



Food and Agriculture Organization  
of the United Nations

# Innovative business models for small farmer inclusion

Background paper for  
The State of Agricultural Commodity  
Markets (SOCO) 2020



# **Innovative business models for small farmer inclusion**

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The State of Agricultural Commodity  
Markets (SOCO) 2020

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**Required citation:**

Michelson, H.C. 2020. *Innovative business models for small farmer inclusion. Background paper for The State of Agricultural Commodity Markets (SOCO) 2020*. Rome, FAO. <https://doi.org/10.4060/cb0700en>

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ISBN978-92-5-133193-4  
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## **Abstract**

Farmer participation in agricultural markets is of major importance for rural economic growth and poverty alleviation in developing countries. This paper discusses market failures and constraints in agriculture in low-income countries, focusing on how these failures and constraints affect small farmers, input sellers and output buyers. It then explores innovative models implemented to address these challenges, including: out-grower schemes; input bundling programmes; decommodification through quality product differentiation; information and communication technologies; distributed ledger technologies; and direct purchasing models. Finally, the paper reviews the existing evidence surrounding these innovative approaches and highlights evidentiary gaps.



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# INTRODUCTION



## Introduction

Agriculture is the single most important productive sector in low-income nations, in terms of share of Gross Domestic Product (GDP) as well as employment. In these nations, two thirds of the population live in rural areas (World Bank, 2018), while worldwide, more than 2.5 billion people depend directly on agriculture for their income.

Consequently, farmer participation in agricultural markets in these regions is of major importance for effective policy related to rural economic growth and poverty alleviation. Ample evidence indicates that agriculture can be an engine of growth early in the development process and a major force for poverty reduction, with the poorest populations benefitting the most. Moreover, development in agricultural sectors can spur growth in other parts of a national economy via forward linkages into non-farm sectors that rely on agricultural output. It can also do so via backward linkages that connect farming to enterprises providing inputs for agricultural production, including seed, labour, machinery, and agrichemicals. Recently, rapid growth in China's agricultural sector has been seen not only as fundamental to a decline in rural poverty but also as critical to the acceleration of China's industrial growth. A similar agricultural revolution set the stage for England's rapid industrial development in the late eighteenth and early nineteenth centuries.

However, for nations still in the early stages of structural economic transformation, the agricultural sector presents two key areas of concern. One widespread challenge involves inertia, wherein agricultural production lags behind as industrial and service sectors grow. This problem is longstanding and widespread: as countries grow richer overall, levels of consumer expenditure on farm goods rise, yet not as quickly as demand for goods from the rest of the economy. As a result, agriculture's share of the total economy declines, with differences in labour productivity between the agricultural and non-agricultural sectors exacerbating intersectoral income inequities. Consequently, agricultural regions become reservoirs for low-skill, low-compensation labour. A developing economy reaches an important turning point in its structural transformation when these labour productivities begin to equilibrate across agriculture and other sectors; agricultural production modernizes and the agricultural economy becomes well integrated with other sectors (McMillan and Rodrik, 2014; Gollin et al., 2002; Timmer and Akkus, 2008). The process and pace of this change can create acute and pervasive challenges related to poverty and food security for developing economies as they grow.

Even so, concern in recent years has centred on the fact that agricultural development is not transitioning but stalled in many parts of the world, including in sub-Saharan Africa and parts of South Asia and Latin America (Timmer and Akkus, 2008). A range of contributing factors may be relevant including underinvestment in extension and infrastructure, along with other policies that may hinder development. Several related problems persist: staple cereal yields remain low relative to what has been shown to be possible in these regions; output prices are often volatile; essential infrastructure is either poor in quality and reliability or lacking altogether; and important services, including input credit and crop insurance, continue to be difficult for many farmers to access. With respect to poverty among small farmers, the core issue is how to develop agricultural sectors more quickly and steadily, spur investment, and raise per capita productivity and income.

Growth and investment in the agricultural sector matter for both intrinsic and instrumental reasons: as a direct means of poverty reduction by reaching the poor where they primarily live and earn their livelihood, and by accelerating other sectors of the economy. In the regions under

review here, small farmers tend to be concentrated in the production of low value raw agricultural commodities: staple cereals, cacao, coffee, cotton, palm oil, and sugarcane. As promoted by national and regional authorities and Non-Governmental Organizations (NGOs), common pathways out of poverty for these farmers include intensification of production; increased farm size; agricultural diversification into new high-value crops; diversification of household income into non-farm sources; or exit from the agricultural sector.

Climate change and environmental degradation constitute additional pressing concerns for small farmers that are intrinsically linked to agricultural growth. Small farmers are impacted by (and agents of) environmental change, such as, land use change – including deforestation – water pollution and soil degradation. Small farmers are also a population whose livelihoods are and will be affected directly by changes in the amount and timing of rainfall during growing seasons, temperature increases and sea-level rise; and they generally lack resources to protect themselves from these shocks. Though this report can have little to say directly about circumstances of climate change and small farmers, these global concerns provide context and urgency to the material presented and discussed here.

The focus of this paper, then, is to identify successful strategies for small farmer inclusion in agricultural development – including options for spurring agricultural development itself in ways that include small farmers actively – and to present and summarize recent evidence on these strategies. The paper will also discuss several innovations in small farmer inclusion, as well as challenges where more innovation and research would be beneficial.

A common thread in the evidence reviewed here relates to risk: the production, post-harvest, and output market risks that impact the traditional marketplace and ways in which new marketing or production relationships mitigate some risks and create others. Buyers, for their part, face new risks associated with purchasing directly from the small farmers rather than via traditional markets and farmers are often required to take on new risks in these relationships as well. Accurate understanding of these risks and of their distribution among farmers and buyers is critical to making headway in agricultural development and in foreseeing implications for equity and inclusion.

Further, while a range of strategies exist to include small farmers more effectively in agricultural markets, the latest cluster of innovations involves computer-backed technologies: low-cost sensors, satellite imagery, and blockchain adaptation. However, these strategies will succeed in achieving sustained changes in outcomes for small farmers only if they address systemic market failures in small farmer production and marketing. In addition, the impact of such innovations must be scrutinized and understood in the context of current market realities, a context of limited formal contractual enforcement and low regulation. We must consider at the outset, who will benefit from the implementation of new traceability systems, who will bear the costs of those systems, and how such systems will alter the distribution of risk. For example, though applying blockchain to small farmer contracting to create immutable records of past transactions has the exciting potential to initiate an economic identity for farmers, we must understand possible drawbacks associated with establishing such an identity and ways to protect farmers against this problem.

Innovations are indeed underway to decrease costs and increase benefits associated with sourcing from small, asset-limited and sometimes remote small farmers, and evidence is accumulating that over time, sourcing models based on contractual features emphasizing quality and jointly managing risk can produce value for both producers and buyers. In addition, new trends in

markets for agricultural commodities including supply chain traceability help us see more clearly various possibilities and challenges for small farmers as they enter into these new arrangements.

We begin with a discussion of market failures and constraints in agriculture in developing countries, with attention to how these affect both small farmers and associated input sellers and output buyers. Section 2 considers when and why buyers would opt to purchase from small farmers, given the costs and complexity associated with this decision. Section 3 presents out-grower schemes – a common model for engaging small farmers – and it reviews how this model relates to decisions by the contracting firm related to vertical integration. Section 4 reviews innovative models implemented to address market failures and constraints that small farmers face, including out-grower schemes; input bundling programmes; decommodification through quality product differentiation; application of particular information and communication technologies; distributed ledger technologies including blockchain; and direct purchasing models. The final section reviews relevant existing evidence and evidentiary gaps.



# CHAPTER 1

**The role of markets and their contribution to economic growth and development (with emphasis on agricultural markets)**





# 1 The role of markets and their contribution to economic growth and development (with emphasis on agricultural markets)

Agricultural markets in developing countries take a range of forms: from spot market transactions in which farmers and small traders meet at the farmgate to relatively sophisticated contracting schemes specifying the timing, scale, price, and quality parameters of a future transaction. Agriculture in these economies is market intensive, characterized by a large number of small traders as well as intermediary transactions between farmer and final consumer.

Facilitating small farmer participation in markets is a central policy pursued in developing economies by international NGOs and development agencies as well as by national governments for promoting poverty reduction and robust agricultural sectors. The hope is that these relationships can spur investment and productivity increases in rural regions. The challenge, frequently, is not only to include small farmers as active participants in these markets, but also to assure their ability to compete, and to participate in ways that lead to household investment, productivity increases, and protection against future poverty.

## *Market failures*

Small farmer competitiveness is often impeded by structural market failures, including credit constraints; limited ability to mitigate price and production risks; lack of scale in market input purchases and output sales; problems accessing production and marketing information, and prohibitive search and transactions costs. These impediments, in addition to poor physical and communications infrastructure and lack of quality standards and differentiation in markets, all constrain farmer choices and decision-making related to production, investment, harvesting, storage, and sale. Such failures can hinder generation of aggregate positive outcomes, and they raise the costs and lower the incentives for working with small farmers.

The failures and functioning of agricultural markets in developing countries critically set the context for both the challenges associated with sourcing from small farmers and also the opportunities that they present. These problems are all manifest in systemic market failure – price instability, thin markets for agricultural inputs, and a lack of formal credit to finance production and sale. These failures and risks set farmers' reservation expected welfare level and influence the contractual terms farmers are willing to accept. For example, small farmers may prove willing to agree to a lower contracted mean sale price (relative to what is available in traditional markets) because contracts can provide implicit price insurance, a measure of protection from the lower tail of the price distribution. In that sense, therefore, the predicament of farmers provides opportunity for contracting buyers.

A second, and persistent, challenge in these markets is a lack of formal mechanisms for contractual enforcement. Classic problems then arise, including, commitment failure, asymmetric information, and adverse transactions costs. In situations where enforcement mechanisms do exist, they often prove too costly or cumbersome for addressing issues such as default or side-selling by farmers. But buyers can also fail to comply when they ultimately purchase, as they may defer from agreed upon quantities or prices, or downgrade an assessment of crop quality.

Consequently, instead of writing contracts that are legally enforceable, parties often rely on informal strategies: establishing trust through repeated interactions (or conversely, through punitive cancelation of contracting relationships), or reliance on reputation, social norms, and third parties such as NGOs to assist with coordination and enforcement. The first-order result

from such informal arrangements is a dearth of written contracts that are legally enforceable and a substantial reliance on oral commitments between growers and buyers. The second-order effect of this informality is that such agreements fail to bundle inputs or provide other important services such as price insurance. Frequently we see under-investment by both parties in relationship-specific assets or processes, a real problem in environments where credit or other services are lacking and where extension services are underfunded by the government.

A third, related challenge, is a lack of extension services or information for farmers about options for new crops, market opportunities, or innovative production practices. This lack of information is a particular challenge for small farmer adoption of “long jump” technologies (Box 1: Big Ajar Case) which require significant investment by farmers in assets, inputs, or new technologies. In such cases, provision of technical assistance and input financing may be essential for small farmer inclusion. A third challenge: input markets often function poorly, with required agricultural inputs unavailable altogether or unavailable at the time when farmers need them.

