



Reducing Post-Harvest Loss

Toolkit based on the learnings from the YieldWise Initiative

FOREWORD

For more than 100 years, The Rockefeller Foundation’s mission has been to promote the well-being of humanity throughout the world. Together with partners and grantees, The Rockefeller Foundation strives to catalyze and scale transformative innovations, create unlikely partnerships that span sectors, and take risks others cannot – or will not.

Post-Harvest Loss (PHL) reduces the income of smallholder farmers (SHFs) by 15 percent and results in reduced food supply in developing regions. To address this problem, The Rockefeller Foundation launched the YieldWise Initiative in 2016, which focused on reducing PHL by focusing on fruits, vegetables, and staple crops in Kenya, Nigeria, and Tanzania—countries where up to half of all food grown is lost. Specifically, the initiative targets four identified value chains – Mango in Kenya, Tomato and Cassava in Nigeria and Maize in Tanzania.

This **PHL Toolkit** brings together the lessons we have learned through the [YieldWise Initiative](#). The toolkit will illuminate the evidence of impact, new knowledge and areas where the initiative was not successful. The toolkit will be a “how to do guide” that provides a blueprint for actors interested in investing in PHL reduction interventions that can be taken to scale for high impact.

We greatly appreciate all the inputs that stakeholders have contributed to the development of this toolkit and look forward to seeing the implementation of other successful PHL initiatives.

Regards,

Dr. Roy Steiner

Senior Vice President, Food



ABOUT THIS TOOLKIT



Purpose: The PHL Toolkit provides practical guidance to stakeholders implementing or interested in investing in PHL initiatives. This toolkit is based on evidence of impact from the YieldWise Initiative, extracting practical ‘how-to-do’ guidance from the initiative’s learnings. The ultimate objective of this manual is to provide strategic information to other actors or initiatives intending to scale and/or replicate effective post-harvest loss initiatives to reduce waste throughout the food chain. Reducing PHL means that smallholder farmers will be able to feed more people and the economic benefits will extend beyond farmers to traders, distributors, sellers, and consumers.



How the toolkit was developed: The toolkit is based on a review of all relevant YieldWise learning, evidence of impact literature and interviews with Rockefeller Foundation staff, implementing partners and actors along the food chain. Information gathered has been synthesized and presented according to the pillars of the YieldWise Model. This toolkit has been developed in an iterative manner with feedback obtained throughout the process.



Structure of the toolkit: The toolkit is presented according to the interventions identified and implemented through the YieldWise Initiative, with the exception of the *Aggregation and Training* which is presented herein as two separate sections. These are core, necessary interventions for PHL initiatives, particularly in these four value chains, hence them guiding the structure of the toolkit.

While each intervention is important, the sequencing thereof may vary depending on the value chain. For example. In the tomato supply chain, YieldWise found the first important step was to develop a formal relationship between the anchor buyer and the aggregated SHFs. After this, technology and financing options were developed. This was however not the same in the mango supply chain.



Intended audience: The toolkit was developed for actors implementing or funding PHL initiatives. This has been developed as a practical, how-to-do guide for this audience.



How to use the toolkit: The toolkit presents nuanced learnings that are pertinent to the above audience. However, local contexts vary and, as such, the lessons presented within may need to be customized and refined according to specific contexts.

THE YIELDWISE INITIATIVE

AUTHORS

The development of this Toolkit was commissioned by the Rockefeller Foundation, and developed by *Genesis Analytics*, the largest economics-based consulting firm in Africa, in collaboration with core team members from the Rockefeller Foundation's Food Initiative team.

