

BEYOND YIELDS - HOW CAN COLLABORATION IMPROVE POST-HARVEST PROFITS WITHIN SMALLHOLDER SUPPLY CHAINS?



INTRODUCTION

Post-harvest inefficiencies significantly reduce the commercial viability of supply chains that source produce from smallholders, impacting on profitability for both the farmers and off-takers. Food losses are especially critical in Africa, since 80 per cent of farms in sub-Saharan Africa are run by smallholders. In some countries, these small farms contribute up to 90 per cent of the food production.

Typically, both buyers and farmers view these losses as simply a “cost of doing business”. However, they often do not realise the extent of the loss or fully understand how this affects the profitability of their business.

HOW DO POST-HARVEST INEFFICIENCIES REDUCE PROFITABILITY FOR SMALLHOLDERS AND COMPANIES?

Twenty per cent of staple foods in sub-Saharan Africa are lost before they reach the market. This figure rises to approximately 40 to 50 per cent for fruit, vegetables and tubers. For Africa’s 470 million smallholder farmers, this loss represents a wasted investment: wasted time spent tending the crop, wasted water and fertilizer used to grow it, and wasted resources used to transport the crop to market.

The situation is particularly acute in sub-Saharan Africa where more than 30 per cent of food produced for human consumption is lost. This amount far exceeds the volume of food aid provided to the region each year. With 70 per cent of people in the region deriving their livelihood from agriculture, the cost of this post-harvest loss is estimated at US\$4 billion per year.

This brief explores how market actors can overcome post-harvest inefficiencies, creating a win-win situation for everyone in the system, boosting income for smallholder farmers by decreasing food loss, ensuring more sustainable sourcing for buyers and a more efficient supply chain.

The paper borrows extensively from the research and experience of the Rockefeller Foundation and its partners who, through the YieldWise programme, are pioneering scalable solutions to reduce post-harvest losses in smallholder value chains.

Post-harvest loss directly affects the bottom line for companies. When smallholders have fewer goods to take to market, off-takers lose procurement efficiency which leads to higher sourcing costs. For example, for Coca-Cola to drive profitability at its Africa operations, it needs to buy large amounts of mangoes at globally competitive prices. But approximately 60 per cent of production is lost in the post-harvest supply chain. As these losses drive up sourcing costs for Coca-Cola, the company finds it is often cheaper to buy mango purée from India rather than source the fruit locally in Kenya. In addition, the delivery of poor quality crops to off-takers leads to higher losses at the factory level.

In the YieldWise initiative for instance, a local Kenyan processor said that mango waste at factory level had decreased significantly after farmers were made aware of the quality of fruit that buyers required. This minimised the cost of doing business for the off-taker.

WHAT INTERVENTIONS CAN OVERCOME POST-HARVEST INEFFICIENCIES?

Crop losses occur at various points along the agricultural supply chain, from processing to storage and distribution. Therefore to effectively address the problem, solutions need to span the entire chain. Smallholders and other market actors need to gain knowledge of and access to handling, processing and storage technologies, as well as the capital needed to make new investments and address procurement constraints.

Furthermore, only market-led solutions offer the scalability required for system change along the supply chain. Past interventions directed at reducing food loss in rural supply chains have largely failed because they focused on only one point in the chain. They did not provide solutions that addressed problems along the entire system from farmer to buyer.

YieldWise analysed where the crop losses occurred, and concluded that the following components were central to optimising supply chains: market linkages, farmer training and aggregation, finance, and use of technologies. They are described in more detail below.

1. Linking smallholder farmers to anchor buyers: Having off-taker agreements with buyers can mitigate some of the uncertainty for farmers, assuring them of a set price for their goods. For example, YieldWise works with key anchor firms including Coca-Cola, WFP, and Dangote Group. In Kenya, Tanzania and Nigeria, these companies experience significant losses in their food crop supply chains, so they have a strong commercial incentive to invest in solutions. But having an assured market is not enough. In Kenya, for example (see case study below), there were greater losses when Coca-Cola first became the anchor buyer because farmers knew they could sell their fruit and so increased production. It was only when farm level practices improved, which included improvements in aggregation as well as links to market, that post-harvest losses decreased.