A fourth challenge involves output markets: price risk, high transaction and transport costs, poor infrastructure, and perishability. Without good infrastructure, reliable storage facilities, and in the absence of trustworthy intermediaries, small farmers may be unwilling to cultivate perishable crops, the distribution of which is time-sensitive and subject to rapid quality deterioration. Moreover, farmers face considerable price risk, especially in rainfed agriculture, and in markets that are thin and poorly integrated. Few developing countries have commodity exchanges for staple cereals that permit hedging against price fluctuations. Moreover, because high transfer costs can insulate domestic prices from world market prices, producers are unable to access commodity exchanges to mitigate price risk. Perishable crops such as horticulture lack any formal mechanisms for price risk management.

A fifth challenge relates to the lack of financial services to support small farmer investment, with credit and production insurance a paramount need. In terms of production risk, new microinsurance products for small farmers have been developed in recent years, but small farmer participation tends to be low. This may, at least in part, be attributable to basis risk or a lack of trust in the insurance provider.

**Box 1**

**Big Ajar Enterprise**

**Case based on documents from the Soybean Innovation Lab.**

**Case type:** Outgrower scheme innovation for a “long jump” technology with as yet no external academic evaluation of impact

**Site:** Northern Ghana

**Crop:** Soy

**Authors:** Edward Martey, Agricultural Economist (Research Scientist), Head of Socio-economics Section, CSIR-Savanna Agricultural Research Institute, Ghana and Hope Michelson, Associate Professor, University of Illinois at Urbana-Champaign

As a grain producer and seed grower operating in Northern Ghana, Big Ajar Enterprise uses a nucleus estate farmer model and public sector support to organize, equip, and purchase soy from small farmers cultivating nearby.

**Problem**

Local demand for soy as an input into animal feed has been expanding in West Africa, in fact, soybean cultivation has outpaced other crops since the mid 1990s. However, less than 0.5 percent of the global annual soybean crop originates from sub-Saharan Africa, excluding South Africa. Regional policymakers and buyers are looking to develop local soybean value chains, to enhance overall economic development and reduce imports of food oil and livestock feeds.

A regional market is emerging for high quality soy: soybeans that are deep brown in colour, of a relatively larger size, are free from debris, well dried, and with a low percentage of broken beans. Among farmers accustomed to growing maize, sorghum, and groundnut, soy is gaining appeal as a new cash-crop option. Even so, soy in West Africa remains a low-value commodity characterized by thin markets. In addition, small

farmers in the region produce small quantities, often of poor quality, and they tend to be located far from regional markets, contributing to high transactions costs. Soy cultivation currently represents a “long jump” technology, requiring increases in resources and expertise. A shift to soy production requires farmers to assume additional production investments and efforts, including changes in tillage techniques, commercial inputs, soil correction, and planting practices. Farmers have proved unable to make the jump to soy in most cases, without some assistance.

### **Innovation**

Big Ajar’s innovation is to utilize input bundling to support small farmers transitioning to production of quality soy, and to offer these farmers a guaranteed crop price at the beginning of the growing season. Bundling input provision with a guaranteed market helps farmers access quality inputs at the right time while also reducing their output marketing risk. Additionally, participating farmers retain the option to sell the rest of their produce to Big Ajar after meeting the contractual obligation. The company also works with farmers to improve soybean quality through good

### **Box 1 continued**

agronomic practices and post-harvest activities. The input bundle scheme is supported by Agricultural Development and Value Chain Enhancement (ADVANCE), Alliance for a Green Revolution in Africa (AGRA), Ghana Grain Council and USAID. Ghana Grain Council and AGRA have supported the construction of a 500 metric tonne (MT) capacity cereal warehouse to provide storage services for smallholder farmers participating in the outgrower scheme, while ADVANCE provides training in business development, along with multipurpose soya processing machinery.

In 2008, Big Ajar Enterprise began outgrower operations in the Upper West Region of Ghana, supporting 100 maize and soybean farmers with certified seeds and ploughing services for the cultivation of two acres of farmland by each participating farmer. In 2019, nearly 500 farmers cultivated nearly 1 000 acres of soy as part of this programme. Big Ajar Enterprise currently facilitates its own credit from both local and multinational banks. Fertilizer is supplied directly to outgrowers, while crop seed is supplied from the firm of Yara/Chemico (importers). This company sells certified seeds to the local market, to other nucleus farms, and to government and input distributors. The harvested crop is sold to processors and to the poultry industry in southern Ghana.

In order to ensure that the outgrowers produce quality soybean, Big Ajar provides technical training with partners (see below) on effective agricultural practices using market facilitation approaches. Big Ajar Enterprise acts as an intermediary between farmers and factor and service markets (inputs, tractor cultivation, threshing, shelling), to assure that farmers receive these inputs and services on time. Farmers pay for these services with negotiated, in-kind deliveries of soy at the end of the season.

The credit input bundle per acre provided to farmers currently includes:

- 15 kilograms of certified seeds;
- one bag of Yara fertilizer;
- 200 grams of inoculum for the soy seed;
- one litre of glyphosate;
- one litre of post-emergence herbicide; and
- optional ploughing services.

Complementary to this input bundle is technical assistance from field supervisors working with the Big Ajar Enterprise. When farmers reimburse these input credits with three bags of soybean after harvest, they can sell the rest of their harvest either to the Big Ajar Enterprise or in other markets. The operation comes with its own risks for the Big Ajar Enterprise: primary challenges include farmer side-selling and low outgrower repayment rates. Though purchase prices are set by Big Ajar at the beginning of the farming season, these prices are not legally enforceable. As a result, farmer shirking and side-selling has proved to be a problem when prices during harvest exceed the previously-negotiated price. In response, Big Ajar has restructured input bundles so they are available only to farmers who have proved credible in past transactions; to reduce side-selling, the

company has also increased monitoring during both the crop vegetative stage and harvest, especially when spot market prices move higher than the contracted price. This monitoring involves participating by lead farmers in all 28 operational communities. Farmers found to be side-selling based on monitoring are eliminated from the scheme, losing the option to sell as contracted farmers in the future.

Going forward, the company must deal with pressures to expand and extend credit and to deliver inputs on time to farmers; it must also manage high costs of field monitoring and of dealing with farmers who fail to comply with the contract.

**Sources:** Martey, E. 2019. Soil fertility management and economics of soybean in Ghana. Department of Agriculture and Consumer Economics, University of Illinois at Urbana-Champaign. [PhD dissertation] <http://hdl.handle.net/2142/104796>; Tamimie, C.A. and Goldsmith, P.D. 2019. Determinants of soybean adoption and performance in Northern Ghana. *African Journal of Agricultural and Resource Economics*, 14(4), pp.292-309; Technoserve. 2010. TechnoServe to Boost Farmer Incomes Through Development of Soy Industry in Southern Africa. TechnoServe, 26 August 2010. <http://www.technoserve.org/press-room/detail/technoserve-to-boost-farmer-incomes-through-development-of-soy-industry-in>. [Accessed June 2018]

A sixth challenge, is that farmers in these contexts commonly lack a verifiable economic identity as buyers and sellers in agricultural markets, they remain largely invisible from the perspective of national economic conditions, production processes and market participation, and resource needs and challenges. In effect, small farmers in the regions under review here are often unable to establish a verifiable reputation as reliable suppliers. This kind of reputation is essential for a

credit identity, improved bargaining power, and full participation in global supply chains.

And finally, a lack of coordination within supply chains leads to limited incentives for farmers to invest in quality. Without quality differentiation, farmers are unable to decommodify; they remain in a quantity trap in which they make investments to increase production primarily via yield increases or increases in area under cultivation.

# CHAPTER 2

## Small farmers and agricultural commodity markets



## 2 Small farmers and agricultural commodity markets

particular, the search costs associated with identifying many individual farmers, negotiating contracts with each one, and then purchasing and paying each one can prove prohibitive.<sup>1</sup> Given the cost and effort involved in transacting with many small producers that are often marginalized by existing formal financial markets, why should agribusiness exert any special effort to include them in a transforming market?

Empirical studies examining whether and why small farmers are included in value chains finds considerable heterogeneity across products, regions, and time (Swinnen *et al.*, 2013; McCullough and Pingali, 2008). Factors explaining this documented heterogeneity include transaction costs, the nature of the sourced commodity, whether the initial production structure is dominated by small farmers, whether companies have access to land to establish larger farms, and the degree to which the firm wants to diversify sourcing across many farmers as a supply risk mitigation strategy. Barrett *et al.* (2012) developed a framework regarding the terms of inclusion of small farmers in supply chains. We discuss several relevant factors below.

When small farmers dominate production of a crop in a given region, bypassing them may be impossible. Such bypassing may also be unacceptable for political reasons if national governments encourage companies to work with small farmers either explicitly or implicitly. For example, a government may link a waiver of export taxes to a company's initiative to work with these farmers. Indeed, companies may take these initiatives in order to maintain good standing with a government. Many commodities are grown by small farmers, and there are many reasons why this is so. For cocoa in West Africa and coffee in parts of Central and South America, policies including price protections (guaranteed minimums) have encouraged small farmers to cultivate these crops in places where little else would make economic sense, given the marginal nature of the land or the remoteness of the farm. For example, only a handful of cocoa farms are larger than 50 hectares in Cote d'Ivoire; the majority of cocoa is produced there by more than 800 000 small farmers, with the trade controlled by several hundred traders and cooperatives, together supplying 50–100 licensed exporters (Reuters, 2019).

In other circumstances, the small farmers offer the advantage of lower costs, in part because of the availability of family labour, which is high quality, without the expense and required oversight of hired labour, and characterized by low shadow wage rates (Skoufias, 1994). This quality family labour advantage can make small farmers competitive in the cultivation of crops that are high-value and high-labour: for example, horticultural crops, the cultivation of which can be profitably accomplished on small plots.

Finally, some work suggests that small farmers present an attractive option for contracts for companies because their lack of good outside market options lowers their reservation expected welfare level; they may be willing to comply with contractual features that farmers with more land, assets, or opportunities would reject.

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<sup>1</sup> A contributing factor was the World Bank and International Monetary Fund structural adjustment programmes of the 1980s and 1990s, which, especially in sub-Saharan Africa, required governments to withdraw support from agriculture – including extension and agricultural input subsidies – and consequently from small farmers.





# CHAPTER 3

**Means of overcoming market failures to purchase from small farmers**



### 3 Means of overcoming market failures to purchase from small farmers

Companies sourcing agricultural commodities in rural regions of developing countries typically pursue one of two approaches to overcome these sorts of market failures: coordination across agents in a chain, and vertical coordination.

The first strategy, coordination across agents, can be difficult and costly to achieve, given the large number of actors engaged in agricultural production and marketing in developing countries. Even so, an agricultural business in this context may cover the costs of coordination, either to advance (exclusively or in part) a Corporate Social Responsibility (CSR) objective or because they see advantages from the outset.<sup>2</sup> A second path to achieving such coordination across participants in a value chain is when an outside actor such as an NGO, government programme, or large producer organization undertakes the investment, effectively subsidizing the costs of coordination for the business or the farmers or both.

A second strategy is vertical coordination.<sup>3</sup> However, aspects of agriculture in developing countries can reduce the attractiveness of this strategy for buyers: markets can be risky due to weather and price variability; intermediaries (especially large wholesalers) can have significant market leverage; vertical integration can increase barriers to entry and market presence. The reality is that companies have tended not to fully vertically integrate in agriculture chiefly because of production risk. Moreover, companies also may worry about the optics and exposure of investing in large farms in developing countries.

