

INCLUSIVE INNOVATIONS

Post-Harvest Service Providers

Improving smallholder incomes by grading and increasing the shelf-life of their produce

HIGHLIGHTS

- Post-harvest service providers perform value-adding activities, such as sorting, packaging, labeling, and branding farmers' produce, which enhances the market price of the produce.
- Some enterprises use cluster farming to address meager smallholder margins on produce and post-harvest losses.
- Post-harvest service providers often make upfront payments to the farmers at the farmgate, which helps the farmers maintain financial sustainability and invest in better inputs and equipment.



A'Melody Lee / World Bank

Summary

In the post-harvest phase, smallholder farmers typically off-load their produce to middlemen at the earliest. Given the reduced shelf life of produce that is not stored appropriately and the lack of standard assessment or grading, they are forced to accept prices that are offered to them. The middlemen and subsequently, the agribusinesses that procure from the supply chain, unlock the true value of the produce by undertaking value addition activities like sorting and grading, packaging and processing before they sell at best market prices. Smallholder farmers do not get a share of these profits, and continue to engage in the cycle of low investment-low productivity-low income farming.

In a bid to address this market gap, social enterprises (SEs) have developed solutions to include farmers in reaping the benefits of value addition services such as processing, packaging, quality assessments, and market linkages. The enterprises help increase the price realization of agricultural outputs by collectivizing farm produce, and adding value through sorting, packaging, labeling and branding. The enterprises either connect the smallholder farmers directly with large corporate buyers, supermarkets, and other such customers, or sell to these customers on the farmers' behalf.

Development Challenge

Smallholder farmers are forced to sell quickly after harvest as they lack storage facilities that will retain the quality of their produce. As they sell small quantities and in unpacked, mixed grade lots, they are unable to negotiate higher prices or wait for better market conditions. Challenges such as short shelf life of some agricultural produce, risk of spoilage, pest attacks, and quality deterioration, lead to distress sales and lower prices for farmers.

In the absence of pricing information and standard quality assessment tools, smallholder farmers often accept lower prices because they do not know whether they deserve better, based on the quality or grade of their produce. An MIT study across 72 villages among potato farmers in West Bengal, India found that average middlemen margins averaged 50-60 percent of farm gate prices in

2008. What was even more worrying was the fact that access to price information was unable to improve the situation when farmers were locked into relationships with the traders or where other market imperfections existed. Access to information, however, did increase the likelihood that farmers would attempt to deal with wholesalers or retailers directly.¹

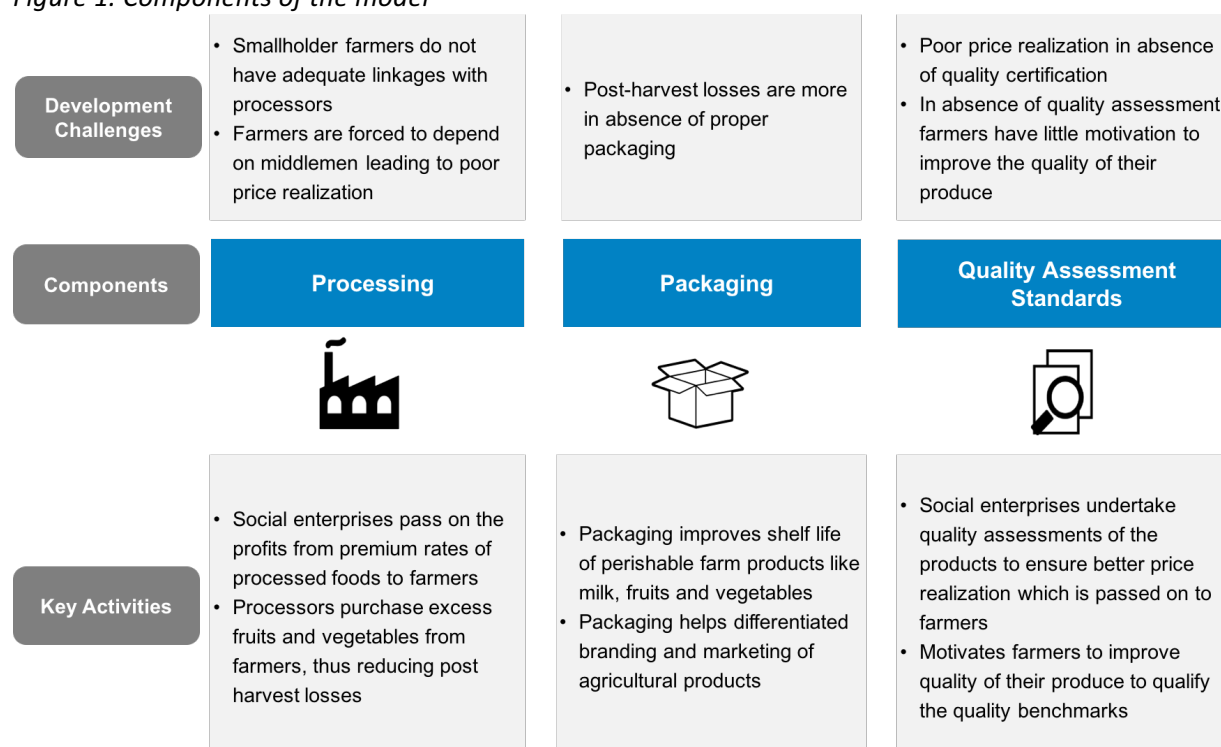
Inadequate linkages with value chain players, like processors, limit the value addition farmers can bring to the basic farm produce. By turning farm produce to food, farmers can increase their share of every dollar that end consumers spend on food. As per USDA's Economic Research Service, only 16 cents from every dollar spent on food goes to the farms. The rest accrues to value adding activities.² Smallholder farmers can only increase their share of food dollars by participating in the value addition process.

Business Model

Components of the Model

In an attempt to address this gap in the agricultural value chain, SEs offer processing and packaging solutions to increase the shelf life of agricultural produce. They share the higher market prices of processed and packaged agricultural products with smallholder farmers by paying them premium procurement rates at the farm gate. Quality assessment conducted by these enterprises also contributes to transparent and often, improved prices for farmers, which motivates them to invest in better quality inputs so that they grow better produce, qualify for higher quality benchmarks, and reap the benefits of premium prices.

Figure 1. Components of the model



Processing

Processing is an activity which arguably, adds the maximum value to fresh agricultural produce, thereby improves farmer incomes. This is particularly so for perishables with short shelf lives such as fruit and milk. Processing not only ensures longer shelf life, but also higher valued output that fetches better prices. Tanzania based Brookside Dairy collects and processes milk from smallholder farmers. It markets value added milk and dairy products such as cheese, butter, ice cream, and flavored milk at higher prices. It distributes the dairy products through distribution depots, agents

and sub-agents to retail outlets, passing on market prices to farmers. Tanzania based Claphijo Enterprise specializes in processing of fruits and vegetables to prolong their shelf life using a solar drying mechanism which it developed in-house. Other enterprises, like eKutir, organize farmers into collectives and provides them with decentralized processing equipment, thereby increasing the capacity of the farmers and gives a greater share of the value to them upfront.