2. Linking farmers to a diversity of buyers: It is important to provide smallholders with a variety of markets so they can manage any excess supply. In the mango case below, alternative local buyers have been identified as supermarkets, local processors, restaurants, hotels, and grocers. Access to additional markets can minimise price volatility which is a disincentive for farmers to invest in post-harvest technologies and practices. In addition, selling for example to a local supermarket which may have less stringent quality requirements, can be a stepping stone for farmers as the build capacity to adopt the more rigorous standards required by larger or export buyers. For instance, agricultural products need to meet strict quality standards, including for size, colour and pesticide use, to be allowed into European markets.

3. Aggregating farmers: Farmers need to acquire postharvest management skills, to be aware of and adopt new technologies, and have the ability to aggregate their crops to meet buyer requirements. But not all farmers have the capacity to do this. In the mango case study, for example, it was found that farmers needed additional capacity to sell directly to buyers. TechnoServe addressed this by

organising them into groups and strengthening existing farmer organisations to enable them to aggregate adequate quality and quantity of goods. This raises the question of how best private or public sector actors can structure training and capacity building for it to be sustainable and scalable. Critical here is how to develop cost-efficient, effective training models that can be introduced into private sector supply chains. One such model could be to use videos to train farmers. Another could be to use traders, who play an important linkage and aggregation role, incentivising them by increasing volumes sold and their profit margins. New technologies such as smartphones could be used to digitize the supply chain, helping buyers to manage it while building stronger relationships with farmers, and without having to make costly investments in direct outgrower relationships.

4. Innovative finance: Finance is essential for maintaining the flow of goods through the supply chain. Financial products are needed to assist market actors at each stage, including lease financing for smallholders or aggregators, and working capital loan products for farmers, aggregators and processors. For instance, ensuring prompt payment to smallholders is critical for building trust between farmers and off-takers. This means that the capital needs of buyers need to be met to ensure quick pick-up, storage, processing, and payment for crops. Smaller off-takers may struggle to access the working capital to pay farmers immediately. A company like Sunny Processors in Kenya says that access to affordable financing is crucial, not only for farmers who want to boost production through better inputs and agricultural practices, but also for them. The high cost of financing can make companies less competitive with imported products. However, not every market actor in the supply chain will need financing and needs vary from crop to crop. This means financial providers need to be innovative and adapt their products accordingly.

5. Loss-reducing technologies: Promoting the adoption of appropriate technologies can improve crop handling, storage, and processing. For example, the use of maize or cassava dryers can reduce losses on the farm and during transportation for further processing. Using hermetic bags or silos on the farm can minimise losses from pests. Edipeel is an organic solution that provides an ultra-thin barrier that protects the surface of fruit, reducing the oxidation and water loss that causes produce to shrivel and lose flavour. Cold storage can be a challenge at the farm level and at collection centres. However, new technologies such as Wakati units increase the shelf life of fruit and vegetables by up to 21 days without having to put them in cold storage. Proper storage during transportation is also critical. In the mango example below, YieldWise promotes the use of crates for better handling during transportation to retail market channels. Technologies will vary according to the crop and will need to be developed for different points along the supply chain. However, some technologies can be used across product chains, like the crates designed for mangoes which can be used for any other tree fruit or fruity vegetable. (See the table above for examples of technologies that can be used to decrease crop losses at various points along the supply chain).

PHL SOLUTION		SOLUTION DESCRIPTION	
PRODUCT SOLUTIONS	Storage and handling solutions	SUPER GRAIN BAGS	Multi-layered, water resistant, polyethylene storage bags used for grain storage
		GUM ARABIC COATING	Edible coating manufactured from acacia tree sap used to coat certain fruits and vegetables to delay ripening
		ZEROFLY BAGS	Insecticide-incorporated storage bags for crops capable of preventing pest infestations
		LIQUID AIR REFRIGERATION: COLD STORAGE	Cooling of air to very low temperatures for cold storage and transport of perishables; technology still to be piloted in an African context
		WAREHOUSE RECEIPTS SYSTEM	Secure storage combined with deposit system and credit mechanism; difficult to implement in contexts where financial systems are not mature
		HEAVY MOULDED PLASTIC CONTAINERS	Durable, protective, and cost effective plastic containers with the ability to prevent crop damage during storage and transportation
		METAL SILOS	Robust, water resistant, hermetic storage units constructed from galvanized iron, usually used for aggregation and storage of grains
		PLASTIC SILOS	Storage units made from food-grade, UV-resistant flexible PVC for both indoor and outdoor use; cheaper and less durable than metal silos
		LOW ENERGY COOLING	Micro controller that allows conventional window air conditioning units to operate at colder temperatures at lower costs for cold storage
		PROCESS SOLUTIONS	Value addition solutions
GRATERS AND PRESSERS	Traditional means of transforming crops from raw state into one with a longer shelf life; used particularly for cassava		
LIQUID AIR REFRIGERATION: INDIVIDUAL QUICK FREEZING	Process whereby individual crops are frozen using liquid air thereby extending shelf life and preserving nutritional integrity		
MOBILE / SOLAR DRYING	Diesel-powered or solar driers used to reduce moisture in crops, thereby extending shelf life allowing SHFs to sell crops at higher prices		
GROWTAINERS	'Mobile farms' built inside insulated containers modified to provide a controlled environment for growing agricultural products hydroponically		
PROCESS SOLUTIONS	Procurement channels	COLLECTION CENTRES	Aggregation points that link farmers to buyers, primarily offering grading, packing and storage services
		CONTRACT FARMING	Contractual agreement where a primary off-taker provides a farmer with agricultural inputs and training to produce contractually specified crops
		DIRECT SOURCING	Procurement channel where farmers establish contractual agreements directly with buyers; limited inputs and technical assistance provided
		SUPPLY CHAIN TECHNOLOGY PLATFORMS	Use of technology platforms to connect farmers and potential buyers, e.g. AgriManagr