One option, with a long history in developing countries and gaining in popularity, is to move the purchase closer to the farmgate, using negotiated contracts to structure the sourcing from growers. Such relationships can include the provision of technical advice and support to assure that production and crop standards are met. Contracts can also facilitate certification of farmers and their production strategies to meet standards set by other entities, public or private. These contracts are often designed to obviate relevant existing market failures. How these contracts are written and enforced has considerable bearing on the sustainability of the relationship, and consequently to the welfare of participating farmers.

Contracts and contracting relationships with small farmers can take a range of forms. An outgrower scheme (a term often synonymous with contract farming) describes a production system in which a firm contracts small farmers individually or through groups, providing the firm with a measure of vertical integration, but without assuming the full financial risk of agricultural production. These contracts allow the firm to transfer control of contracted aspects of production and marketing to growers while providing them with more reliable access to inputs, markets, or other forms of risk abatement. For purchasing firms, outgrower schemes can provide a measure of control over supply and quality standards while diminishing vulnerability to commodity price fluctuations, all without the company increasing its exposure to production risk.

Contracts with farmers and groups of farmers can address specific aspects of marketing, for example, an agreement by the buyer to purchase the seller's output with the buyer assuming certain risks and rights related to marketing location and timing, and with the farmer retaining control over production. Production-management contracts involve more buyer control over

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<sup>2</sup> Some evidence does suggest that for these initiatives to be profitably sustained, the initiative should be fully integrated into the business portfolio of the company.

<sup>3</sup> A range of models of vertical coordination exist in agricultural markets, with the type of vertical coordination adopted by the company influenced by the characteristics of the commodity, associated factor markets, and institutional environment. Swinnen & Kuijpers (2017) provide a typology and examples of different types of vertical coordination.

these production practices. Contracts that add resource provision represent the greatest level of control for buyers, as they not only provide a market for the product but also control aspects of production and supply some key agricultural inputs. This final contract type is closest to full vertical integration, with the farmer effectively being compensated as a manager of the production while the crop is in the field.

Outgrower schemes have a long history in developing countries, dating back to colonial era production of major cash crops including cocoa, cotton, tobacco, and sugarcane. Smalley (2013) describes the rise of contract farming since the 1960s in sub-Saharan Africa. Outgrower schemes today take a range of physical forms. We see centralized models (common for crops including tobacco, cotton, sugarcane, and tea) in which companies provide technical and production support, and ultimately purchase and either process or directly market the crop. In a second model – sometimes called a nucleus estate model (more common for crops such as oil palm) – the company will also cultivate its own estate plantation to guarantee some minimum amount of production for a central processing facility. Models in which the company is less directly involved in production or marketing can involve subcontracted purchasing agreements, with buying intermediaries making their own informal arrangements with farmers regarding production processes and quality. The least formal variety of contracting features smaller, geographically proximate companies working according to seasonal oral agreements with farmers.

In summarizing recent evidence on the household welfare effects of contract farming, Bellemare and Bloem (2018), Barrett et al. (2010), and Ton et al. (2017) discuss possibilities for such relationships to contribute to broader reductions in poverty and development. Most of these household-level analyses have studied the average effects of contracting on household outcomes, including crop yields, food security, assets, incomes, and poverty status. Only a handful of researchers have considered the heterogeneity of these effects across participants, examined effects of these relationships on the second moment of the household welfare outcome distribution, or analysed effects over time. Narayanan (2014) finds heterogeneous effects across contracted growers in India, with some producers worse off on average than non-contracting farmers; this research provides empirical evidence that contracting relationships come with new challenges for contracting parties.

For buyers, one important challenge associated with these contracts is that farmers may opt to sell contracted production to buyers outside of the contract (a practice known as side-selling); when inputs are provided to the farmer via loans, side-selling is often also associated with loan default. Farmers may side-sell when yields or prices are lower than expected, relative to the traditional market, or if credit market failures or limited cash reserves lead them either to side-sell in the face of a household emergency or apply contracted inputs to other crops.

Clearly, the value of the commodity will influence the business's willingness to address market imperfections through institutional innovations. Kjuipers and Swinnen (2016) argue that innovative business models are more likely to be implemented and to succeed in high-value food chains than in staple foods.

In the next section, we review innovative business models to address market failures commonly faced by small farmers. Some of these models solve market failures in the context of a contract, using its terms to provide insurance from production or market risk or to deliver essential services not available through other private or government actors. We also discuss innovations that do not require a buying agreement between a farmer and a buyer.

# CHAPTER 4

**Innovative models to address market failures and small farmer constraints**



## 4 Innovative models to address market failures and small farmer constraints

Various innovations can decrease costs of contracting with small farmers to buyers. While another set of innovations can increase benefits to both parties of transacting; these innovations can change the amount and nature of risks involved and can change the distribution of that risk.

Some of these innovations involve new technologies; others, despite being relatively low-tech models of structuring relationships and incentives, innovate nonetheless in their execution and sustained engagement. Such distinctions, however, are counter-productive, as successful engagement with these challenges may require a blend of these strategies.

### *Risk mitigation through contracting*

For households with very limited financial resources, consumption smoothing in the face of price and production shocks may force asset sales or other adverse consequences for capital accumulation and future production (Rosenzweig and Wolpin, 1993; Carter and Barrett, 2010; Cisse and Barrett, 2018). Because evidence suggests that uninsured risk can negatively impact production (Rosenzweig and Binswanger, 1992), addressing such risks (depending on the crop and the circumstance) can promote farmer investment in agricultural production, even in circumstances where credit markets are systemically weak.

### *Production risk*

Contract relationships that induce individual farmers or groups of farmers to invest in new, risk-mitigating production, harvesting, or processing technology (for example, irrigation or cold chain) indirectly contribute to risk mitigation. Recent initiatives suggest a range of options for contract farming to include production insurance directly: the World Bank, for example, has argued that agribusiness buyers are in a better position to bundle lending and production insurance to small farmers because the contracting relationship itself, and associated services, provide additional means of enforcing the lending contract (Meyer *et al.*, 2017).

Evidence from an experiment in Ghana, points to the value of production insurance for smallholders (Karlan *et al.*, 2014). In the experiment, randomly selected groups of maize farmers received either cash grants, or an opportunity to purchase rainfall index insurance, or both. The study found that production insurance alone led to strong increases in farmer investment, with farmers taking on riskier and potentially more profitable production choices. Insured from production risk, farmers were able to find the financing they needed. Other relevant evidence includes Cole *et al.* (2017) who found that rainfall insurance uptake by a randomly selected group of Indian small-scale farmers led farmers to invest in “higher return, rainfall sensitive crops”. Nonetheless, take-up remains strikingly low for these production insurance products, in part because of the complexity of the basis risk that farmers assume. Both studies – Karlan *et al.* (2014) in the first year of the three-year study and Cole *et al.* (2017) – offered the production insurance product for free. In contexts where the product is not free, farmers have often proved unwilling to invest in production insurance. In the Karlan study, in years two and three they provided the insurance at randomly varied prices and found that 40–50 percent of farmers were willing to purchase it at the actuarially fair price.

Other initiatives have successfully linked production insurance to credit,<sup>4</sup> or folded the insurance product into the costs of services and production inputs. A Kenyan microinsurance firm, PULA, reports success in signing up more than 1.7 million smallholder farms in 10 African countries and India: the innovation here is that because the cost of the insurance is included in the price of seed and fertilizer, farmers do not pay for insurance directly, but are instead covered through bundled weather index insurance based on satellite data that evaluates weather-related input losses. Bundling insurance with other services is also the strategy pursued by the One Acre Fund; this project, evaluated in Deutschmann et al. (2019), is found to increase small farmer maize production, yields, and profits, though this complex and integrated package of services does not allow the impact of the production insurance to be sorted out from other components.

An additional opportunity: as data on yield, production and weather becomes increasingly available through private and public efforts utilizing mobile platforms with small farmers (Olam Direct<sup>5</sup> is an example), costs of structuring insurance premiums may decline as information about risk-factors improves, insurance companies with greater incentive to provide insurance products (Daum et al., 2018 describe this sort of smartphone-enabled data collection system). Monitoring costs may also decline as the costs of high resolution satellite imagery decline, or as these data collection options are combined with machine learning, geospatial data analysis, and cloud computing, further reducing basis risk and policy costs.

### Price risk

Price risk mitigation offers a second area for contractual innovation. With the advantages of hedging in international futures markets, and with geographic diversification in sourcing, buyers are in a position to mitigate grower price risk in markets where prices exhibit either high volatility or persistently low levels. Research has demonstrated that purchasing agreements that guarantee farmers a minimum price and provide farmers with a measure of price insurance can provide powerful incentives for farmers; farmers in Nicaragua contracting with Walmart proved willing to accept a lower mean price for horticultural products (relative to the traditional market) in a contract that provided a minimum price (Michelson *et al.*, 2012).

This sort of insurance can be valuable when traditional domestic markets for a contracted commodity are thin – as can be the case with rainfed horticulture – or when the international price exhibits high inter-annual volatility and extended periods in which prices are depressed (coffee and cacao).

Price guarantees through contracts have been shown to provide powerful ways to induce investment in production. For example, researchers working with a rice processor in Benin ([Box 2: Contract Farming – The Benin Case](#)) found that a contract guaranteeing a producer price showed production impacts similar to contracts that also included extension and input loans. With a price guarantee, farmers were willing and able to seek out their own input services and financing. Relatedly, Intelligentsia Coffee ([Box 3: Intelligentsia case](#)) provides guaranteed prices to its coffee growers (through an intermediary importer) for set quantities of multiple coffee quality grades in long term contracting arrangements.

<sup>4</sup> Insurance can unlock credit for small farmers given that it reduces the risk to the lender. Meyer et al. (2017) review recent evidence in a book for the World Bank.

<sup>5</sup> Olam Direct <https://innovationaward.org/portfolio-item/olam-direct-2019/>



**Box 2****Contract farming – The Benin case**

<b>Case type:</b>	<b>Summary of academic evaluation of private sector initiative varying contract design for sourcing rice</b>
<b>Site:</b>	<b>Benin</b>
<b>Author:</b>	<b>Hope Michelson, Associate Professor, University of Illinois at Urbana-Champaign</b>

In developing countries, many policy and private sector programmes have worked to facilitate and support contract-farming arrangements between small farmers and buyers. Though empirical evidence regarding the welfare effects of these efforts is mixed, these studies commonly approach the question by evaluating the net effect for households of a contracting relationship, relative to a counterfactual of not having any contract. As yet, few studies or initiatives have formally experimented with the attributes of contracts to ascertain the relative importance of different contractual features.

A contract of this sort can take many forms – specifying price, quantity, quality, timing and specifics regarding delivery; but a contract can also bundle agricultural inputs, financial services (including credit and production insurance), and extension services. Which features prove to be most important to ensuring desired outcomes? For the contracting buyer, these desired outcomes likely include ensuring stable product supply over time, and meeting required quality standards without side-selling. For the farmer, they include a marketing relationship that simplifies transactions and provides some premium in services, mean price increase, or price volatility reduction.

**Innovation**

A recent study by Arouna *et al.* (2019) implemented in collaboration with a rice processor in Benin, was designed to provide evidence on this point, randomizing the features included in rice contracts with small-scale rice farmers. The contracting buyer in the study was Entreprises de Services et Organisations de Producteurs de Bante (ESOP), a private rice processing and marketing company with previous experience in using small-farmer contracts to purchase rice.