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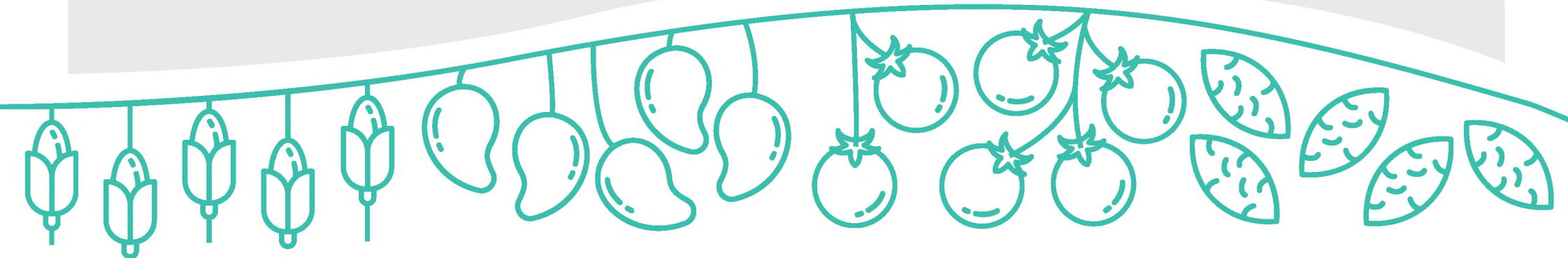
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THE YIELDWISE INITIATIVE

ACKNOWLEDGMENTS

We sincerely thank the anchor implementing partners of the YieldWise Initiative.



Implementing partners in the Tomato Value Chain in Nigeria & the Mango Value Chain in Kenya



Implementing partners in the Cassava Value Chain in Nigeria



Implementing partners in the Maize Value Chain in Tanzania



Implementing partners in the Tomato Value Chain in Nigeria

We sincerely thank the contributors, organizations and individuals who provided us with insight, comments, examples and ideas.

Access Agriculture
Tanzania Postal Bank (TPB)
Farm Concern International
University of Nairobi
Farm Radio International (FRI)
Syngenta Foundation
Natural Resources Institute
Azuri Health Ltd
Tanzania Agricultural Development Bank (TADB)
Federal University of Agriculture Abeokuta
Association of Kenya Mango Traders (AKMT)
The World Resources Institute (WRI)
Dilox Company Limited
Agricultural Finance Corporation
Global Alliance for Improved Nutrition (GAIN)
JKUAT
ACIOE Associates
BRiTEN

Sustainable Food Lab
Mediae
Farmtrack Consulting Ltd
University of Greenwich
Wageningen University
Peptang
Deloitte
Milan Innovancy
Initiative for Global Development
Corporate Council of Africa
University of Illinois
Albright Stonebridge Group
Global Knowledge Initiative
Africa Practice
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Iowa University

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Psaltry International Limited
WFP
Crest Agro Products Limited
Landesa
Allied Atlantic Distilleries Limited
Turret Media
Niji Foods Limited
Arog Bio Allied
Agro Services Limited
FMS Farms Limited
Rural Urban Development Initiatives (RUDI)
County Government of Makueni, Kenya
Ministry of Agriculture, Kenya
Ministry of Agriculture, Tanzania

Your inputs have shaped this toolkit and enabled the future improvements of Post-Harvest Loss initiatives.

THE YIELDWISE INITIATIVE

ACRONYMS

ABP	Anchor Borrower Program	NIRSAL	Nigeria Incentive Based Risk Sharing System for Agricultural Lending
AGM	Annual General Meeting	OPEX	Operational Expenditure
AGRA	Alliance for a Green Revolution in Africa	PFA	Pestfree Area
AKMT	Association of Kenya Mango Traders	PHL	Post-Harvest Loss
AU	African Union	PIATA	Partnership for Inclusive Agricultural Transformation in Africa
CACS	Commercial Agricultural Credit Scheme	PICS	Purdue Improved Crop Storage
CAPEX	Capital Expenditure	PO	Producer Organisation
CBN	Central Bank of Nigeria	RPCs	Reusable Plastic Crates
DFI	Development Finance Institution	SHFs	Small Holder Farmers
FAO	Food and Agriculture Organization	SIDO	Small Industries Development Organization
FBO	Farmer Based Organisation	SLM	Sustainable Land Management
FRI	Farm Radio International	SME	Small and Medium Enterprise
FSC	Farmer Service Centers	TADB	Tanzania Agriculture Development Bank
FtMA	Farm to Market Alliance	TPB	Tanzania Post Bank
GAPs	Good Agricultural Practices	TWG	Technical Working Group
IPM	Integrated Pest Management	UBA	United Bank for Africa
IVR	Interactive Voice Response	UBN	Union Bank of Nigeria
LPO	Local Purchase Orders	VETA	Vocational Education Training Authority
MOU	Memorandum of Understanding	WFP	World Food Programme
MT	Metric Ton	WRI	World Resources Institute
NCA	National Construction Authority	ZECC	Zero Energy Cooling Chamber
NGO	Non Governmental Organisation		