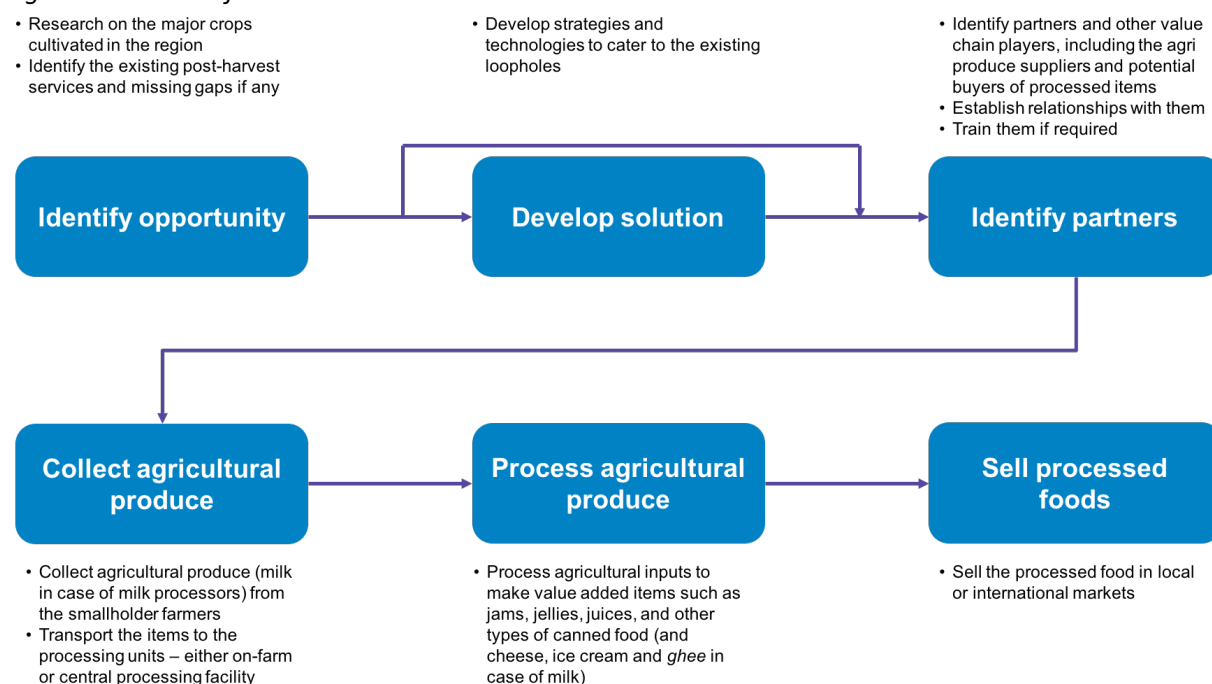
Packaging

SEs support farmers with sorting and packing, which improves the shelf life of agricultural produce. The process also involves branding that guarantees a certain quality for a certain premium. Indonesia based PT. Bimandiri Sedaya Agro supplies a range of fresh fruits and vegetables to supermarkets in the country. It selects and grades the fresh produce from the farmers and packs them in different sizes before selling them to the supermarkets. Another social enterprise in India, Parvata Foods is dedicated to building integrated value chains for the organic produce of farmers residing in the hilly areas of Northeast India. The enterprise packs and brands organic fruits, vegetables and spices collected from the smallholder farmers and supplies at premium prices to leading retail chains in urban areas.

Quality Assessment

SEs also add significant value to farm produce by undertaking quality assessment and certification. This allows for significant transparency in the quality (for example, percentage of fat in milk, grade and size of fruit) which determines fair market prices of the produce. It not only allows farmers to negotiate better prices, but also motivates them to focus on enhancing productivity and quality as they see income gains improve with better quality. By eliminating about ten layers of middlemen and offering differentiated packaging, branding and marketing of certified organic products, Parvata Foods pays 70 percent of its receipts from retails chains to farmers at the farm gate during collection.³ Kenya based Nu Bree Dairy delivers pasteurized milk to retail customers and businesses in the country. The stringent quality assessment undertaken by the enterprise ensures that its network of dairy farmers consistently receive premium prices for the milk they supply.

Figure 2. Process of the model



Cost Factors

Post-harvest service providers incur fixed costs on rent of the establishment, equipment expenses, utilities, management salaries, insurance and cost of interest on borrowed funds. Variable cost

includes cost of raw materials, packaging material, transportation, contract labor/ seasonal employees, and marketing. Table 1 shows the typical project cost incurred to establish a small-scale fruit processing unit.⁴

Table 1. Typical project cost for a fruit processing unit

S. No.	Particulars	Amount (USD)
1	Land	3,750
2	Land development	7,500
3	Civil work	34,650
4	Plant and machinery	60,345
5	Miscellaneous fixed assets	3,000
6	Preliminary and Preoperative Expenses	2,925
	TOTAL	112,170

Milk, fruit and vegetable processing enterprises have to make significant investments in establishing the plant (including processing and quality assurance equipment), and in collection & distribution vehicles. Kenya based Nu Bree made an initial capital

investment of approximately USD 250,000 for the processing plant, and spent USD 550,000 to buy collection and distribution trucks. It incurred an initial expense of USD 5,000 in marketing activities to create demand for its solution. Its operational expenses include the maintenance of the machinery and equipment and payment to farmers. India based post-harvest dairy enterprise Shree Kamdhenu Electronics Private Limited (SKEPL) also incurred similar capital expenses in buying machinery and development of technology. Human resource costs are a major operational cost component for SKEPL. Tanzania based food processing enterprise Claphijo incurred initial capital expenditure in developing and manufacturing of solar driers. Its major operational costs include buying produce (fruits and vegetables) for processing, and transportation cost to transfer the processed food to its target customers including supermarkets and boarding schools.

Over 50 percent of the revenue generated by sale of post-harvest value added products is derived from sales to grocery wholesalers, supermarkets and convenience stores.

Other variable costs include packing material and transportation. Enterprises also need to make upfront payments to farmers and laborers, while their clients that include big corporates defer payments. The enterprises need to maintain high working capital and liquidity that add to their costs.

Revenue Streams

Grocery wholesalers, supermarkets and convenience stores are some of the major customers of post-harvest service providers.⁵ The end-consumers for post-harvest service providers include upper-middle income to high-income populations that are able and willing to pay a premium for quality products and services.