The study worked with 953 farmers organized into 107 farmer groups, randomly assigning these farmers to one of three treatment groups or a control group. The first group signed written contracts with ESOP at the beginning of the production season for a specified quantity of rice to be delivered in 80–100 kg bags on a specified date and location, meeting a quality standard defined by an impurity percentage (presence of foreign matter and debris). Farmers in this group were contracted to grow a specific rice variety, and all contracts guaranteed a harvest sale price fixed at USD 0.27 per kg. According to the researchers, the price ranged from “USD 0.20 to USD 0.33 per kg, depending on the buyer (collectors, traders, or consumers) and the place of sale (farm gate, village, or market)”. The contract also defined what a breach of contract meant, and how such breaches by either party would be resolved.

These contracts bundled additional components onto the initial agreement, with variations for each farmer treatment group. Features were nested by treatment group; farmers in the second group were offered contracts that included all of the features in the contract of the first group, but the contract added extension services provided by the purchasing company: 3–5 extension visits including information on agricultural practices and post-harvest handling.

In addition to the basic contractual features of the first group, farmers in the third group received not only these extension services, but also seed and fertilizer provided on loan from the buyer at a price specified in the contract; these input costs were deducted from the end-of-season payment to farmers. The control group farmers in this study were rice growers who lacked any contracting relationship with the buyer.

**Findings**

The researchers studied the effects of the contracts on four outcomes: the hectares that these farmer planted in rice in the contracting year; paddy rice productivity (yields) measured in kg harvested per hectare; the share of harvested rice sold by each farmer; and household per capita rice income (rice harvest value divided by household size).

The study finds differences among the values of these farm and household outcomes by contract, with the contracts setting price, quality and transaction details leading to increases in rice productivity, the quantity of rice sold by the participating household, and per capita rice income for the household. Though the contracts that also included extension services and input provision by the buyer also led to improvements in these outcomes, the magnitude of these increases is statistically indistinguishable from the contract that only specified price, quality, and transaction details. The contracts that included extension and extension plus inputs did increase the allocation of available land to rice production, while the price contracts with no other features did not.

A key finding of the study is that the price guarantees alone proved sufficient to impact rice productivity, marketed rice share, and per capita rice income among treatment farmers. The study did not examine effects on farmer side-selling or contractual breach – outcomes relevant to assessing the prospects for the contracting relationship to continue. As the authors conclude:

**“Price guarantee frequently resulted in outcomes statistically indistinguishable in their magnitude from more complex (and costlier) contracts that provide extension training and/or input loans. This suggests that once price uncertainty is resolved, farmers can, on their own, address issues of technical efficiency and capital constraints.”**

Price guarantees through contracts with buyers potentially avoid some of the equilibrium problems associated with national or international price protections. Supports at prices above market equilibrating levels tend to increase production relative to circumstances without such protections. Even so, implementing such supports at national or international levels could have pernicious outcomes: by increasing the average price and the profitability of coffee cultivation, for example, an international price floor is likely to increase investment in coffee farming, encouraging established growers to expand production and new growers to join in. As quantities in the global market consequently increase, surpluses can accumulate without buyers and an acceptable floor price, with adverse consequences for producers, especially smaller-scale farmers with scarce resources and bargaining power in the marketplace. When shadow markets emerge at prices lower than any floor for unsold production, the downward spiral continues.

Price risk mitigation through a contracted buyer can lead to a different outcome, inducing growers to produce more than they otherwise would, yet also to remain within the parameters of the contract. However, unanswered questions relate to the general equilibrium effects of the provision of insurance to a subset of producers.

One primary challenge in such arrangements is the risk for the buyer, specifically farmer side-selling. Though farmers may adhere to the contract as long as the outside market price is below or similar to the contracted price, they may deviate when the price sufficiently exceeds the contracted price, calculating that gains from such one-time defections exceed the longer term benefits of adhering to the contract.

Contracts featuring protection from price volatility therefore are likely to be most sustainable and most successful in circumstances where farmers value the insurance because of fundamental instability in their outside market option, or where their discount rates are not excessive. More research and evidence on this topic is needed.

**Box 3****Intelligentsia direct farm programme**

<b>Innovation:</b>	<b>Direct trade WITH distinguishing farmers that including buying all quality grades of a farmer's production, at fixed prices as yet no external academic evaluation of impact</b>
<b>Site:</b>	<b>Sourcing from farmers in Latin America and East Africa</b>
<b>Author:</b>	<b>Hope Michelson, Associate Professor, University of Illinois at Urbana-Champaign</b>

Intelligentsia is a Chicago-based coffee roaster and retailer at the innovative forefront of the direct trade model of coffee purchasing. Along with Peter Giuliano of Counter Culture Coffee and Stumptown founder Duane Sorenson, Intelligentsia's Geoff Watts is credited with originating the direct trade model in 2002.<sup>6</sup>

Direct trade coffee is a term that has grown to mean sourcing as directly as possible from coffee growers, shortening supply chains to increase coordination, quality, and value to the farmer and the end buyer. Direct trade can mean single origin coffee purchasing, in which beans from a single farm or group of farms are segregated based on quality grades; but increasingly today it means working directly with farmers and farm associations through an aggregator or importer. The significant and salient feature is the direct engagement between the farmer and the coffee seller, including direct negotiation of the terms of trade: price, quality, volume, and delivery.

The enabling environment for coffee is that a segment of coffee consumers has proved willing to pay for what it sees as high quality coffee with distinctive taste. Quality in this model is based on tangible aspects of the product including aroma and appearance rather than intangibles based on third-party private certifications including Fairtrade or Rainforest Alliance.

**Challenge**

Though the conventional coffee market (known as the C-market) is characterized by low and volatile prices, most specialty coffee is purchased on differential terms in which buyers pay some fixed differential over the C-market. For growers, the challenge of the conventional market is volatile prices. The challenge for specialty coffee buyers is related to finding sufficient quality supply in a market that has long incentivized quantity over quality investments by farmers.

Quality is a path that growers can use to decommodify, but growers moving into high quality production based on high-priced microlot production face challenges as well. Producing specialized quality coffee represents additional effort, expense, and risk; moreover, specialty growers may end up with little or none of their seasonal output meeting stringent microlot standards. Having foregone production of hundreds or thousands of pounds of lower-quality beans, they cannot prosper by selling only 50 or 100 pounds of elite-level coffee for USD 5 or even USD 10 a pound. Therefore, a quality-based model needs to provide additional returns and/or risk-mitigation to farmers, given the additional investment required for production of this sort.

**Innovation**

Intelligentsia structures its direct-trade contracts with farmers to decouple them from the C-market; purchasing microlots of coffee but also other quality grades on fixed-price terms independent of the price level and the fluctuations in the C-market. Their sourcing uses both quality-based long term contracts and transparent payment mechanisms.

Intelligentsia argues that producing coffee of extraordinary quality is difficult, and that farmers are likely to produce a pyramidal distribution of quality grades in a single harvest season, with the lowest (A grade) quality beans the most common and with AAA or microlot coffee comparatively scarce. Intelligentsia nonetheless buys it all, calling its agreements multi-tiered contracts, specifying five different quality levels at five different price points. The contracts are designed to create persistent incentives for quality and to remove the price volatility from the market for farmers, thereby enabling growers to project earnings at least one year ahead, an advantage which in turns helps Intelligentsia to sustain and retain its array of growers.

While direct trade models of purchasing and marketing coffee are now well established in the industry, two features of Intelligentsia's model are unusual and notable:

The contractual commitment to purchase multiple quality grades of coffee from a farmer or farmer's association.

The commitment to purchase those quantities and quality grades at prices set at the beginning of the season. The substrate innovation here is the purchase of multiple quality grades from contract growers, a departure from the standard "microlot" model, in which buyers directly purchase only the highest quality coffee from suppliers. Direct trade as practiced by Intelligentsia means quality lot separation by farmers and the ideal is that all contracts are multi-grade contracts: they write contracts for blender-grade coffees (A and AA) with growers who supply single-origin (AAA) and microlot coffees as part of their commitment to create more value. These contracts reward growers for their efforts to produce the highest quality possible by purchasing at premium prices coffees that don't "sell themselves" in the same way that the extremely high quality grade coffees do (AAA and microlots).

This unconventional approach to direct trade makes Intelligentsia vulnerable to being poached by buyers who intervene and offer growers a higher price for high quality microlot output, but who only want to purchase the microlots. Moreover, sustained relationships must weather ups and downs in the international coffee market. Legally unenforceable, these contracts rely on continuity and a record of trust. Intelligentsia measures its success based on the duration of their supplier relationships; Michael Sheridan, Intelligentsia's Director of Sourcing and Sustainability, reports that

60 percent of their purchase volume in 2018 came from growers that they have bought from for more than 10 years.

Sheridan describes this model as "analog blockchain", relying on building trust and shared value over time rather than a distributed ledger. The company's published criteria for Direct include the following:

- that the coffee is of exceptional quality;

<sup>6</sup> Peet's Coffee and Tea purchased a majority stake in Intelligentsia in 2015

**Box 3 continued**

- that the grower commits to quality investments as well as production based on sustainable environmental and social practices;
- that the price paid to the grower or the local cooperative is at least 25 percent above the Fairtrade price;
- that the participants in the transaction allow for transparent financial disclosures all the way back to the farmer;
- that a member of the Intelligentsia team visit a minimum of once per harvest season.

Shortening the value chain in this way allows farmers to benefit from quality investments. Given that effort maps into returns, stable financial incentives for growers allow them to improve quality. The company fosters durable relationships in which communications address not just price but also trends in consumption and taste, impacting farmer decisions around production and harvesting.

***Decommodification through quality product differentiation***

The large number of growers, intermediaries, and traders involved in agricultural markets in developing countries makes it difficult for information about product quality to pass through the value chain. Potential product quality premiums are therefore not generally available in these markets, and given the sheer number of transactions and the scope of sourcing across many farmers and locations, it is difficult for quality signals and product differentiation based on brand or reputation to take hold. As a result, there are pernicious asymmetric information problems for products characterized by unobservable quality parameters; some of these are related to food safety, including aflatoxin contamination (Hoffman and Gatobu, 2014) and pesticide residue (Ortega and Tschirely, 2017). Hoffman and Gatobu (2014) argue that quality heterogeneity can impede small farmer market participation, contributing, consequently, to household market autarchy.

Fafchamps *et al.* (2008) find that quality differentiation in India's traditional markets for fresh vegetables and fruit is based on observable attributes of the product, including size and colour; though these quality grades do map into differential prices, there is no information pass-through along the chain related to, for example, pesticide use or the quality of the water used in irrigation, making it difficult for buyers and consumers to assess food safety. The authors conclude that the current non-staple crop marketing system is focused on quantity rather than quality.

Where contract farming does incorporate quality-based price premia (differential prices based on quality grades), this grading can provoke complaints from farmers about opportunistic product devaluation on the part of the buyers to manipulate and reduce the contracted prices. This information asymmetry between buyers and sellers on quality grading can lead to chronic underinvestment in production by farmers (who take such price manipulations into account in expectation), which, in turn, can adversely (and paradoxically) impact the product quality that reaches the market.

Two classes of innovations relate specifically to quality and smallholders. One class is to structure contracts or services to provide affordable third-party quality assessment and enforcement. Saenger *et al.* (2013) used a randomized control trial with Vietnamese dairy producers to add lab-based measurement of milk quality parameters previously unobservable to the farmers though available to buyers (including fat content). They found that farmers that provided access to third-party milk quality testing through the project, increased their investment in milk production with consequent improvements in both production and quality. The authors offer an important observation, however: before the purchasing company implemented individual testing of farmers' milk in a lab at the dairy plant, "...farmers had an informational advantage about the quality of their milk; now, the company has an advantage".