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1

About the YieldWise Initiative



1 ABOUT THE YIELDWISE INITIATIVE

THE GOAL OF THE YIELDWISE INITIATIVE

To reduce PHL by at least 50% in crops across sub-Saharan Africa and **improve resilience** in the lives of **millions of SHFs** and rural lives.

Based on the potential impact, together with potential for demonstration effects and the local context, four value chains were identified in three countries as the focus for YieldWise:

Tomato in Nigeria (Fruits & Vegetables)

Nigeria is the largest tomato-producing country in Sub-Saharan Africa and the largest importer of tomato paste in the world. Tomato is a high-value fruit crop, however PHL are estimated at 45-60% of production.

Cassava in Nigeria (Roots & Tubers)

Nigeria is the largest cassava-producing country in world. Cassava suffers from extremely high losses and has diverse market requirements and opportunities.

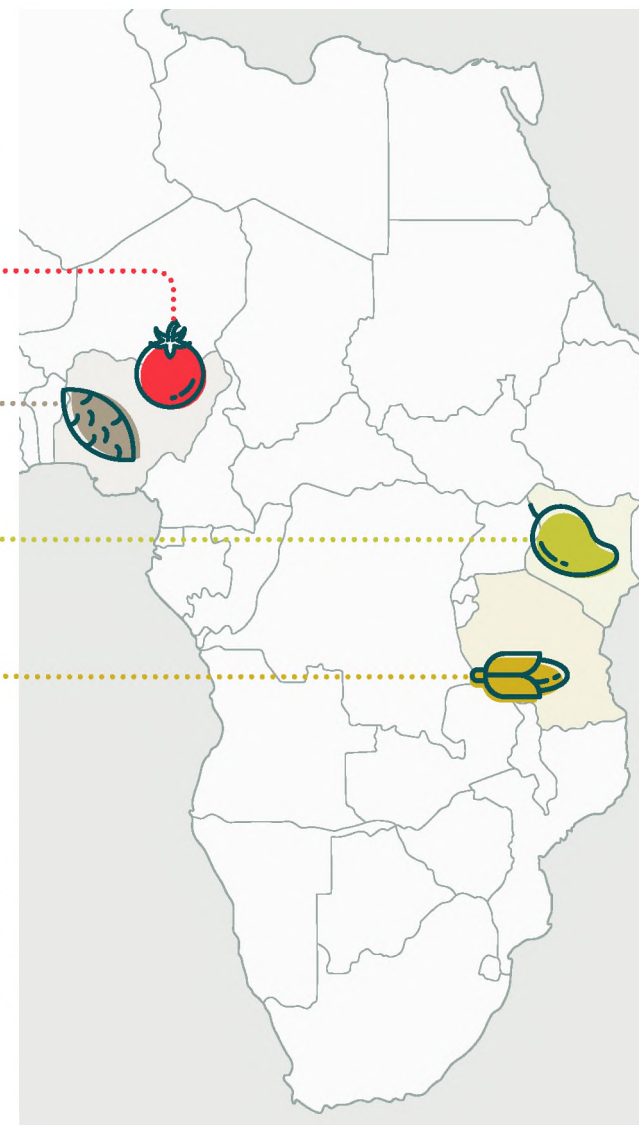
Mango in Kenya (Fruits & Vegetables)

Mango is an important food and cash crop and production in Kenya has increased by 400 percent from 2001-2012. A significant proportion of the crop is lost during and after the harvesting process.