Some enterprises clean and sort the grains obtained from smallholder farmers and charge a premium for the product when they on-sell to other wholesalers and retailers. Other enterprises process the grains into flour and sell it to Fast Moving Consumer Goods (FMCG) companies that in turn either brand the products and retail them, or use the produce as raw material for producing other processed ready to eat food products such as biscuits. A number of other post-harvest service companies process fruits and vegetables into juices, jams, jellies, and pickles, and sell these in the local and international markets.

Milk processing enterprises earn revenues by direct sale of milk and higher value milk products. Branding allows these enterprises to earn higher revenues as well as build customer loyalty for new products. India based Milk Mantra collects the milk from small dairy farmers, a part of which is sold directly. The enterprise earns additional revenues from value added products such as buttermilk,

yoghurt and milkshakes that it sells under the Milky Moo brand. It uses innovative packaging, which increases the shelf life of milk by up to four days and packaged paneer up to 21 days.⁶

Governments in developing countries are supporting small scale and micro food processing businesses by farmer families (particularly women) through aggregator models, such as eKutir.⁷ A few enterprises however, engage in sale of small scale food-processing solutions to farmers. Tanzania based Claphijo Enterprise, for instance, earns revenues by selling solar driers that reduce postharvest losses and domestic food waste. The drier brings down the moisture content of fresh produce from 60 percent to less than 10 percent and are priced at about USD 400, making them affordable to smallholder farmers given the reduction in post-harvest losses. The solar driers require minimum technical expertise for operation.⁸

Financial Viability

The profit margins of the interviewed post-harvest service enterprises range from 10 percent to 70 percent.⁹ An indicative set of food processing industry profitability ratios globally¹⁰ is shown in Table 2.

Table 2. Food processing industry profitability ratios

	2015 Q4
Gross Margin (Annual TTM)	22.7 percent
Operating Margin (Annual TTM)	12.5 percent
Net Margin (Annual TTM)	8.7 percent

Source: Food Processing Industry, Profitability, Information and Trends 2016

According to Model Project Report on Fruit and Vegetable Processing Unit by National Bank for Agriculture and Rural Development (NABARD), India¹¹, the profit after depreciation, interest and tax generally increases year-on-year as indicated in Table 3.

Table 3. Profit year-on-year

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
-5.8 percent	3.3 percent	9.5 percent	10.5 percent	11.5 percent	11.9 percent	12.2 percent	12.8 percent

Enterprises that only sort and package for on-selling earn lower margins while those that invest in processing and convert the produce into food products are able to charge a significant mark-up over cost of production. Table 4 shows the margin earned on processed foods against the cost incurred in processing the agricultural produce.¹²

Table 4. Margin earned on processed foods

Processed products, costs and returns from 100 kg of tamarind fruit			
Product	Cost of agricultural produce + Processing cost (USD)	Retail value of processed items (USD)	Value addition (USD per kg of tamarind fruit)
Powder	21	45	0.24
Sauce	50	98	0.48
Pulp	63	112	0.50
Toffee	201	292	0.92

A number of enterprises in this business model have been able to attract equity funding in the early stages. SKEPL received early stage investment from two impact investors, Aavishkaar and Grassroots Business Fund. Another Indian milk-processing enterprise Milk Mantra has attracted multiple rounds of investments. In 2014, it secured an investment for the fourth time from Aavishkaar, and has also attracted the interest of mainstream private equity investors including Fidelity. Securing investment from big investors, in addition to continued support from existing investors endorses Milk Mantra's growth potential and strategy of focused functional innovation and its 'ethical sourcing' initiative.¹³

Interestingly, not all post-harvest enterprises benefit from branding and selling to retail customers. Often, the costs outweigh the returns. Enterprises that have adopted a business-to-business approach have found it easier to achieve financial viability. This approach reduces the need for investments in branding and marketing, and also ensures them stable contracts for longer durations. For instance, Kenya based Nu Bree shifted from a business to customer model to a business to business model. Currently, the enterprise sources milk from small dairy farmers; it processes and packages the milk, and sells the milk to commercial customers such as hotels, restaurants, schools, universities, hospitals and corporates. The enterprise has also changed its engagement model with farmers. Instead of sourcing milk from dispersed farmers, the enterprise operates under a cluster contract farm model. In this model, Nu Bree owns one large scale farm cluster with a network of 100 small farmers. The farmers pay 2.5 million KES (USD 24,750) for a contract, against which the enterprise provides 10 cows, cattle feed and adequate fodder to each dairy farmer. Nu Bree then buys milk from these dairy farmers at market prices. With this innovative strategy, the enterprise achieved break-even within three months of its operations.

Other enterprises focus on maintaining high quality standards and adopted innovative technologies to ensure financial viability. Tanzania based Brookside Dairy has developed key performance indicators to ensure consistent high quality production. The high quality ensures minimum reject, hence reducing the losses for the non-salable items, thereby ensuring financial viability. The enterprise is not only focused on the volume of milk produced and sold, but also closely monitors its products for fat content and bacteria levels. It works closely with its farmers to ensure that the quality and quantity of the milk delivered to its collection centers remain consistent. Likewise, Dutch Agricultural Development & Trading Company (DADTCO) has developed a patented 'split' processing technology that helps on-farm processing of fresh cassava, instead of attempting to transport the perishable crop over long distances to a central processing plant.¹⁴ The loss figure estimates ranged between 10 percent-12 percent in India, 6.2 percent in Java, and 5.3 percent in Indonesia.¹⁵

Partnerships

Post-harvest enterprises engage in different partnership models to maximize individual and common financial benefits. A number of them establish partnerships for business development and other associated activities, especially when replicating their model in a different market. For instance, SKEPL partners with milk co-operatives for its business development in Nepal. The enterprise also forged an alliance with the international NGO, Winrock International, which helped it in running a pilot in Nepal.¹⁶

A few enterprises establish partnerships for financial support while others seek technical knowledge and training support as these are not skills they can recruit in-house. Some enterprises leverage these partnerships to startup the business. For instance, Claphijo Enterprise partners with various stakeholders including business associations for information exchange, and donors for funding, trainings, workshops, and exchange visits. The enterprise also partners with the University of Agriculture, Tanzania for its support in the testing and analysis of its solar drier. Similarly, in its early stages, Milk Mantra was established in collaboration with global processing and packaging technology experts, Tetra Pak, Multivac and DeLaval. The enterprise leveraged the association to develop its ready to drink packaged milk under the Milk Moo label.¹⁷ Arusha Women Entrepreneur together with its partner World Vision, provides technical and management skills training to women

farmers. It trains them on various topics including microenterprise development, marketing skills, conflict resolution, and food processing skills.