Because third party quality verification and enforcement can be prohibitively costly, this is an area in which technological and institutional innovation can make a difference. In a randomized control trial with watermelon sellers and buyers in China, Bai (2018) found that buyers are not willing to pay enough for quality-based (sweetness) branding to cover the fixed costs of the certification. Moreover, the Saenger *et al.* (2013) study with milk producers in Vietnam discussed above had surprisingly low uptake among farmers of the third-party quality certification – only seven out of 94 farmers who were offered the service made use of it.<sup>7</sup> Development and deployment of low-cost sensors or smartphone-based assessments of quality could offer cost-effective and scalable ways to eliminate or reduce asymmetries like these in product quality between contracting parties. The degree to which reduction of the information asymmetry leads to enhanced value for both parties, however, will likely depend on the thickness of the market and the degree to which the buyer enjoys a monopsony for local production.

A second area for possible innovation in quality differentiation involves small farmer commodity agriculture: farmer investment in quality differentiation as a means of “decommodifying” their production. Coffee provides an apt example (see [Box 3: Intelligentsia case](#)). Coffee production is critical to small farmers in many regions in Africa, Latin America, and Asia, with total global exports exceeding USD 19 billion in a sector employing more than 125 million people on an estimated 12.5 million farms (IISD, 2019). Worldwide, prices in the international coffee market (C-market) are frequently low and persistently volatile; the international price dropped below USD 1 per pound in 2019, well below costs of production in most regions of the world. Quality differentiation in the C-market includes assessment of the following observable attributes: bean size, physical defects and moisture levels.

Over the past thirty years, however, coffee has become an increasingly differentiated product in final retail markets catering to an emergent population of sophisticated consumers (who treat and consume coffee as a positional good). This quality differentiation at the retail level creates opportunities for participants in the value chain to benefit from emerging rents. While ethics-based certification (including measures of sustainability and Fairtrade) has as yet shown only limited success in improving farmer prices and incomes (DeJanvry *et al.*, 2015), quality is an option that growers can use to decommodify.

However, the transition to higher quality production brings challenges. Though there may be incentives for cultivation of specific varieties, or for preservation or enhancement of product quality through sophisticated production practices or post-harvest processing, complicated supply chains and markets configured to reward quantity production can make decommodifying a difficult and risky undertaking for small farmers used to growing to maximizing production and yields.

As a result, a major challenge for specialty quality buyers in the coffee trade is identifying, securing, encouraging, and supporting sufficient supplies of quality coffee in a market that has long incentivized volume. Specialized quality involves effort, expense, and risk, as well as lower per-hectare production output. A quality-based model must therefore provide additional returns and risk-mitigation to farmers. To address these imperatives, Intelligentsia Coffee (see [Box 3: Intelligentsia case](#)) has developed a contracting model with growers that use quality-based long-term contracts, setting fixed prices and quantity guarantees for multiple quality

<sup>7</sup> In a follow up survey, farmers who did not request the third-party verification did so because they reported satisfaction with the buying company’s quality assessment (50 percent) or because they were uncomfortable verifying the results outside of the company (40 percent). The authors argue that the intervention was effective regardless of the low redemption rate; it may be that the credible ability to verify quality independently is enough.

grades and transparent payment mechanisms. Shortening the value chain in this way allows contract producers to benefit with greater safety from investments in quality coffee. The company fosters durable, direct relationships in which they can invest with farmers in quality and influence decisions about production and harvesting. Evidence suggests that models of quality-differentiated based coffee sourcing are indeed providing better financial returns and technical support to small growers than the traditional market (Macchiavello & Miquel-Florensa, 2019).

Recent trends in the global market for chocolate suggest that similar quality differentiation driven by consumers prizing unique bean varieties and flavours, might be beginning to emerge. The MOKA chocolate case (see [Box 4: Moka case](#)) presents the details of one bean-to-bar company working to move growers from a quantity-based to a quality-based model of production in a cocoa market long characterized by prioritizing quantity production over quality differentiation.

## Box 4

### Moka case:

#### Small grower decommodification, an USD 8 chocolate bar

**Case type:** Cutting-edge decommodification innovation with no external objective evaluation of impact

**Site:** Cameroon

**Author:** Hope Michelson, Associate Professor, University of Illinois at Urbana-Champaign

Moka Origins is a bean-to-bar chocolate company with international operations centred in Cameroon and chocolate processing in Pennsylvania. Originating as a portfolio of humanitarian programmes organized and implemented through the Himalayan Institute, Moka Origins founded a farm in Cameroon in 2015, and expanded into specialty coffee and chocolate production and marketing in 2017. The farm in Cameroon incorporates an outgrower purchasing programme, a plant nursery, and a farmer field school. The farm is also a base of operations for sourcing and farmer initiatives focused on cacao quality in Cameroon.

#### *Problem: cacao production quantity is emphasized over quality in West Africa.*

Unlike coffee, most of the cacao grown in West Africa is produced and sold without significant evaluation for quality. The cacao market is dominated by a handful of large buyers, and most cacao (~60 percent) is produced by small farmers in two countries: Ghana and Cote d'Ivoire. Jeff Abella, one of Moka's founders, describes a "quantity trap" in chocolate production, with farmers focused on achieving quantity and yield increases with scant concern for quality. Moreover, the region's reputation for poor quality beans, weak infrastructure, and labour exploitation has led specialty chocolate makers in the European Union and the United States of America to largely avoid sourcing from West Africa, further dampening incentives for farmers to invest in bean quality. The company has asserted that because high-volume production is centred on large-scale buyers, farmers can build profitable relationships with smaller companies (like Moka itself) by focusing on quality rather than exclusively on volume.

Though smallholder farms near Moka in Cameroon have been growing cacao for many years, technical assistance has been distant and scarce. It has generally been provided under government auspices by the knowledgeable, but low-resourced, Institute of Agricultural Research for Development. Addressing this deficit, Moka seeks to develop a supply chain sourcing distinctive high-quality beans.

When Moka began this direct effort with farmers in 2015, the company encountered considerable variability in crop quality, not only from one year to the next, but also within one-year time frames, even when beans were sourced from the same farmers and the same trees over a span of weeks or months. Processes of fermentation and drying can have a considerable impact. Smoking the beans to dry them quickly for sale, for example, can have consequences with regard to flavour. Because bulk cacao purchased for milk chocolate production can mask such variations, the commodity chocolate market does not require much of the farmers in terms of harvesting and post-harvest practices.

One key challenge, therefore, for a bean-to-bar buyer like Moka is promoting farmer investment quality, both in production and in processing. Moka argues that significant changes are possible to raise the quality and market value of the product.

#### **Innovation**

The chocolate market in the European Union and North America is segmented into bulk commodity chocolate (95 percent) and fine chocolate (5 percent), and Moka has focused exclusively on the fine chocolate segment.<sup>8</sup> Moka's innovation is twofold: on the marketing end, one set of innovations involves creation, promotion, and sale of a high priced chocolate bar (currently between USD 8 and USD 15) to discriminating consumers. But the company also uses its product lines to educate consumers about cacao farmers, cacao beans, and bean-to-bar chocolate. The company believes that this high-end chocolate market has strong growth potential as consumers learn about and come to appreciate the differences. Because the number of bean-to-bar chocolate makers in the United States of America is expanding, there may be a parallel expansion of the informed clientele. Nonetheless, Abella affirms that the bean-to-bar sector must continue to educate potential customers about why their chocolate is healthier, tastier, and more sustainable.

<sup>8</sup> FCIA <https://www.finechocolateindustry.org/differentiate>

**Box 4 continued**

Though Moka was founded with a social and environmental mission, their sales have depended on what Abella calls “quality rather than cause”.

On the farmer end, current initiatives involve training farmers to improve the fermentation and drying processes before sale. Fermentation, for example, must begin immediately after the beans are harvested and require up to seven days to achieve a rich flavour. Drying is similarly critical; improperly or insufficiently dried beans can deteriorate and injure the flavour. Working actively with participating farmers, Moka is also investing in fermentation centres and nurseries. The overall strategy is to build robust relationships with growers and make or encourage other quality investments in pruning, irrigation, processing, drying, and storage.

Is the Moka model scalable? Moka argues that while not all bean-to-bar companies (there are currently 185 such companies in the United States of America alone) can operate their own farms in cacao-growing regions as centres for such deep and sustained farmer engagement, possibilities do exist to partner with intermediaries. Accordingly, Moka has expanded in recent years to sourcing cacao from Sierra Leone, the United Republic of Tanzania, Uganda, Côte d'Ivoire, Ghana, Sierra Leone, and the Dominican Republic; they have expanded through identifying trusted sourcing partners including Kokoa Kamali in the United Republic of Tanzania and Zorzal Cacao in the Dominican Republic.

Moka sees enormous potential in specialty chocolate; foreseeing a future market in which single-origin chocolate bars are prized for their distinct flavours and bean varieties, and farmers can invest in quality instead of quantity production, as is currently the case for coffee.

**Input provisioning**

A persistent challenge in agricultural development and policy is small farmer under-investment in productive technologies, including hybrid seed, agrichemicals, and mineral fertilizers. While contracting buyers often will agree to support farmers through input supply, these agreements (in which inputs are offered on credit with the balance deducted from end-of-season output sales to the company) expose the buyer to risks of small farmer side-selling and input diversion (using inputs on non-contracted crops). The [Big Ajar case \(Box 1\)](#) describes the struggles of a buyer firm contracting with small farmers for soy in Ghana, a relatively new crop in that region which requires adoption of new inputs and production practices. Though the firm has faced problems with side-selling, it is working on building long-term relationships with farmers who value the price stability and guarantees that the contract offers over time. Other firms are offering graduation schemes to individual farmers or cooperatives to incentivize contractual compliance in which producers who prove reliable over time become eligible for additional services (such as financing or training) either through the buying company or associated partners.

Investing in the broader small business environment that supports input and marketing services to small farmers could also yield benefits for the small farm sector in developing countries. Trader networks are often under-capitalized, leading to delayed payments (meaning that small farmers implicitly provide credit to agricultural traders during the last-mile segment of market transactions). A recent study focuses on search costs that small farmers bear as they seek out and finance agricultural inputs (Aker, Blumenstock and Dillon *et al.*, 2020); the researchers created a directory of mobile phone numbers for small shops in rural Tanzania, many of which are engaged in farmer services. Preliminary results from the study find large increases in call volumes for enterprises listed in the directory, suggesting that search costs may also be inhibiting timely and cost-effective connections between rural consumers and such firms.

**Information and communication technologies for agriculture**

In markets characterized by limited infrastructure and many actors and transactions, farmers and traders can face prohibitive costs associated with acquiring the information they need to reach important decisions related to agricultural production and marketing. Recent years have seen a range of initiatives to apply Information and Communication Technologies (ICT) to agriculture, especially to problems of information access. Such services can foster a scaling of information delivery, providing diagnosis of crop diseases, facilitating farmer-to-farmer interactions, and supporting interaction between farmers and service providers.

Several innovative possibilities for ICT applications involve using ICT to lower costs of communicating, using bulk short message services, recorded voice messages, or voicemails to provide extension services and production advice, including reminders on pesticide application timing, weather forecasts, and crop diagnostics. ICT can also assist in coordinating dates and times for harvest and delivery, in reducing costs for farmers associated with delays and perishability, and providing real time price information to farmers.