Maize in Tanzania (Cereals & Grains)

Maize is a particularly important crop: along with other cereals, it forms the bulk of the Tanzanian diet, yet 20-40% of the maize harvest is lost each year. 20% of cereals are lost before they even make it to market.

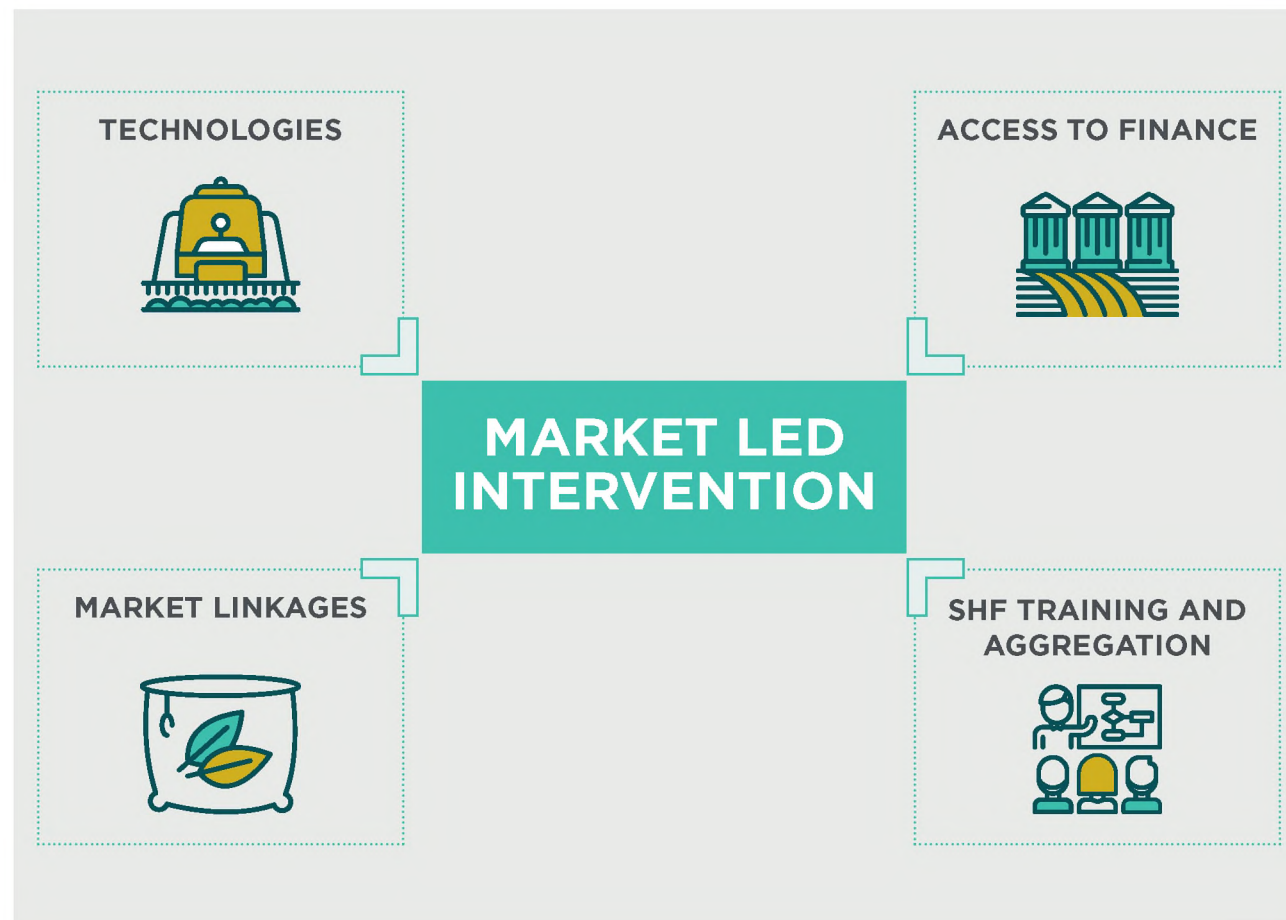
Historically, PHL interventions have targeted staple crops such as cereals and grains. While the YieldWise Initiative does address cereals and grains, it is also important to demonstrate that losses can be reduced in value chains for fruits, vegetables, and roots and tubers. **These crops are grown in large quantities by a significant number of SHFs across Sub-Saharan Africa.** In addition, they play a crucial role in food security and resource management for many rural and, increasingly, urban populations. Fruits and vegetables, in particular, are high in micro nutrients that can be critical to a nutritionally sound, diverse diet—for example, mangoes are a major source of vitamin A. In addition, many of these specialty crops use extensive amounts of land and water to produce but easily spoil, bruise, and rot if not properly harvested, stored, and transported.