Enterprises form partnerships with forward and backward value chain stakeholders to increase business profitability. For instance, Nu Bree partners with dairy meal manufacturers to get better prices on dairy meals. The manufacturers provide dairy meal at subsidized rate of KES 1800 (USD 17.82) for a 90 kg bag of dairy meal. A number of enterprises in this business model aggregate farm produce, sort, grade and package it, and deliver in bulk quantities, thereby saving transportation and transaction costs. Normin Veggies, an association of various vegetable industry stakeholders including independent and small farmers, development foundations, corporate farms, input and service providers and local government units, performs these activities. The enterprise then ships the aggregated cluster produce to institutional buyers such as supermarkets, hotels, restaurants, and fast food chains.

Implementation: Delivering Value to the Poor

Awareness

Smallholder farmers in most developing countries are unaware about the benefits of packaging, processing and quality certification. Even if they understand any of these benefits, they do not know how to avail the benefits for their own financial betterment. A number of enterprises support the smallholder farmers by providing requisite training and guidance. For instance, Cameroon based Guiding Hope builds capacity amongst the rural communities by providing technical training in all aspects of honey collection, storage, and processing, to improve product quality. Likewise, SKEPL conducts practical trainings showcasing and comparing both the traditional and electronic methods of measurement and quality assessment.

Enterprises adopt innovative strategies and build innovative partnerships to build awareness. Claphijo Enterprise takes help from local women self-help groups (SHGs) that create awareness about its solar drier. Milk Mantra conducts demonstrations at parks, schools and tennis courts across the state, and sampling at temples such as Lingaraj Temple in Bhubaneswar regarding the importance of appropriate packaging to prevent spoilage of perishable items such as milk and milk products.¹⁸

Acceptance

Smallholder farmers find it easier to go through the middlemen route, as they have been doing historically. It is a paradigm shift for some of them to move away from these relationships or adopt different approaches to packaging and processing to increase the value of their produce and reach the market directly. Enterprises adopt different strategies to make it easier for the farmers to make this shift. SKEPL allows milk cooperative members to test the product for 2 months. This trial period allows the customers to test the machines and get familiar with modern methods of calibration of milk quality and quantity.

A number of enterprises leverage local connections to understand customer requirements. This helps them design appropriate solutions and also engage with farmers more closely. Nu Bree works with farmer leaders in rural communities to increase acceptance of the enterprise's model. The farmer leaders educate fellow farmers on the benefits of working with the enterprise under the cluster contract model, under which the farmers can increase their income by a factor of 10 times vis-à-vis being a stand-alone supplier.

Accessibility

Post-harvest service providers eliminate middlemen and facilitate direct access to markets. In order to do this, they need to build or organize the supply chain from farm to processing unit, and finally to buyers. Often, the ease that they provide encourages farmers to shift from transacting with a

known trader. Parvata Foods, for instance, is building integrated value chains for the organic farmers in Sikkim, by providing market linkages along with packaging and branding of the products obtained from them. The enterprise collects produce from farmers directly from the farms, where it is weighed and assessed for quality. The produce is then transported to a central processing plant for processing, packaging and distribution. The enterprise supplies organic agricultural products such as fruits, vegetables and spices¹⁹, sourced from farmers located in hilly and inaccessible areas to retail outlets.

Affordability

The business model helps to build financial sustainability of the smallholder farmers. A number of enterprises make payments for the agricultural produce at the farm gate, providing much needed liquidity and working capital. Parvata Foods pays 70 percent of the total value of the produce at the farm gate of the organic farmers in Sikkim.²⁰ Likewise, SKEPL's solutions ensure payment to the dairy farmers as soon as they supply milk to the milk-co-operatives.

A few enterprises provide value-added food products at affordable prices to the financially weaker sections of the society. These organizations aim to fight malnutrition and poverty, in addition to helping farmers earn better incomes. Prosoya Kenya, for instance, buys maize, sorghum, soya beans and finger millet from smallholder farmers, extrudes the composite, fortifies the extrudate with vitamins and minerals and sells it at affordable prices to the people living below poverty line. Similarly, Mali based enterprise Malo Traders sells locally grown fortified rice to consumers at an affordable price. It trains farmers to improve the production process and reduce rice wastage. It fortifies the rice with nutrients to provide affordable food to the poor.

Results and Cost Effectiveness

Scale and Reach

The post-harvest services serve as a link between the agriculture and industrial segments of the economies of most developing countries. Enterprises in this business model tap into growing and lucrative commercial demand even as they ensure fair and equitable distribution of the benefits to smallholder farmers. Given that its end customers are mainstream, and often global, this business model has significant potential for scale. This business model is also mature, with many enterprises that are over a decade old. Their reach and engagement with communities and end-buyer markets is therefore, significantly stronger than enterprises in less mature business models. Most of the milk processing enterprises have created innumerable impacts while providing financial upliftment to small dairy farmers. SKEPL works with nearly 7000 partners, each impacting at least 300 farmers. The enterprise has directly impacted nearly 2.1 million small dairy farmers in India. Geographically, the enterprise has reached over 8750 villages located in 72 districts in 17 states of the country.²¹ Milk Mantra, sources milk from over 40,000 small dairy farmers, and has resulted in financial inclusion of the community.²² Brookside Dairy has impacted nearly 45,000 Kenyan and 55,000 Ugandan dairy farmers, and has together provided them about USD 100 million for milk delivered to the enterprise.

Other enterprises have also created commendable impacts on the lives of smallholder farmers in remote rural areas. Parvata Foods supports livelihood of nearly 300 organic farmers in the state of Sikkim.²³ Another Indian enterprise, Moksha Yug Access (MYA) works with over 15,000 farmers across 1,110 villages in the state of Karnataka. Enterprises operating in Africa, Guiding Hope and DADTCO have also significant impact on the lives of the rural smallholder farmers in Cameroon and Mozambique. Guiding Hope has impacted 1,000 beekeepers and their families, totaling to nearly 10,000 individuals. In 2011, DADTCO entered in partnership with SABMiller to produce cassava beer, 'Implala', which has created a sustainable source of income for 4500 smallholder farmers in Mozambique. Mobile processing units in Mozambique have benefited nearly 6000 smallholder farmers with average 1.2 hectare of farm land.

Table 5. Examples of companies and reach

Company	Country of operation	Years of operation	Number of farmers reached	Other impact parameters
Brookside Dairy	Kenya, Tanzania, Uganda	23	1 million	-
Guiding Hope	Cameroon	10	10,000	-
Milk Mantra	India	7	40,000	-
Moksha Yug Access	India	10	15,000+	1,110 villages in Karnataka, India
SKEPL	India, Nepal	20	2.1 million	8750+ villages in 72 districts in 17 states in India
T'ikapapa	Peru	10	500+ farmer families	

The business model is readily adaptable, that a number of enterprises that provide post-harvest services report that they have or plan to expand geographically. SKEPL built a strategic partnership with Winrock International to foray into Nepal. The absence of competition and presence of dairy farmer cooperatives also made Nepal a favorable destination.²⁴ Kenya based Brookside Dairy, has become the largest producer and supplier of milk and milk products in the country, plans to expand to countries in West Africa. Another Kenya based enterprise Prosoya Kenya plans to expand its operations to East and Central Africa. Likewise, India based Parvata Foods aspires to expand into exporting processed spices to Europe and US. Likewise, Nu Bree plans to leverage technology to strengthen linkages between farmers and finance providers as well as end-customers. It is in the process of developing 'Lima Soko', an e-commerce platform to connect farmers to buyers in domestic and export markets, 'Lima Lending' to connect farmers to finance partners, 'Lima Insurance' where farmers can access affordable insurance policies than there are in the market, and 'Lima Logistics' to connect its transportation partners with farmers.