We can briefly review here some of these innovations and extant evidence of their efficacy. Overall, this evidence suggests that providing information alone (through ICT or other means) is unlikely to be sufficient in itself to address these production and marketing needs. Information provision shows measurable benefits to farmers when this information corrects a serious asymmetry in a given market, especially when such markets (including credit and infrastructure) are already performing well. Moreover, research suggests that innovations of this sort have greater potential to ameliorate problems or failures in agricultural markets in developing countries when these efforts are combined with other services (Harou et al., 2019; Futch and McIntosh, 2009; Mitra et al., 2015; Fafchamps and Minten, 2012; Goyal, 2010; Feder et al., 2004).

### *ICT and price information*

For example, Aker, Ghosh and Burrell, (2016) reviewed research on the effects implementing a range of initiatives to provide information services to farmers and agricultural traders in developing countries via new low-cost methods relying primarily on cellular phones. The paper considered the effects of more than 140 initiatives that link buyers and sellers, and provide information related to price, weather, pest infestations and other conditions to farmers and traders. Because they found that outcomes including yields, profits, marketing, and technology adoption are mixed, the authors caution that more attention should be given by researchers and implementers to how farmers receive and negotiate this information, and if and how they find it credible and useful.

Recent work of this sort has explored aggregate effects of improved and lower-cost information on market functioning, and has highlighted two related issues within that context that deserve attention. First, who benefits most from such improvements (distribution of gains from the improved functioning), and second, what are the effects of specific price information services. Expansion in mobile phone network coverage has been found to promote greater market integration and efficiency, as measured by reductions in price dispersion across markets over time (Aker, 2010; Aker and Fafchamps, 2014; Mittal and Mehar, 2012). A number of studies, however, have failed to find meaningful effects of price information services on farmgate prices received by farmers (Futch and McIntosh, 2009; Mitra et al., 2015; Fafchamps and Minten, 2012; Goyal, 2010), though they have observed in some cases measurable changes in farmer marketing behaviour (for example, location of sale and investment in marketing transport) in response to market information. Even so, those behaviour changes have not, in the time frame of the studies examined, impacted prices received or farmer incomes.

### *ICT and supply chain coordination and management*

Cellular phones can also provide contracting buyers with a means of efficiently communicating quantity and harvest timing information to farmers, and of providing production advice in contexts where private or government extension services are under-resourced or altogether absent. Casaburi *et al.* (2014) found that sending SMS messages with reminders to sugarcane farmers about the timing of production practices (including weeding, intercropping, and fertilizer delivery) increased yields by approximately 12 percent on average. Preliminary evaluations of



Digital Green, an NGO that uses video-based extension in Ethiopia, Uganda, and India, find that their services have modestly increased adoption of a promoted agricultural practice in Bihar (Vasilaky *et al.*, 2018) and better understanding and adoption of promoted technologies in Ethiopia (Abate *et al.*, 2018). Nonetheless, studies have also found negligible effects for provision of technical information to farmers using ICT (Casaburi and Kremer, 2016; Harou *et al.*, 2019), though publication bias against null results has likely made such studies scarce in peer-reviewed-literature.

Relatedly, mobile money services, allowing users to transfer money via cellular phones and electronic money accounts established with mobile network providers, can decrease the costs of managing and distributing payment to many small farmers. These technologies can also potentially reduce payment delays associated with transferring cash payments or with printing and cashing paper checks. Jack and Suri (2014) document that households using mobile money in Kenya are better able to smooth consumption in the face of shocks; and a rapidly-expanding literature documents ways that mobile money can lower transaction costs, improve saving (Demombynes and Thegeya, 2012) and assure the privacy of financial resources held by women within the household (Aker *et al.*, 2016).

Some important caveats relate to these innovations and their implementation at scale in supply chains. Evidence suggests that cell phone network coverage has become a determinant of supply chain placement (Michelson, 2013) and consequently of small farmer participation, as contracting firms prioritize farmers living in areas with network coverage. Because cell phone network service is not universally available in agricultural regions, and because farmers in areas with service must acquire the skills to use it and bear the associated costs, the rising importance of cell phone access as a precondition for participation in contract farming schemes risks marginalizing the poorest farmers. In addition, while mobile-phone based microlending is a keystone component of a rapidly developing mobile-money ecosystem for small-scale farming, and while such services show great promise in providing financial services to marginalized rural populations, this industry remains largely unregulated, and concern is rising in the popular press about exorbitant interest rates for microloans, lender fraud, and inescapable cycles of debt (Donovan and Park, 2019; Owuor, 2019). Empirical studies in development economics have yet to investigate these issues<sup>9</sup>

### ***Distributed ledger technologies: Blockchain***

Since the 2008 launch of Bitcoin, corporations and researchers have been exploring the potential advantages of Distributed Ledger Technologies (DLTs) across numerous industries. Distributed Ledger Technologies (DLTs) are digital databases that enable transfer of value and information without third-party intermediaries; the DLT databases use cryptography to link and secure data entries. The technology uses a peer-to-peer distributed network of computers to eliminate intermediaries from data processing and storage; the distributed network validates and stores records of transactions. Although DLT software must be purchased and implemented by individual participants within a supply chain, the database is collectively managed by all supply chain actors, creating (at least in theory) a traceable and transparent records of all actors in every transfer and transaction. Blockchain is the most common form of DLT on the market to date. Accessing DLTs requires an internet connection and an internet-enabled device.

<sup>9</sup> One exception is Lake (2013), who documented incidents of fraud in Ugandan mobile money and discussed the need to balance encouraging investment and growth in the sector with consumer protection.

In the agri-food sector, researchers have identified applications for DLTs in supply chains, food safety, trade finance, agricultural financial services, market information distribution, land registries, international trade agreements, and climate change mitigation (Tripoli and Schmidhuber, 2018). The recurring hope is that DLTs can streamline business operations, cut costs, and address market inefficiencies for large-scale agribusinesses, and perhaps even for small farmers. The development sector also sees potential benefit for producers, and global agribusinesses and international non-governmental organizations are experimenting with DLT pilot projects. However, research at this point has not extended beyond large-scale speculations about the use and impact of DLTs.

Because DLTs and blockchain have been so zealously promoted as a benefit in so many realms, their actual usefulness needs to be examined carefully, particularly for addressing market failure in developing countries. Ornes (2019) offers useful critiques, emphasizing that blockchain provides two important services that distinguish it from other systems of digital record keeping: (1) facilitating transactions in a context characterized by a lack of trust and (2) generating transaction histories that are immutable and collectively held. These two advantages seem especially important for solving endemic problems in agricultural markets in many developing countries: a widespread lack of trust, subtended by a dearth of reliable documentation of supply relationships. If blockchain technology can address these issues effectively, one collateral benefit could be a reduction of costs of farmer acquisition to purchasing firms looking for suppliers and a rise in confidence among farmers that market systems are transparent and fair.

At this point, however, evidence remains scant with respect to the application of DLTs to value chains and small farmer contracting. A few small-scale pilot studies are underway including an Oxfam BlocRice programme in Cambodia, using “smart contracts” (contracts that can directly mediate the transfer of funds between parties under mutually specified conditions) to link small-scale rice growers more directly with exporters. But researchers have yet to conduct empirical studies of DLTs’ feasibility along global agri-supply chains nor have impacts on agribusinesses and small farmers been examined as yet.

The current literature on DLTs identifies market inefficiencies that DLTs, if implemented properly, could help overcome, and it describes theoretical limitations for implementing DLTs, including in rural contexts. A handful of studies have analysed the potential of DLTs to improve the management of the global supply chains for palm oil in Indonesia and Malaysia (Hirbili, 2018), for tilapia in Ghana (Rejeb, 2018), and for coffee in Burundi (Thiruchelvam, 2018). For smallholder farmers, projected benefits of DLT include stronger market participation through digital contracts and better access to credit. Pilots of DLTs in the agri-food sector include a collaboration between IBM and major agribusiness companies, including Dole and Nestlé, to investigate blockchain applications in the agri-food sector; a collaboration between the global accounting firm of PricewaterhouseCoopers and the Chinese corporation Alibaba using blockchain to track food products from the point of production to the consumer as a means of addressing food safety concerns.

A sustained and honest look at the potential suitability and limitations of DLTs as well as any potential risks is an urgent need at this early stage in the technology’s development and deployment. Areas of interest include implementation costs (especially to reach the geographically-disbursed networks of supply chain actors) and the cost of compliance with diverse regulatory structures. If these costs are not borne by third parties (governments, NGOs, or CSR divisions of a contracting buyer) they are likely to impact small farmers, creating another barrier to market participation. Moreover, the technology itself is not fool-proof: because many DLTs designed by corporations are not decentralized, they can be vulnerable to hacking; and

even if security is more robust, errors or outright fraud in data entry can do considerable damage (Hirbili, 2018). The degree to which small farmers will benefit from the incorporation of digital innovations into supply chains remains unresolved.

### *Blockchain and economic identity for small farmers*

One option with intriguing possibilities is using blockchain to establish an economic identity for small-scale farmers, a case made by Ashish Gadnis (see Box 5: BanQu and Box 6: AB InBev). The problem defined and identified by BanQu with respect to small farmers and global supply chains is that those who produce food in global agricultural supply chains are largely invisible from the perspective of economic condition, production processes and market participation, resource needs and challenges. In effect, farmers are unable to establish a verifiable reputation as reliable suppliers. BanQu defines this invisibility with special emphasis on economic predicament. Without a stable, verifiable economic identity, farmers are unable to demonstrate their participation and value in global supply chains. A key problem here, as BanQu sees it, is that transaction information is not owned by the farmer. This lack of information about identity and relationships as agricultural suppliers and market participants impedes access to credit markets, and makes them vulnerable to predatory lending, with loans at interest rates as much as 25–46 percent.

**Box 5**

**BanQu case**

**Case:** Based on interviews  
**Case type:** Cutting-edge innovation with, as yet, no external academic evaluation of impact.  
**Author:** Hope Michelson, Associate Professor, University of Illinois at Urbana-Champaign

BanQu is a company using blockchain to increase transparency in supply chains and service delivery. BanQu works with public and private sector partners. Calling themselves a “non-cryptocurrency blockchain platform,” They are currently working with small farmers in 14 countries. BanQu’s published motto is “Dignity through identity”. According to their reports, as of March 2019 they had registered 70 000 households on their platform, 85 percent of which they identify as “last-mile” farmers and producers. A blockchain is a method of recording and securing transactions using a distributed ledger; every user has access to an immutable copy of all transactions. While blockchain originated with cryptocurrency, new applications employ the blockchain mechanisms that relate to trust and attribution. These applications enable and document transactions in environment that lack trust in contracting parties and in transaction records.

**Problem**

The BanQu innovation provides services to both the farmer and the buyer. The premise is that if a farmer can prove their existence in a given supply chain, independent of the buyer, then that documented identity can unlock access to financial services and other marketing opportunities as suppliers. To achieve that identity, participating farmers can make their transaction history, stored in the BanQu platform, available to financial institutions and thereby improve their access to financial support. It’s noteworthy, that in this arrangement, the buyer takes the initiative in seeking, paying for, and providing to others the participating farmer’s economic history and identity through BanQu’s services, receiving last-mile transparency in exchange for these efforts. Monitoring payments at the first point of aggregation, (between the buyer on the ground and the farmer), BanQu provides a platform that documents quantities delivered, dates of delivery, prices paid, the total payments to the farmer. In the long run, the buyer’s farmer acquisition cost is expected to drop towards zero because these records will accumulate on the blockchain and allow the prospective buyer to see with whom a farmer has worked. As a result, the service potentially opens up farmers to new market opportunities.

