., & Phillip, L. (2015). Linking communities of practice with value chain development in smallholder farming systems. World Development, 74, 363-373.

Macchiavello, R. (2022). Relational contracts and development. *Annual Review of Economics*, *14*, 337-362.

Macchiavello R, Morjaria A. 2015. The value of relationships: evidence from a supply shock to Kenyan rose exports. Am. Econ. Rev. 105:2911–45

Macchiavello, R., & Miquel-Florensa, J. (2019). Buyer-driven upgrading in gvcs: The sustainable quality program in colombia.

Mattern, M. W., & Ramirez, R. M. (2017). Digitizing value chain finance for smallholder farmers (No. 119216, pp. 1-28). The World Bank.

Meagher, K. (2019). Working in chains: African informal workers and global value chains. Agrarian South: Journal of Political Economy, 8(1-2), 64-92.

Meemken, E. M., Barrett, C. B., Michelson, H. C., Qaim, M., Reardon, T., & Sellare, J. (2021). Sustainability standards in global agrifood supply chains. Nature Food, 2(10), 758-765.

Miller, C., & Jones, L. (2010). Agricultural value chain finance: tools and lessons. Practical Action Publish

Mitchell, T. (2014). *Is knowledge power? Competition and information in agricultural markets* (No. iiisdp456). IIIS.

Mitra, S., Mookherjee, D., Torero, M., & Visaria, S. (2018). Asymmetric information and middleman margins: An experiment with Indian potato farmers. *Review of Economics and Statistics*, *100*(1), 1-13.

Mohan, S. (2016). Institutional change in value chains: Evidence from tea in Nepal. World Development, 78, 52-65.

Muto, M., & Yamano, T. (2009). The impact of mobile phone coverage expansion on market participation: Panel data evidence from Uganda. *World development*, *37*(12), 1887-1896.

Nagy, D., Schuessler, J., & Dubinsky, A. (2016). Defining and identifying disruptive innovations. *Industrial marketing management*, *57*, 119-126.

Ouma, E., Dione, M., Birungi, R., Lule, P., Mayega, L., & Dizyee, K. (2018). African swine fever control and market integration in Ugandan peri-urban smallholder pig value chains: An ex-ante impact assessment of interventions and their interaction. Preventive Veterinary Medicine, 151, 29-39.

Pastakia, A. (2012), "Building pro-poor value chains: experiences from rural India", The Journal of Entrepreneurship, Vol. 21 No. 2, pp. 269-288.

Reardon, T., Barrett, C.B., Berdegué, J.A., and Swinnen, J.F.M. (2009), 'Agrifood industry transformation and farmers in developing countries', *World Development*, Vol 37, No 11, pp 1717–1727.

Reardon, T., Liverpool-Tasie, L. S. O., & Minten, B. (2021). Quiet Revolution by SMEs in the midstream of value chains in developing regions: wholesale markets, wholesalers, logistics, and processing. *Food Security*, *13*, 1577-1594.

Reddy, A. A., Raju, S. S., Suresh, A., & Kumar, P. (2018). Analysis of pearl millet market structure and value chain in India. Journal of Agribusiness in Developing and Emerging Economies, 8(2), 406-424.

Ruben, R. (2017). Impact assessment of commodity standards: towards inclusive value chains. Enterprise Development & Microfinance, 28(1), 82-97.

Saenger, C., Torero, M., & Qaim, M. (2014). Impact of third-party contract enforcement in agricultural markets—A field experiment in Vietnam. *American Journal of Agricultural Economics*, 96(4), 1220-1238.

Stromquist, N. P. (2019). World Development Report 2019: The changing nature of work: By the World Bank. Washington, DC, World Bank, 2019, 151 pp.

Swinnen, J.F.M, and Maertens, M. (2007), 'Globalization, privatization, and vertical coordination in food value chains in developing and transition countries', *Agricultural Economics*, Vol 37, No 2, pp 89–102.

Svensson, J., & Yanagizawa, D. (2009). Getting prices right: the impact of the market information service in Uganda. *Journal of the European Economic Association*, *7*(2-3), 435-445.

Tefera, D. A., & Bijman, J. (2019). Cooperatives in modern food supply chains: a case study of the malt barley sector in Ethiopia. Design and Management of Interfirm Networks: Franchise Networks, Cooperatives and Alliances, 217-237.

Vellema, S., Ton, G., de Roo, N. and van Wijk, J. (2013), "Value chains, partnerships and development: using case studies to refine programme theories", Evaluation, Vol. 19 No. 3, pp. 304-320.

Verhofstadt, E., & Maertens, M. (2013). Processes of modernization in horticulture food value chains in Rwanda. *Outlook on Agriculture*, *42*(4), 273-283.

Verhofstadt, E., & Maertens, M. (2013). Processes of modernization in horticulture food value chains in Rwanda. Outlook on Agriculture, 42(4), 273-283.

Villalba, R., Venus, T. E., & Sauer, J. (2023). The ecosystem approach to agricultural value chain finance: A framework for rural credit. World Development, 164, 106177.

Vorley, B., Lundy, M., & MacGregor, J. (2009). Business models that are inclusive of small farmers. In *Agro-industries for development* (pp. 186-222). Wallingford UK: CABI.