Source: Monitor Deloitte analysis

Table 1: Post-harvest loss solutions

HOW CAN SUPPLY CHAIN ACTORS COLLABORATE TO IMPROVE POST-HARVEST PROFITS?

As indicated above, it is important that constraints across the system are addressed in order to guarantee the efficient procurement of goods for off-takers. Isolated interventions are unlikely to achieve the tipping point of commercial sustainability. Support services that function efficiently and well connected market actors are critical for the effective transfer of crops from producers and agro-processors to consumers. The following types of actors all have roles to play.

Core supply chain actors

Large anchor buyers signal demand by making commitments and arranging contracts with their suppliers (local processors) to purchase specified quantities of smallholder farmers' products.

Alternative local buyers help to fill demand and can assist farmers in meeting less rigorous local quality requirements, especially if goods are designated for the local market.

Smallholder farmers produce the required quality and quantity of goods, while adopting post-harvest loss-reducing practices and technologies to minimise loss at the farm level.

Existing **aggregation and procurement** centres are used, or new centres are established, where farmers come to aggregate crops and sell to traders and consolidators.

Service providers:

Implementing partner NGOs, aggregate and train smallholder farmers on how to reduce on-farm crop losses and meet market standards for quality and quantity. Agro-dealers develop channels for distributing post-harvest technologies to smallholder farmers. Individual farmers might not need to purchase or own these technologies. It may be more efficient for farmer organisations or other actors in the value chain to use buyers' crop orders as collateral to acquire loans, purchase the technologies, and then lend or lease them to farmers.

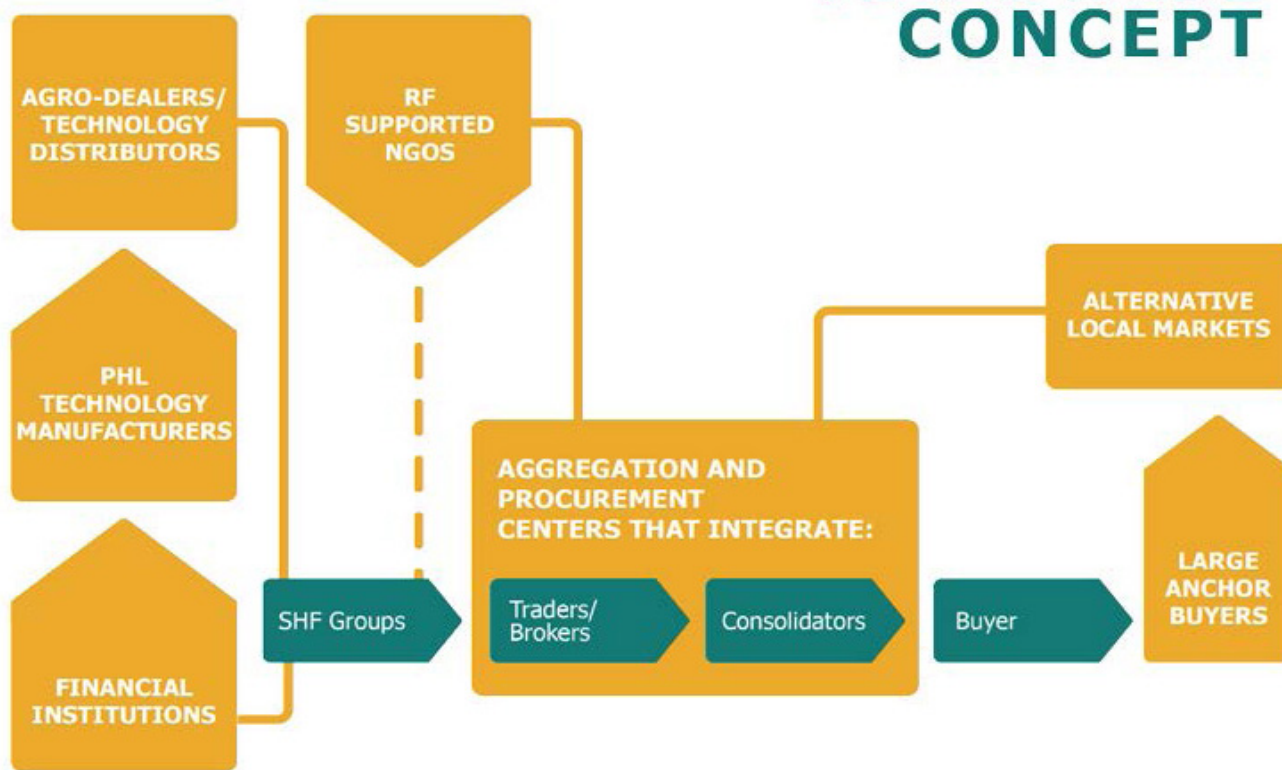
Financial institutions provide loans to finance farmers' acquisition of post-harvest technologies, using anchor buyers' sourcing commitments as collateral. They also meet the financial needs of other supply chain actors.