**Innovation: How it actually works**

When deployed in supply chains, blockchain functionality is generally focused on the consumer (documenting information about product origins and displaying that information to consumers) but BanQu positions itself as a farmer-focused application. BanQu uses blockchain’s immutability (data that is secure from tampering and deletion) as well as consensus from an array of participants. In conventional record-keeping systems, one party owns the data; but in a Blockchain arrangement, – an identical record of each transaction is acquired and maintained by the buyer, by the farmer, and by BanQu. BanQu’s innovation is that it does not hold onto the data. There is in fact no single and proprietary database. If a relationship with a buyer ends, records will still be accessible by the farmer. With SMS records as proof, they can also log onto the platform. For the purchasing company and the farmer there are shared benefits:

- accurate price records;
- secure payments;
- no need for stored hard-copy receipts;
- direct relationships between the buyer and the producer;
- records for intermediary aggregators, and potentially unlocking financing and other production and marketing resources.

Other initiatives are also underway to build a blockchain-based system of financial services for small farmers. HARA, an agri-tech start-up in Indonesia has used blockchain to deliver microloans to 2000 farmers in East Java, and claims a 97 percent repayment rate (Maghfirah, 2019). The start-up Humaniq has created an app called Ethereum that uses blockchain to create biometric digital IDs for users, providing identity verification for banking. Similar start-ups include BanQu, Credits.vision, OneName, ShoCard, and BitNation (Kshetri, 2017).

Again, several concerns are relevant that have not been thoroughly addressed thus far in reports, project proposals, and associated coverage. The actual economic value to small farmers of information documented in the DLT, is not yet established; nor is the degree to which increased costs associated with the adoption and implementation of the system are passed on to contracting small farmers in the form of, for example, reduced product prices or decreased provision of associated services (extension, transport, etc.). Moreover, what might the costs or risks be for small farmers associated with building an immutable economic identity? There is substantial documentation of small farmers churning in and out of supply chain contracts

(periods of adoption and disadoption of the marketing opportunity) (Ruben, Boselie and Lu, 2007; Barrett *et al.*, 2012; Andersson *et al.*, 2015; Michelson, 2017); these important dynamics require additional study. For example, if farmers often fail at supplying a contracted buyer before succeeding later in longer term contracting relationships, how would immutable records impact or impede that process of economic learning and growth?

## Box 6

### AB Inbev case

<b>Case:</b>	Based on interviews
<b>Case type:</b>	Cutting-edge innovation with as yet no external academic evaluation of impact
<b>Site:</b>	Zambia and Uganda
<b>Author:</b>	Hope Michelson, Associate Professor, University of Illinois at Urbana-Champaign

Anheuser-Busch InBev (AB InBev) is partnering with BanQu in Zambia and Uganda to source local cassava (Zambia) and barley (Uganda) for local brewing. Headquartered in Belgium, AB InBev is a multinational brewer with total 2018 sales of more than USD 54 billion (AB InBev, 2018). AB InBev is the world's largest brewer with a 28 percent share of global beer sales by volume. It encompasses more than 500 beer brands in 50 countries. Before being acquired by AB InBev, SABMiller was sourcing from small farmers in Zambia and Uganda as a means of meeting local demand and as a way of securing government excise tax breaks.

#### Problem

Smallholder farmers who supply the world's agribusinesses with their valuable raw product are generally unable to prove their participation in these global value chains. Their transactions with buyers are not documented in such a way that demonstrates the value farmers contribute. In turn, companies committed to supply chain transparency struggle to document the "last mile" of the supply chains, in part because of the fragmented, and spatially and temporally dispersed nature of the transactions with their primary small farmer suppliers. AB InBev localizes its production in several countries in sub-Saharan Africa by sourcing primary inputs for brewing in the same countries where the brewing takes place. Structuring production in this vertically-integrated way sets them apart from many other businesses sourcing agricultural commodities in developing countries. This structure meant that the company had to strengthen their local barley and cassava supply chains, presenting new market opportunities for farmers but also challenges for AB InBev.

Moreover, AB InBev has made a public commitment to "skill, connect, and financially empower" 100 percent of the farmers they source from by 2025. This commitment requires the company to design fully traceable supply chains, as well as to assess and improve its suppliers' financial circumstances.

The incorporation of BanQu-mediated transparency in the last mile of the supply chain is valuable both to AB InBev's corporate social responsibility (CSR) and its business operations.

#### Innovation

In 2018, AB InBev began a pilot using the BanQu blockchain platform for their cassava sourcing in Zambia, an initiative supported by the Zambian government. The company has registered 2 000 farmers and has sourced 1 400 metric tonnes of cassava in Zambia. Registered farmers are provided with a unique ID; once they deliver the cassava, the quantity they deliver is recorded along with their ID, which triggers payment. Transactions are recorded on the BanQu platform; farmers can see their cassava sale price, quantity, and payment immediately via an SMS message.

Farmers bring an agreed upon quantity of cassava or barley to a BanQu platform. The quantity is weighed. The price is pre-set (local prices paid are set by national AB InBev teams). The farmer then receives an SMS that reports, "you sold XX amount and YY is your payment." Initially, the system was token-based and the farmer took that token to a cashier for payment. Now the system uses mobile money.

The system improves sourcing transparency and transaction monitoring for AB InBev: through the BanQu platform, AB InBev can see in real time which farmers are delivering what quantity and whether and how much each farmer is paid.

To receive BanQu transaction records, farmers just need a basic handset phone; no smartphone is required. Records are tamper-proof and not held or controlled by any single party. A problem that the platform has not yet solved relates to quantities supplied: contracts between farmers and intermediaries have lacked clarity and farmers have oversupplied cassava. As of the time of writing this case, the company was working on setting up clearer quotas and quantities with farmers as well as specific quality specifications for the next year.

#### Evidence so far

AB InBev initially adopted the BanQu model to solve problems of complexity and inefficiencies in their supply chains with small farmers; they were primarily concerned with managing aggregators, who presented a multi-faceted challenge. Previously the aggregators sometimes sourced too

much quantity and sometimes too little to meet production needs; moreover the production sourced was often of variable quality. In addition, AB InBev suspected farmers were not receiving the full payment for their product – aggregators were capturing too much of the payment relative to the intermediary services they were providing. AB InBev wanted a better means of monitoring aggregators.

The BanQu system has improved the company's ability to observe the price that the farmer is being paid. Initial evidence of AB InBev's pilot in Zambia (and Uganda) suggests that the BanQu technology ensures that the AB InBev payment reaches farmers in a timely manner and without interference on the part of the aggregator.

## Box 6 continued

According to AB InBev, the advantages from the business side have proved considerable beyond monitoring and coordinating, buying and payment. For example, AB InBev reports that using BanQu has allowed them to “close the loop” on their supply chains, allowing them to provide inputs to barley growers in Uganda (where barley was not grown previously and inputs to support barley production were not widely available); in

Uganda then AB InBev uses BanQu to trace input deliveries to farmers. The technology also strengthens AB InBev’s relationship with its aggregators by giving them a clearer picture of their operations and identifying areas of need for training.

In addition, AB InBev has identified possible evidence of a spillover onto non-participants in terms of creating a mobile money and financial ecosystem locally. Initially, farmers didn’t have a mobile money network in the region where they were sourcing cassava. Providers were reluctant to install the required infrastructure – including agents and network boosters – in these areas, as the perception was that demand was sparse and thin. Once the BanQu system was up and running and farmers were receiving payment, AB InBev and BanQu worked with cell phone companies to help them understand the mobile money opportunity in the region. The cell phone companies then installed the network boosters quickly and provided free SIM cards to the farmers.

### Scalability and Future

The collaboration involves a local NGO, named Musika, in Zambia that supports aggregators through capacity building. The project has learned that training and support for the aggregators is critical as they switch over from paper or maybe excel management system to BanQu.

AB InBev plans to expand sourcing from small farmers with BanQu in India and Brazil. AB InBev has identified the following critical factors that will require coordination as they expand: aggregator capacity; small farmer phone ownership and network access; and involvement of mobile money providers. Their 2019 goal was to work with an additional 2 000 growers in Zambia (for a total of 4 000), 7 000 barley farmers in Uganda, 1 000 barley farmers in India, and a pilot for Brazilian cassava farmers.

**Sources:** [www.smartbarley.com](http://www.smartbarley.com); AB InBev and BanQu present their collaboration and how to explain blockchain to small farmers: <https://www.youtube.com/watch?v=FAxg3JGH0dU>; Statista. 2020. <https://www.statista.com/statistics/257677/global-market-share-of-the-leading-beer-companies-based-on-sales>; Felgenhauer, K. & Wolter, D. 2008. Outgrower Schemes—Why Big Multinationals Link up with African Smallholders. Paris: OECD Development Center.

## Traceability

To conclude with one additional and potentially important ICT application for supply chains: traceability. Customer demand for food safety and quality (especially for unobservable credence attributes related to production) requires increased emphasis on traceability and transparency in agricultural supply chains. In some cases, this imperative is founded in new food safety regulations; in others, major buyers have made public commitments to environmental or labour standards that require collection and dissemination of key facts and figures about supply chains. Many retailers envision a future in which tracing product history all the way back to farm production becomes a reality for most food products, and in which attributes related to production and logistics are accessible by consumers at the point of purchase, via QR codes and cell phone applications.

In developing countries, however, traceability continues to be challenging. This presents risks to buyers that are concerned about being connected to small farms where production practices remain socially or environmentally harmful. This may even be the case when broader policy contexts or even contract terms, albeit implicitly, encourage destructive practices like child labour or deforestation. Buyers also face food safety risks when sourcing from dispersed small farms as, without a traceability system, they cannot be sure whether hazardous pesticides or contaminated water was used during production. Traceability initiatives may reduce risks of this sort, thereby decreasing uncertainty about practices and product origin and opening up new market opportunities for small farmers. However, the chronic lack of systems in developing countries allows some marginal farmers to continue cutting corners in hurtful ways, opting for the cheapest recourse rather than the healthiest or the most humane.

Implementing technologies that promote traceability can obstruct market participation for small farmers; especially when they lack the resources to track and monitor environmental, social,

and logistics variables, using technologies like barcoding produce in the field, allowing a given product to be traced to its point of origin. Satellite imaging can track potential environmental effects of agricultural production, including deforestation (relevant, for example, to concerns about land clearing for cocoa production in West Africa and palm oil production in Indonesia). Currently these technologies come with potentially prohibitive costs: barcoding requires professional procurement, databases, and data management, all of which require technical skill and significant investment on the part of the buyer or implementing intermediary. As a result, barcoding of this kind in developing regions remains scarce, with only a few pilots and empirical studies underway. But as it grows as a traceability and verification practice, an important question arises for small farmers: how can traceability be implemented to support small farmers in supply chains, rather than place many of them at a disadvantage?

### *ICT innovations: Opportunities*

Opportunities exist to use new technologies to permit farmers to aggregate and share information about their own experience with buyers and input sellers. For example, blockchain platforms in supply chains create a history of transactions between farmers and buyers, making it easier for buyers to review the record and reputation of a prospective farmer, while another promising set of innovations could provide real time electronic aggregation and dissemination of small farmer interactions with specific buyers. New technologies thereby have the potential to allow farmers to evaluate potential buyers in a reciprocal way. In theory, a DLT – were its transactions and data synthesized, distilled, and made accessible and public – could serve both purposes, as long as care is taken to ensure the accuracy and clarity of information provided by users on such a platform.