The dairy sector is well developed in several countries, with successful national and local brands. Given the extremely local context in milk consumption, there is room for small enterprises to develop niche markets. In India, mature value chain enterprises such as Parag Milk Foods are seeking to build local brands for value-added products such as cheese, ice creams, varieties of yogurt and milk-based beverages. Likewise, for Prabhat (Dairy), only 18 percent of its total revenue of INR 1,440 crore (USD 216 million) comes from liquid milk, while the rest is from value-added products such as cheese, milk beverages and yogurts under the GO brand.²⁵

Improving Outcomes

The post-harvest services model has direct and indirect impacts on the lives of smallholder farmers that were otherwise delinked from the value chain. Given the labor intensive nature of the business model, post-harvest enterprises also provide employment to women and youth from rural communities, thereby improving smallholder household incomes and training them for non-farm livelihoods.²⁶ Tanzania based Arusha Women Entrepreneur, for instance deals in processing of peanut butter made from locally grown groundnut. The enterprise employs low-income women from peri-urban Arusha. Likewise, Kenya based Stawi Foods creates jobs for youth and smallholder farmers in Kenya. In addition, it provides women access to improved seeds, better techniques and technology, thereby contributing to increase in incomes within poor families.

Several interventions have led to direct increase in the incomes of smallholder farmers, although most of these impact figures are self-reported by the enterprises. Nu Bree, for instance, has helped increase the income of small dairy farmers by a factor of 10. Likewise, Normin Veggies secures

increased price premium of 10 percent-20 percent for smallholder farmers compared to traditional supply chains. Parvata Foods creates value for the farmer by increasing incomes and by providing the necessary market linkage and a brand to sell their organic produce in larger markets. The enterprise pays farmers 70 percent of the total payable amount at farm-gate, which is one of the highest in fruit and vegetable category in India. The enterprise ensures that farmers get about USD 0.08 to USD 0.15 more per kilogram than that paid by middlemen and unorganized procurers.

Cost Effectiveness

In the absence of post-harvest services, smallholder farmers will continue to sell their agricultural produce, mostly through middlemen. The post-harvest services business model is cost-effective as most enterprises procure inputs from smallholder farmers in large quantities, add value to the inputs by processing, packaging, branding and labeling, and sell the same at higher prices in local and international markets. The end-customers for these value-added products are willing to pay a premium for good quality produce, organic certifications and packaged and processed milk. For instance, Milk Mantra marks up the price of its product by 10 percent-20 percent as against the price offered by the state cooperatives, and is still financially sustainable.²⁷ Claphijo Enterprises has a profit margin of 60 percent-70 percent on its solar drier, which is priced at about USD 400.²⁸ The enterprise strategizes its financing in such a manner that even after earning this high profit margin, the driers are affordable to farmers.

Parvata Foods helps increase farmers income by **USD 0.08-USD 0.15** per kilogram. Nu Bree has helped increase the income of smallholder farmers by a factor of **10**.

Taking it to Scale

Challenges

Post-harvest value addition enterprises face market challenges, farmer challenges, and enterprise challenges. Market challenges include the dominance of middlemen and large corporates that inhibit the scaling of SEs. Despite the low prices offered to them, farmers find it easier to sell their produce to middlemen rather than reaching out to the post-harvest service providers. Given the large scale of their operations, large corporates can cross-subsidize their products and services, thereby challenging the pricing strategy of post-harvest service providers.

Farmer challenges include the need for farmer education, the inadequate access of farmers to finance to improve crop quality. Milk processing enterprise Nu Bree underscores the challenge of inconsistencies in quality and quantity of milk supply that impacted its overall quality. To address this, the enterprise introduced cluster contracting model, where farmers enter into contracts with Nu Bree and are provided cows, feed and fodder requirements. They are required to sell the milk back to the enterprise thereby ensuring consistent quality and supply of milk. Other specific challenges linked to milk processing include inappropriate collection system of raw milk that leads to delay in the collection process and often results in spoiling of milk before it is processed. Therefore, enterprises need to establish collection points with a robust collection infrastructure.

Enterprise challenges include the need for investments in equipment, quality assurance, working capital and manpower. Working capital is needed as farmers need to be paid upfront, while the larger companies that buy the products have longer credit periods. SKEPL highlights that skilled manpower is a key challenge, given that rural semi-skilled labor is migrating to peri-urban and urban areas to work in malls and quick service restaurants. SKEPL tackles this issue by offering market based compensation to the workers.

Role of Government and Policy

Governments have been very supportive of the small scale food processing industry in most developing countries. Different agricultural-support programs have connected smallholder farmers to mainstream processing, packaging and exporting partners; provided them facilities either directly

or in partnership with other stakeholders in the system, such as finance providers and FMCG companies; and supported them with incentives and subsidies.

Several governments collaborate with development finance institutions for financial support. For instance, in Kenya, the government is executing a project commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) for private sector development in agriculture. One of the outcomes includes provision for training in hygienic butchery techniques such as processing, and packaging as per national standards. This simple practice has brought a 5 percent reduction in meat wastage per day.²⁹ General improvements in the business climate can be conducive to growth of these enterprises. Kenya-based Nu Bree indicated that government support to startups in the country has improved; licensing used to be a challenge earlier (the enterprise requires a trading license and distribution license for its operations) but is easier now.

In Peru, indirect government support and benefits such as incentives, 50 percent rebate on tax, and permission to employ workers on flexible contracts, helps the agribusiness firms benefit. Peruvian enterprises seek general assistance from the government such as access to finance, better infrastructure, and adequate research and development in modern technology to boost post-harvest value-chain activities in the sector.³⁰ Tanzania-based enterprise Claphijo highlights the promising prospects of government industrialization policy in the country. The policy emphasizes on technology innovation in the agriculture sector, and more specifically post-harvest value-addition component.³¹

The Government of India has supported the food processing industry for several decades – the National Dairy Development Board and Nagpur Orange Grower's Association are examples of government-run processing establishments that positively impact the lives of several smallholder farmers, while adding to the country's GDP. In addition, the Government permits 100 percent FDI in this sector, and has developed agri export zones. The central government has established 3.2 million tons of food processing capacity with an investment of about USD 300 million in the last two years.³² It further plans to establish 250 small agro-processing clusters at an estimated cost of over USD 750 million. The clusters will reduce post-harvest wastages, worth USD 1.35 billion per annum, will help increase farmers' income and will also keep the prices of perishables under check.³³ A number of states including Jharkhand³⁴, Odisha³⁵ and Bihar³⁶ have also launched food processing policies.