Transporters maintain quality as they move goods from the farm gate or aggregation centres to market. This can include using the proper containers to minimise

breakage or spoilage during transport (for instance with eggs, mangoes or tomatoes), cold storage to guarantee freshness and minimise ripeness (fruits, vegetables, milk), or proper storage to safeguard low levels of moisture for staple crops (cassava, maize).

Strong leadership is required to crowd-in, structure and coordinate the market actors needed to make progress on reducing food losses in a supply chain. On occasion, a leading off-taker has enough commercial interest in the supply chain to justify the investment of their time. However, it is more likely that an independent, neutral party needs to take on this coordination role using noncommercial funding in recognition of the public good benefits. For the process to be sustainable, it is important to include economic incentives for market actors.

YIELDWISE CONCEPT



■ Current actors
■ Additional actors engaged (or created)

With support from the Rockefeller Foundation, the YieldWise initiative facilitates this coordination in several value chains across Africa. Figure 1 shows how YieldWise has worked with the Kenyan mango supply chain to link existing core market actors (in blue) with new actors (in orange) in order to create efficiencies in the movement of mangos to off-takers.

Figure 1: YieldWise – Mango value chain in Kenya

YieldWise's approach is to develop an initial demonstration phase of how these structured relationships work, and then move to scale and sustainability. While it is yet to be determined what this looks like, the project is exploring how to incentivize more off-takers to integrate farmers into their supply chains, is establishing how technology or agricultural input providers can obtain the financing and capacity to continue developing new technologies to minimise post-harvest losses, and has been engaging with government to make positive changes in the enabling environment.

CASE STUDY: YIELDWISE AND MANGOES IN KENYA

YieldWise is working with a range of stakeholders in the mango value chain to enable farmers to access consistent and reliable buyers for their products and to reduce postharvest food loss by linking them to guaranteed buyers and storage solutions.

The key participants in the partnership are:

- **Meru Greens Horticulture**
a Kenya-based fruit and vegetable exporter.
- **Sunny Processors**
a Kenya-based processor of mango pulp.
- **AGCO/GSI**
a global leader in agricultural equipment.
- **TechnoServe**
a non-profit organization that develops business solutions to poverty.
- **The Coca Cola Company**
the largest beverage company in the world, sourcing for its African juice products.
- **A local farmer business organisation**
owned and operated by a group of aggregated farmers.

TechnoServe is working with Coca-Cola to identify where losses occur in the supply chain. It is also working directly through Coca-Cola's suppliers and processors to improve quality control, helping the company to meet its supply needs and driving demand down to the smallholder level. TechnoServe is currently working with 20,000 smallholder mango farmers in Kenya, of which 4,200 have been part of the initiative since the pilot phase. They have approximately 339 farmer groups which are using 20 physical aggregation centres distributed across four regions. Some of the centres offer cooling services to prolong shelf life and reduce heat-related losses. Most of these centres are managed by the farmers but some are managed by the buyers or off-takers.