A related class of innovations could permit farmers to upload special notifications related to trader purchasing practices, offered prices, or seller compliance with agreed upon parameters (for timely delivery of contracted inputs, for example). The Casaburi *et al.* (2014) sugarcane study discussed earlier also describes a feature that allowed farmers to report delays in fertilizer delivery to the contracting purchasing company. The results suggest that such reporting by farmers led to fewer delays through increased monitoring and enforcement by the company. This is of course key – systems to aggregate information by farmers about their experience with buyers and sellers will be powerful if it either affects the reputation of these buyers and sellers among small farmers (speeding up and amplifying processes of information sharing among farmers that already take place) or if it is used by another actor in the supply chain or by the government to enforce adherence to contractual terms or broader agricultural policies.

### *Direct purchasing, intermediaries and new methods of aggregation*

One assumption underlying many of these initiatives to contract with small farmers is that eliminating middlemen from the supply chain can improve coordination between farmer and buyer, product traceability, and value to both parties. Implicit and under-examined from an economic perspective, however, is the premise that middlemen in these transactions are redundant, that the services they provide are less valuable than the margin that they take, and that their elimination is an unqualified benefit to the other transacting parties as it frees up value in the middle of the supply chain. However, this is by no means certain: careful research is needed on if, and how, the elimination of middlemen affects supply chain performance, farmer service provision, or broader equilibrium functioning in associated markets. In fact small-scale agricultural production in developing countries may in many situations require some form of intermediating aggregation. Because large-scale buyers now rarely contract with thousands of individual small farmers, intermediaries are common; moreover, not all intermediaries are

created equal (see discussion of this point in the [Box 3: Intelligentsia](#) and [Box 6: AB InBev](#) cases). Sometimes the intermediary in question is an NGO absorbing the costs of coordinating with farmers; sometimes it is a private wholesaler, who passes those costs on to the farmer or the buyer.

Insufficient research exists on intermediaries, including traders who transact at the farmgate and those who operate at and across small rural markets and larger regional or wholesale markets. Intermediaries play a critical role linking small farmers with buyers and we often lack details on their operations, status quo contracting relationships and operations, and response to the entry and sustained competition of new buyers and market pressures. Work by Fafchamps (2003) on market institutions in sub-Saharan Africa offers a rich picture for the late 1990s and more recent contributions, by Michelson et al. (2018) and Yang et al. (2014) in China, and Bergquist and Dinerstein (2019) in Kenya, provide some new important insights about the roles of intermediaries in low-income rural markets.

In countries with a developed agricultural sector, direct farm relationships are also gaining some traction and market presence among smaller farms. Especially those trying to establish a market niche and take advantage of opportunities created by increased consumer demand for local foods (see [Box 7: Food Hub](#) case).

Though these aggregating intermediaries often have a high degree of leverage in the supply chain (see [Box 6: AB InBev](#) case), the literature about them has yet to examine this topic more carefully. Cooperatives, for example, can vary dramatically in their effectiveness, their management, and the degree to which they benefit small farmers, as they may need to negotiate trade-offs between inclusiveness and efficiency. Before research joins in a dismissal of intermediaries as useful in these markets, their configuration and work does need to be looked at more closely.



**Box 7****Food Hub case**

<b>Case:</b>	<b>Innovation with academic literature backing</b>
<b>Sites:</b>	<b>The United States, specifically rural America</b>
<b>Author:</b>	<b>Hope Michelson, Associate Professor, University of Illinois at Urbana-Champaign Maggie Cornelius, Graduate Student, University of Illinois at Urbana-Champaign</b>

**Introduction**

Food hubs – businesses and groups that aggregate, distribute and market local and regional foods in order to sell them in the same geographies (Barham, 2012) – began to appear in the early 2000s in the United States of America in response to increased consumer demand for local and traceable food products, and as a solution for small and medium-sized farmers struggling to compete with commercial agriculture. The years 2008–2013 saw the greatest rate of growth for food hubs: 63 percent (Cleary, 2017). In 2016, the United States Department of Agriculture registered the existence of 242 self-reporting food hubs (2017).

**Problem**

The dominance of commercial agriculture in the United States of America's food systems has been associated with a significant decrease in the presence and market shares of small and medium sized farmers. Many small farms in the United States have exited the market, and those that remain can struggle to compete. Yet consumer demand for local food is rising, with more than 50 percent of households of any income level in the United States of America reporting a willingness to spend more on local produce (Rushing and Ruehle, 2013). There is the potential for small farms to scale up production to meet this demand opportunity, but these farms often lack the marketing and distribution systems to reach this market (Jablonski, 2016). Marketing directly to supermarkets and wholesalers is not an option either, given that these large-scale outlets often demand large volumes, low prices, and seasonally consistent quantities. In addition, larger buyers tend to have vertically and horizontally integrated procurement systems that can be difficult to penetrate (Jablonski, 2016).

**Innovation**

Farmers and community groups are creating food hubs to strengthen market linkages between small farms and socially conscious consumers. The food hub business model is distinct from that of a farmers' cooperative. Whereas farmers' cooperatives scale their businesses through collective aggregation, food hubs practice "strategic co-competition" and preserve the individual identity of each participant farm (Berti and Mulligan, 2016). Farms participating in food hubs "retain their individuality, organizational independence, control their own brand identities and their economic strategies" (Berti and Mulligan, 2016), and are consistent with consumer demand for local, identifiable produce.

Food hubs also locate themselves strategically in order to serve overlooked and untapped markets. Food hubs are more evenly distributed geographically than merchant wholesalers, with 70 percent in urban areas, 6.5 percent in non-metro areas, and 3.5 percent in rural areas (Cleary, 2017). Many are committed to serving food deserts (Barham, 2012).

The United States Department of Agriculture has established numerous public-private partnerships and funding opportunities to support food hubs (Jablonski, 2016). State governments are also provisioning funds to support food hubs (Jablonski, 2016); 350 organizations in Michigan have made a commitment to support state food hubs so that 20 percent of Michigan's food purchases come from Michigan farmers by 2020 (Miller and Mann, 2015).

**Evidence**

Evidence so far suggests that the food hub model is profitable under specific circumstances. In order to break even, researchers found that a food hub needs to be located in a county with approximately 182 600 people. (In comparison, merchant wholesalers need a minimum of 105 380 people (Cleary, 2017).) Researchers also have found that food hubs' success is dependent more on "social capital" than grocery stores' success; social networks with shared values enable food hubs to form new partnerships that expand the reach of their product (Cleary, 2017).

Researchers studying racial demographics and food hub profits found that the presence of African American consumers had a positive effect on food hub profits but not on merchant wholesalers (Cleary, 2017). Considering that food deserts in the United States of America are often populated by racial minorities, this evidence is promising, as it suggests that food hubs have significant potential to meet the produce needs of populations living in food deserts. Studies of two food hubs in New York City and Vermont, two different markets, found that both food hubs successfully increased low-income consumers' access to fresh produce (Berti and Mulligan, 2016).

There is competing evidence about whether food hubs take market share from other local produce businesses. One study found that food hubs do tend to steal customers from other local produce outlets (Cleary, 2017). However, another study of a food hub that sourced from farms across the state of New York identified a net increase in rural employment and economic activity, evidence against the theory that food hubs only succeed by stealing market share from farmers' markets (Jablonski, 2016). In terms of food hubs' competition with grocery stores, research finds that the presence of grocery stores proximate to food hubs does not affect the food hubs' profits. This points to local produce's ability to compete with commercial produce when it is made available to customers (Cleary, 2017). Another study which surveyed food hubs' profits found that on average only 29 percent of their profits come from selling to grocery stores, suggesting that food hubs diversify the places from which people may buy local produce (Cleary, 2017).

**Future**

The growth rate of food hubs in the United States of America has slowed since 2013, but food systems analysts say that scaling, not proliferation, is the next step for food systems driven by food hubs (Berti and Mulligan, 2016). New challenges will accompany scaling, such as quality control, diversifying product offering, and improving accessibility and convenience, especially for low-income communities (Berti and Mulligan,

2016). Opportunities for growth include partnerships with Meals on Wheels and similar programmes (Cleary, 2017). Researchers call for further data collection and analysis to monitor this developing trend, as well as policy models for national and state governments to support this "re-construction of regional and local agri-food systems" (Berti and Mulligan, 2016).

## Box 7 continued

**Sources:** Barham, J., Tropp, D., Enterline, K., Farbman, J., Fisk, J. & Kiraly, S. 2012. Regional Food Hub Resource Guide. Agricultural Marketing Service, USDA; Berti, G. & Mulligan, C. 2016. Competitiveness of Small Farms and Innovative Food Supply Chains: The Role of Food Hubs in Creating Sustainable Regional and Local Food Systems. Sustainability; Cleary, R., Goetz, S., McFadden, D., Ge, H. 2017. Location and Profit Drivers of Local Food Hubs. Presented at the 2017 Agricultural and Applied Economics Association Annual Meeting; Jablonski, B.B.R., Schmit, T.M., Kay, D. 2016. Assessing the Economic Impacts of Food Hubs on Regional Economies: A Framework that Includes Opportunity Cost. Agricultural and Resource Economics Review; Rushing, J. & Ruehle, J. 2013. Buying into the Local Food Movement. An A.T. Kearney Study.

# CHAPTER 5

## Conclusion



## 5 Conclusion

In this paper, we have presented and discussed challenges associated with small farmer participation in agricultural supply chains, with special attention to current and chronic market conditions and how failures impact small farmer participation in new marketing opportunities. Countenancing those contexts, we have described innovative models for improving the inclusion of small farmers in agricultural sourcing in ways that could provide genuine economic benefit to rural regions in developing nations. One takeaway from this work is that because collateral risks are important, contractual innovations addressing risk mitigation can be decisive to small farmer inclusion and continued participation. Several of these risk mitigation strategies have been reviewed and evaluated here. We have also reviewed innovative private sector models for addressing large-scale failures in agricultural markets, and we have posited that more impactful initiatives would include: investments by governments to improve needed infrastructure; credit extension and support for small farmers; and effective enforcement of buyer-seller contracts for agricultural goods.

While our hope is that this material might prove helpful as a basis for policy makers or businesses considering initiatives related to small farmers and agricultural markets, there are other dimensions to this engagement that require serious attention in specific contexts: land and land tenure status; concerns regarding farmer gender and participation; and the predicament of landless farm labourers. Similarly, we have also only touched briefly on the history programmes for purchasing agricultural commodities directly from impoverished small farmers and the associated social and political complications of those programmes.

A final point relates to the research and evidence we have accessed to shape and evaluate these initiatives. In that process, we frequently encountered narratives of efforts that “failed” – that ceased operations well short of a stated objective in work with small farmers in developing regions. Reasons for abandoning these projects are also numerous: buyers that effectively disappeared when the time came to fulfil contracts and purchase production; certification schemes that proved too burdensome for growers; commodity processors that shut down after only a few years after in-country operations had commenced. Though this body of evidence is potentially significant to future success in addressing challenges reviewed in this paper, the study of small farmers and agricultural market systems in developing nations remains generally unexplored. For a better and more robust understanding of what can work, we must seek clearer, fuller understanding of both what has succeeded and what has failed.



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ISBN 978-92-5-133193-4



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CB0700EN/1/09.20