Conclusion

The success of this business model depends on critical factors such as access to good quality agricultural produce to ensure end-product quality; supply contracts for key produce to mitigate price volatility; strong forward contracts with buyers for on-selling processed and packaged produce, and sufficient stability in demand to be able to charge prices that provide reasonable margins.³⁷ The model has adequate regulatory support in a number of developing countries but faces liquidity challenges as it must pay farmers upfront at the farm gate. On the other hand, enterprises face payment delays from its end-customers, who are large corporates and supermarket chains. This model is highly scalable considering the indispensable requirement of post-harvest services in most developing economies to leverage their agricultural potential and augment GDP through value-added agricultural exports.

* INR to USD rate conversion: 1 INR = 0.015 USD

* KES to USD rate conversion: 1 KES = 0.0099 USD

* TZS to USD rate conversion: 1 TZS = 0.0005 USD

Table 6: SEs: Post-Harvest Service Providers

Company	Country	Solution Description
Arusha Women Entrepreneur	Tanzania	Arusha Women Entrepreneurs trains and employs women in the production and marketing of peanut butter. Smallholder farmers supply the peanuts which are processed into peanut butter and sold in bulk to a large wholesaler as well as to supermarkets and kiosks, and through door-to-door sales.
Brookside Dairy	Kenya, Tanzania, Uganda	Brookside Dairy Limited is a dairy processing enterprise that produces, processes, and markets milk and dairy products. The enterprise offers fresh pasteurized milk, cream, butter, yogurt, ghee, and long life milk products in Indian Ocean Islands, East Africa, Rwanda, Burundi, Egypt, and the Middle East.
Claphijo Enterprise	Tanzania, Namibia, Kenya, Uganda	Claphijo Enterprises specializes in offering post-harvest management of crops by processing dry foods through dehydration of fruits and vegetables using a solar drying mechanism. It markets the products using an in-house brand known as Mama's Flavours.
Dutch Agricultural Development & Trading Company (DADTCO)	Netherlands, Nigeria, Mozambique and Ghana	DADTCO together with its partners covers the whole cassava value chain, from agricultural production with smallholder farmers, input supplies, processing and the marketing of the final product in local and international markets.
eKutir	India	eKutir uses an entrepreneurship model combined with ICT to deliver solutions to BoP communities. The model involves partnerships with domain experts, service providers, and market players, who provide a suite of products and services through a distribution network of local, village-level entrepreneurs. These entrepreneurs connect suppliers, aggregators and distributors to this network of smallholder farmers.
Guiding Hope	Cameroon	Guiding hope engages with local bee farmers in Cameroon to trade organic honey, beeswax, and propolis. It helps in building technical capacity of small bee-farmers to increase their product quality and range.
Kilimo Markets	Tanzania, Kenya	Kilimo Markets is an outgrower engaged in trading of grains and pulses, sesame, groundnuts, beans and maize. It exports to different markets including South Africa and Kenya for maize; South Asia, Africa and Europe for beans; and India for pulses.
Malo	Mali	Malo Traders sells locally grown fortified rice to consumers at an affordable price. The organization aims to fight malnutrition and poverty in Mali by helping farmers to increase their incomes through improving the production process to reduce rice wastage and by enriching the rice they produce with nutrients.
Milk Mantra	India	Milk Mantra focuses on the dairy supply chain across urban supermarkets in Eastern India, particularly Odisha. Its strategies include developing products with a longer shelf life to cater to consumers in major Indian cities.
Moksha Yug Access	India	Moksha Yug Access provides market linkage to small dairy farmers through its supply chain network. MYA also provides technological support that seeks to improve the quality of milk and dairy products sold in the network.
NorminVeggies	Philippines	Northern Mindanao Vegetable Producers Association Incorporated (Normin Veggies) is an association of various vegetable industry stakeholders that facilitate cluster farming, thus saving transportation and transaction costs for the smallholder farmers.
Nu Bree	Kenya	NuBree sources milk from small-holder dairy farmers, processes and packages the milk and distributes it to consumers in Nairobi and neighboring regions. The enterprise distributes milk to hotels, restaurants, schools, universities, hospitals and corporates.
Parvata Foods	India	Parvata Foods supplies organic produce like fruits, vegetables and spices sourced from farmers in inaccessible areas to retail outlets through a farm-to-store model. It supplies the produce to organized retailers such as Reliance, and Mother Dairy. It also sells directly to exporters.

Parag Milk Foods	India	Parag Milk Foods holds a diverse portfolio in over 15 consumer centric product categories. The enterprise manufactures and promotes cow's milk and milk products, under brand names such as Gowardhan, Go, Topp Up and Pride of Cows. Its product portfolio includes <i>ghee</i> , fresh milk, milk powder, milk powder, processed and natural cheese, butter, dairy whitener and <i>gulab jamun</i> mix.
Prabhat Dairy	India	Prabhat Dairy provides a range of products in the ingredient business category (such as sweetened condensed milk, dairy whitener), and consumer business category (such as flavored milk, yoghurt, cheese). The enterprise has over 450 milk collection centres, over 15 milk chilling plants and over 80 bulk milk coolers.
Prosoya Kenya	Kenya	Prosoya Kenya buys maize, sorghum, soya beans and finger millet from small scale farmers, extrudes the composite, fortifies the extrudate with vitamins and minerals and sells it at affordable prices.
Shree Kamdhenu Electronics Private Limited (SKEPL)	India, Nepal	SKEPL has conceptualized the need of an Automatic Milk Collection System (AMCS) in early 1990 for ensuring transparency, mutual faith and error-free operations of Milk Collection. It also manufactures Electronics Weigh Scale with Quality testing equipment (EMT or Milk Analyzer). SKEPL sells its products under the brand name of Akashganga.
Stawi Foods and Fruits	Kenya	Stawi Foods and Fruits is a food processing business that involves milling of nutritious porridge flours, sold in the Kenyan market.
T'ikapapa	Peru	The T'ikapapa model links small operation farmers, who preserve and produce hundreds of native Andean potatoes varieties, with other potato chain partners to take advantage of high-value niche markets in urban centers.
The Bimandiri company	Indonesia	PT. Bimandiri Sedaya Agro supplies various kinds of fresh fruits and vegetables to modern market or super market. It selects and grades the fresh produce from the farmers and packs it in different sizes before selling it to super markets.