1 ABOUT THE YIELDWISE INITIATIVE

MODEL

YieldWise was designed as an integrated solution to PHL. In doing so, YieldWise integrated four key interventions, namely **Technology**, **Market Linkages**, **Access to Finance**, and **Training and Aggregation**, in a market-led solution to PHL.



According to the [FAO](#) *Food and Agriculture Organization (FAO)*, food loss is of great importance to combat hunger, raise incomes and improve food security. Overcoming this by implementing effective PHL programs requires that an in-depth assessment of the value chains of relevance be conducted, identifying areas in the value chain where the losses are the most significant. Drawing on extensive literature, including the FAOs [PHL measurement framework](#), research conducted by the [Sustainable Food Lab](#), and The World Resources Institute's (WRIs) [Reducing Food Loss and Waste](#) work, YieldWise was designed as a holistic solution to overcome PHL in the four above detailed value chains.

By integrating and targeting the interventions into a single market-led solution, YieldWise aimed to overcome many of the challenges that previous initiatives have faced. The four interventions shown on the left were identified as being the most key in overcoming the root causes to food loss and waste in the value chains of relevance to the initiative. These are elaborated on in the remainder of this manual.

1 ABOUT THE YIELDWISE INITIATIVE

CHANGE MODEL

To accomplish the goal of the YieldWise Initiative, the connection of **aggregated SHFs** to structured market demand, unlocking access to **post-harvest reducing technologies** and **finance**, and influencing key actors to prioritize investments in loss prevention is key, as demonstrated in the change model shown below.

INDIRECT IMPACT "CONTRIBUTION"

Secure rural livelihoods in other value chains and geographies

Increased value placed on natural capital by SHFs, and in corporate and public sector decision-making

Advanced health through increased food security

DIRECT IMPACT "CONTRIBUTION"

Stable and growing SHF livelihoods and improved rural lives

Less vulnerable ecosystems through efficient value chains, sourcing from SHFs with minimal PHL

Increased food availability of high quality, nutritious, non-toxic foods

..... ACCOUNTABILITY LINE

INITIATIVE GOAL "ATTRIBUTION"

"Reduce food losses by at least 50% in representative value chains, improving millions of rural lives."

OUTCOMES "ATTRIBUTION"

Buyers demand products sourced from SHFs

SHFs trained and aggregated to meet market demand

Value chain actors have necessary access to finance

PHL technology prevents loss and spoilage

Ag. sector values and prioritizes loss prevention

INTERMEDIATE OUTCOMES "ATTRIBUTION"

Large buyers are able to source locally and sustainably from aggregated SHFs

Aggregated SHFs able to participate in and adapt to local and multinational chains

Processors, traders and SHFs have access to finance to purchase technologies or to fund working capital

Technologies are accessible and affordable for SHFs and other value chain actors

PHL becomes a core business focus for private and public sector and implementation partners

SHFs are linked with assured, predictable demand from large buyers and alternative markets

Buyers, processors and traders incentivized to invest in SHF training, aggregation and market links

Funders, governments and private sector invest in loss prevention

SHFs, processors and traders permanently adopt and effectively use PHL technology