A cold chain is a temperature-controlled supply chain or system that helps to preserve and extend the shelf life of perishable food, thereby stretching its marketable timeline. Through the YieldWise project, AGCO's global brand, GSI, is prototyping a solar-powered cold storage shed for perishable produce that will allow smallholder farmers to reduce postharvest loss and improve market access. The project has enabled them to test the efficacy of the shed and determine a market entry strategy. The results are promising with the cold sheds delaying ripening and enabling the fruit to stay fresh for up to three weeks in the storage facility. This enables farmers within the catchment area to store their harvest until they can confirm a buyer or aggregate produce from different farmers to attract buyers requiring large volumes. This not only stops crop loss at the farmer level and during transport, but one of the off-takers for YieldWise, Meru Greens, says it has also decreased transportation costs because farmers can now store more for longer and so do not require trucks to collect produce as often.

The YieldWise initiative highlights key lessons on how to work with market actors to decrease crop loss and improve efficiencies in the procurement of goods.

- **Creating a structured relationship** between buyers and aggregated smallholder farmers is critical to unlocking both finance and technology options at the farmer level. Without an assured market, farmers do

not have the incentive to invest in processes to reduce post-harvest losses. Without farmer demand, other service providers, for instance technology providers or financial institutions, are less willing to service the value chain activities.

- **The sequencing of different components** varies depending on the crop. In the tomato supply chain, YieldWise found the first important step was to develop a formal relationship between the anchor buyer and the aggregated smallholder farmers. After this, technology and financing options were developed. This was not the same in the mango supply chain.
- **The prioritisation of components differs from product to product.** For the mango supply chain, smallholder farmers did not need financing to access post-harvest loss technologies. Finance was however needed for traders and aggregated farmer groups
- **Smallholder aggregation and buyer commitment are two challenging components.** Large buyers prefer to source from well-functioning farmer organisations, with aggregators meeting their aggregation targets by working with established farmer groups. This poses a challenge in scaling the model up to farmer groups that may not have strong capacity.
- **Building trust is critical between farmers and off-takers.** However, price fluctuations between agreed upon contract prices and prevailing market prices have led to some smallholder side-selling. Price fluctuations have resulted from weather conditions and government policies (such as import or export bans), which are largely out of the control of the off-taker. More flexible contracts and MOUs can be effective in addressing side-selling.
- **Finance is critical all along the supply chain.** Processors and exporters indicated that access to affordable finance is crucial so they can take competitive advantage of market opportunities and technologies. Affordable financing can help companies meet their working capital needs, access higher value markets (e.g. organic or Global Gap certification), or test new technologies (e.g. the development of affordable crates for transporting mangoes).

REFERENCES

Deloitte (2015). **Reducing Food Loss along African Agricultural Value Chains.** Deloitte & Touche.

Lipinski, et al. (2013). **Reducing Food Loss and Waste.** World Resources Institute and United Nations Environment Programme.

Global Knowledge Initiative (2014). **Reducing Global Food Waste and Spoilage.** A Rockefeller Foundation Initiative.

Shared Value Initiative (2015). **YieldWise: Building a Better Food System in Africa Through Shared Value Partnerships.** By Kyle Muther, Senior Consultant, FSG.

The Rockefeller Foundation (2015). **Reducing Post-Harvest Loss through a Market-led Approach: Lessons from Smallholder Farmer Sourcing in Kenya's Mango Value Chain & Mozambique's Cassava Value Chain**

CONTRIBUTORS

Research and writing by Debora Randall, Wasafiri Consulting.

Coordinated and edited by Ian Randall of Grow Africa and John Macharia of AGRA.

Knowledge and experience gratefully received from YieldWise partners:

- Olivia Karanja, Rockefeller Foundation
- Rosemary Muthomi, Meru Greens
- Kushal Parel, Sunny Processors

GROW AFRICA SMALLHOLDER WORKING GROUP
BRIEFING PAPER

**BEYOND YIELDS - HOW CAN
COLLABORATION IMPROVE
POST-HARVEST PROFITS
WITHIN SMALLHOLDER
SUPPLY CHAINS?**

**CENTRE FOR
NO-TILL
AGRICULTURE**
MECHANISED TRAINING SITE
T. 0208 624 048
AMANCHI



GROWAFRICA

www.growafrica.com



www.agra.org