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CASE STUDY: SKEPL

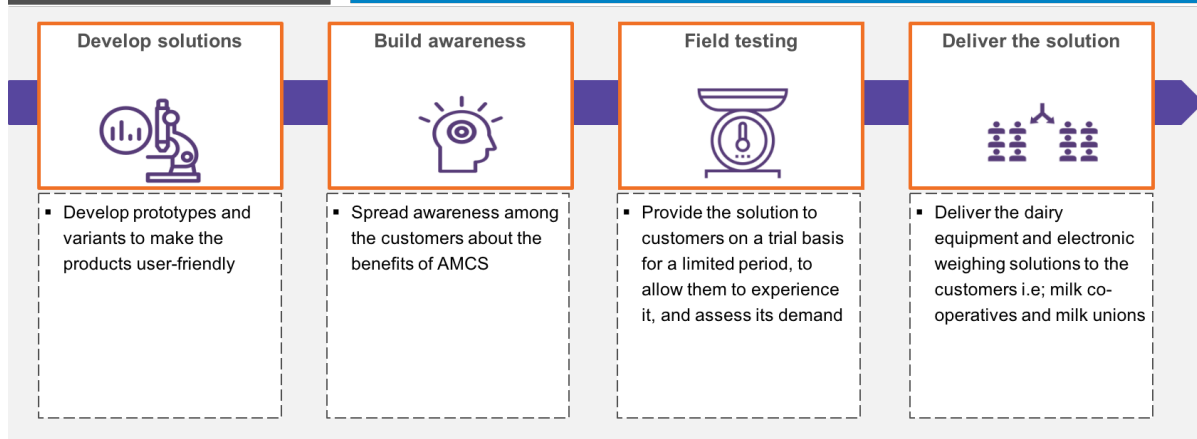


Founding year: 1996
HQ: Anand, Gujarat, India
Countries of operation : India, Nepal, Vietnam
Orientation: For-profit
Employees: 85
Turnover: USD 2.1 million

Almost in every village of India, there is milk co-operative that collect milk from farmers. In the past, it was manual collection. A passbook was maintained to record the quality and the amount paid to the farmer. This often caused mistrust due to lack of transparency, and delays in payments.

SKEPL has developed a solution "Akashganga" to measure the volume, and quality of milk. The solution is targeted at milk co-operatives or milk unions that measure and assess milk quality, and pay farmers based on the report that the machine generates real-time. It has also reduced the time lag between the collection of milk at the collection point and receipt of money by the farmers from nearly 10 days to almost zero.

The enterprise has directly impacted nearly **2.1 million small dairy farmers** in India.



Operating Model

Shree Kamdhenu Electronics Private Limited (SKEPL) recognized the need of an Automatic Milk Collection System (AMCS) in early 1995 in order to ensure transparency, trust and error-free operations in the milk collection process. The enterprise provides dairy equipment and electronic weighing scales to dairy farmers through dairy co-operatives and milk unions. It is an ISO 9001:2008 certified enterprise that integrates the electronic weighing scale with quality testing equipment such as electronic milk tester or milk analyzer, and data processor or computer. SKEPL delivers products and services under the brand name of AKASHGANGA.

SKEPL leverages technology to provide customized solutions for milk collection. Some of the products and services include nano-based (hand held device) milk collection systems, solar operated milk collection systems, daily SMS-based milk quality reports, USB drive-based data transfer for integrating with payment gateway, financial accounting software (with regional language support) to draw up to balance sheet. General Packet Radio System (GPRS) and File Transfer Protocol (FTP) based data transfer from collection point to chilling plants or bulk milk coolers or dairy plants.

SKEPL allows milk cooperative members to test the product for 2 months. This trial period allows the customers to test the machines and get familiar with the modern methods of calibration of milk quality and quantity. The milk co-operatives that are interested in adopting the technology on a permanent basis can purchase the machines after this test phase. Farmers test the product and share feedback with other farmers – and SKEPL leverages this word-of-mouth marketing to increase sales of its product. The enterprise has also explored other avenues for business development, such as

SKEPL has over **25 service centers** with trained personnel and a presence in over **17 states in India.**

participation in government tenders. It engages with local communities such as milk unions in Nepal for business development activities in the country.

The enterprise educates its customers regarding the significance and use of the electronic machines. It provides practical training to customers and allows them to experience the difference between the traditional and electronic method. This helps in building trust with the customers. SKEPL also customizes the solution as per farmers' requirements. For instance, quality reporting requirements are different across Indian states such as Gujarat and Maharashtra; therefore the solutions provided are also different. The enterprise supports its customers regarding the best use of the product, and according to the enterprise, customers can recover the cost of the product within 6-7 months if they follow the suggestions of SKEPL.

Financial sustainability

SKEPL incurs most of its operational costs in human resource management, and most of the capital costs in technology development. Its sources of revenue include annual contracts with the milk unions, and fees obtained for after-sales service support. The enterprise has raised money from two investors - Aavishkaar and Grassroots Business Fund. The price range of the solution ranges between USD 1050 and USD 1800, based on the configuration, with the enterprise making a gross profit margin of around 20 percent on each AMCS.

Impact

SKEPL works with nearly 7000 partners, each impacting at least 300 farmers. Therefore, the enterprise has directly impacted nearly 2.1 million small dairy farmers in India. The intervention has eliminated low payment to farmers and adulteration of milk, thereby increasing farmers' income.

The enterprise was the implementation partner in a project funded by Department for International Development (DFID) through a Poorest Area Civil Society (PACS) program. SKEPL provided manufacturing, installation and maintenance services for Automatic Milk Collection Units (AMCUs) installed at village cooperative societies as part of the project. The model demonstrated that the investment made through the program ensured 26 percent increase in income for the dairy farmers, reduced their challenges in selling the milk and increased transparency at the collection point. Dairy farmers used to receive an average of INR 3114 (USD 47) per month by pouring milk into the Dairy Co-operative Societies (DCS). With this intervention, the amount increased to INR 3981 (USD 60) per month. There was also an average 20 percent increment in the amount of milk poured into the DCS by an individual dairy farmer, and around 6 percent increase in the rate of milk because of the improvement in the quality of milk and good dairy practices.

Challenges and Lessons

Skilled manpower is a key challenge for SKEPL, given that rural semi-skilled labor is migrating to peri-urban and urban areas to work in malls and quick service restaurants. Another important challenge is capital and management of its funds. SKEPL lacks collateral securities and finds it difficult to avail working capital loans for its business. To manage funds and raise working capital, SKEPL's promoters have had to provide personal assets as a collateral security. SKEPL addresses the issue of human resource management by providing appropriate compensation and growth opportunities to its people.

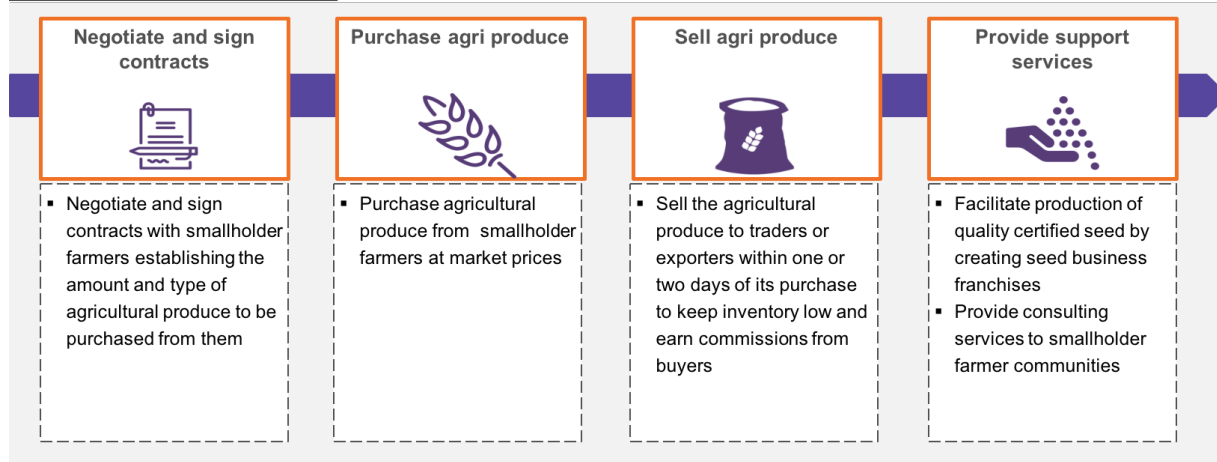
CASE STUDY: KILIMO MARKETS



Founding year: 2010
HQ: Arusha, Tanzania
Countries of operation : Tanzania, Kenya
Orientation: For-profit
Employees: 224
Turnover: USD 6.6 million

Local buyers and middlemen exploit farmers by paying them less than market prices for the agricultural produce. In the absence of adequate information and access to markets, farmers are forced to sell the produce to them.

Kilimo Markets provides comprehensive post-harvest business solutions for smallholder farmers in Tanzania. It is a farmer-owned business model that is replicable and scalable over a wide area, and aims to benefit smallholder farmers. It partners with farmers to provide quality inputs, contract management services to small hold farmers, and warehouse operation and logistics support. It buys and aggregates agricultural produce from smallholder farmers at market prices and sells it to traders, thereby earning a commission from them. The enterprise promotes sustainable development in its areas of operation by providing smallholder farmers confirmed linkage to markets to sell their agricultural produce. This results in increased agricultural production and increased income of smallholder farmers. It has **served over 2600** smallholder farmers in its areas of operation.



Operating Model

Kilimo Markets engages in trading of grains and pulses, sesame, groundnuts, beans and maize. It exports to different markets including South Africa and Kenya for maize; South Asia, Africa and Europe for beans; and India for pulses. It procures raw produce from smallholder farmers through buyback arrangements at fixed prices, and exports it through forward contracts. It thus connects farmers to better market opportunities. In addition, Kilimo Markets provides extension services.

Kilimo Markets has several subsidiaries, one of which is Kilimo Markets Limited Market Brokerage Service (KMB), which is licensed as a warehouse operator that provides both, access to affordable finance and efficient warehousing for smallholder farmers. It brokers contracts with smallholder farmers and also manages grain as collateral. KMB operates in the Tanzania warehouse receipt system in partnership with a leading national bank. The bank provides finance to the entire value chain of this business unit. This arrangement helps smallholder farmers have access to easy and affordable finance by depositing their agricultural produce in the Kilimo Markets warehouse.

Kilimo Markets sought to address two key challenges of smallholder farmers, namely, market links, and inadequate financing and contract facilities.

Another subsidiary, Kilimo Markets Seed Growers Services (KMSG) facilitates production of quality certified seeds by creating seed business franchises owned and managed by the Farmer Marketing Associations (FMAs) and the parent company Kilimo Markets. Kilimo Markets also provides consulting services to smallholder farmer communities organized into FMAs. It provides training on various topics including savings-led microfinance, farmer financing solutions, agriculture best

practices, productivity, and resource management. The enterprise also provides training to smallholder farmers in enterprise development and management, agribusiness registration, supply chain management, and entrepreneurship. Kilimo Markets leverages partnerships with government extension agencies and research institutes to ensure sustainability. It is actively developing partnerships with private and NGO partners.

Financial Sustainability

Kilimo Markets ensures financial sustainability using its strategy of aggregating smallholder produce in large quantities, and maintaining low inventory through efficient matching of contracts. The enterprise buys produce from the smallholder farmers at market prices and sells it within one or two days. The high volumes afford economies of scale which helps the enterprise negotiate better prices from the buyers. In 2015, it sold nearly 300-500 tons in single contracts. The primary source of revenues for the enterprise is income from the sale of exports. Other sources include fee for training and advisory services, and rent for warehousing facilities.

Some of the top cost components for the enterprise include transportation of produce, payment to farmers. Another important cost component is the cost of finance loaned from banks. Some of the initial funding sources of Kilimo Markets include finance from a bank that the enterprise had partnered with in the first two years of operation, and grant money from a challenge. The bank provided USD 90,000 to Kilimo Markets over a period of two years. It also received USD 150,000 from African Enterprise Challenge Award in 2011. Kilimo Markets achieved break-even last year; however it is not yet profitable.

Impact

Kilimo Markets has already served over 25,000 smallholder farmers, and has paid them over USD 3 million in premiums for their agricultural produce. In the absence of the enterprise, the smallholder farmers would receive at least 30 percent lower price from the local buyers. The enterprise promotes sustainable development in its areas of operation by providing smallholder farmers confirmed linkage to markets to sell their agricultural produce. This results in increased agricultural production and increased income of smallholder farmers.

It is expected from past experience that at least **60 percent** of the beneficiaries will be women because of the way the groups, especially the VSLGs are formed and trained that appeal to women more than men.

Challenges and Lessons

Kilimo Markets faces a dearth of qualified personnel, who could support business activities in several ways including the operational activities and specific activities such as keeping a note of the subsidies permitted for the business model. The enterprise also mentions inadequate access to capital and infrastructure, bureaucratic struggles, and policies at regional level as other critical challenges.

The enterprise is planning its expansion, especially in South Asian countries including India. However, it has been facing several roadblocks. The enterprise has limited understanding of government policies, taxation rules and regulatory framework in India. It also faces challenges because of bureaucratic inefficiencies, and instability in prices due to trader cartel. Kilimo Markets has also gone through extreme situations wherein the enterprise encountered, non-adherence and breach of contractual agreements by buyers, including large processor firms.