PHL is measured and reported across the value chain

1 ABOUT THE YIELDWISE INITIATIVE

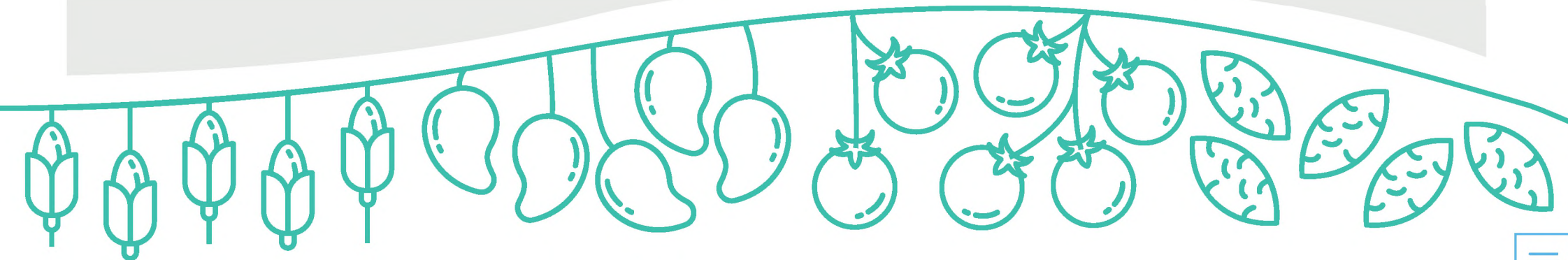
EARLY EVIDENCE OF IMPACT

The pillars of the YieldWise Initiative have contributed in varying degrees to the achievement of targets on loss PHL reduction. The combination of training on GAPs and post-harvest management has promoted the increase in high quality and durable produce, which when harvested and stored properly add value to SHFs.

EARLY SIGNS TOWARD PHL REDUCTION:

- Adoption of GAPs by farmers thereby reducing losses during the growth stage;
- Adoption of technologies to promote better harvesting and post-harvest management such as storage, processing, and transporting technologies;
- Linkages to markets to prevent farm gate losses, especially during market gluts, when farmers are unable to get good prices for their higher quality produce; and,
- Promotion of value addition and processing which further increases the shelf life of farm produce.

When coupled with the influence on institutional practices and change/introduction of policy, the Initiative aims to promote the adoption of learning beyond the immediate value chain actors, and the potential adoption of learnings in other value chains.



Introduction to Post-Harvest Loss



2 INTRODUCTION TO POST-HARVEST LOSS

INTRODUCTION

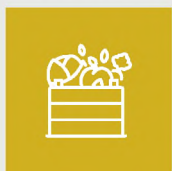
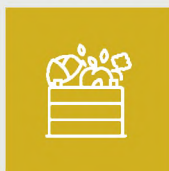
This section begins by introducing PHL. More specifically, it details:

- ↳ What is PHL;
- ↳ The size of PHL;
- ↳ The effects of PHL;
- ↳ The types of PHL;

WHAT IS PHL?

PHL is a measurable quantitative or qualitative loss in a given agricultural product that occurs during the various phases of the post-harvest system. It includes the deterioration of produce and other occurrences that restrict use of produce.

Size of Post-Harvest Loss



1/3 of all food produced worldwide is lost or wasted annually

This loss represents a cost of **USD 2.6 trillion per annum** including USD 700 billion in environmental costs and USD 900 billion in social costs.

- In sub-Saharan Africa, 37% of food produced is lost between production and consumption.
- The annual value of post-harvest grain loss in sub-Saharan Africa is USD 4 billion, which exceeds the value of total food aid that the region has received over the past decade.

SOURCES: Food and Agriculture Organization, FAO, 2019 | World Bank Group, Agriculture in Africa: Telling; Telling Myths from Facts, 2018

2 INTRODUCTION TO POST-HARVEST LOSS

THE EFFECTS OF POST-HARVEST LOSS



Economic Impact on SHFs

75% of the sub-Saharan population is employed by the agricultural sector of whom majority are SHFs. PHL makes SHFs economically vulnerable as it results in inconsistent income and lack of growth in farming activities as revenues may not be sufficient to re-invest in future farming activities. SHFs are economically vulnerable due to the following:



Inconsistent and unpredictable incomes



Limited of knowledge of good agricultural practices (GAPs)



Limited access to finance to invest in PHL technologies



Limited access to good quality post-harvest techniques



Health Impact on Consumers

Agricultural produce such as fruit, vegetables, cereals and grains are an important source of nutrients. PHL such as loss in quality from infestation of pests and moulding due to poor storage risk the health of consumers as the nutritional value of produce is altered and may not be suitable for consumption. Additionally, PHL may affect food security and nutritional security and a reduction in the availability of food demanded may result in diseases such as malnutrition. Findings from a study linking nutrition and PHL in the tomato value chain in Nigeria can be found [↓here](#).



Environmental Impact

PHL accounts for approximately 4.4 gigatons of greenhouse gas emission annually. These include on-farm agricultural emissions and energy used to produce, transport and store food that is ultimately lost. Examples of how PHL negatively impacts the environment include the following:



Inefficient use of water



Increased carbon footprint



Poor usage of agricultural inputs and land

2 INTRODUCTION TO POST-HARVEST LOSS

TYPES OF POST-HARVEST LOSS



Loss in Quantity

PHL in the form of loss in quantity through weight and/or volume loss. Weight losses are mostly due to attack of produce by pests (insects, birds and rodents) or leakage of products (poor packaging, spillage during grain handling). Although this may occur at all stages of production, it is more prevalent in the harvest phase through storage and transportation. Volume loss can occur as a result of infestation or consumption by insects, rodents, birds or poor packaging. This type of loss may not always be apparent and requires measurement of produce.



Loss in Quality

This form of PHL involves a wide range of possible criteria which affect the exterior, shape and size of produce. Losses in quality affect the market value of produce but are difficult to quantify as criteria or standards of quality need to be established to measure the loss in quality. The following are the common criteria used to assess the quality of produce: moisture content, color, odor, cleanliness, infestation of insects and other living organisms.



Economic Loss

PHL in the form of a reduction in quantity and quality results in the loss of money and affects subsequent production.

Examples of economic impact of PHL include:

- Inadequate transport systems make it more challenging for SHFs to sell produce where market prices are attractive. As such, SHFs often sell to brokers at farm gate prices thereby forgoing potential high profits.
- Inability to store produce in appropriate and secure facilities can force SHFs to sell produce immediately after harvest which affects profits should market prices be higher at a later time.

At the SHF level, PHL reduce the income made from farming activities which also affects subsequent harvests as they may have less revenue to re-invest. At the processor level, businesses have to import produce to meet their production quantity requirements which increases production costs and in turn profits.

Training



3 TRAINING

INTRODUCTION

This section presents guidance regarding PHL interventions. More specifically, it details:

- ↳ Why do SHFs need training;
- ↳ Topics that should be considered during training;
- ↳ Good practices for training materials;
- ↳ When training should be delivered and the key messages to be conveyed;
- ↳ How training messages should be reinforced to support retention and uptake;
- ↳ Who is best placed to deliver training;
- ↳ How to showcase the benefits of GAPs and post-harvest technologies through training; and,
- ↳ What platforms exist for effectively mass communicating with SHFs.



 Training resources and materials that PHL programmes can begin integrating in their implementation can be accessed in the Appendix (Click on Icon on the right).

3 TRAINING

WHY DO SHFs NEED TRAINING?

The lack of adoption, or the misuse of technology due to behavioral or economic constraints is a contributor to PHL. Training can illuminate the benefits of simple practices such as harvesting early in the day, protecting products from the sun, or using plastic bags to reduce water loss, for example. Similarly, the utilization of training techniques can increase probability of success and decrease costs for SHFs.

WHAT WERE THE ACHIEVEMENTS OF THE YIELDWISE INITIATIVE?

More than 700,000 farmers were trained through the YieldWise program. A total of 282,111 farmers were trained through the YieldWise Initiative and 470,016 through the Partnership for Inclusive Agricultural Transformation in Africa (PIATA) consortia. The following number of farmers were trained in the respective value chains:



37,566
SHFs trained



48,065
SHFs trained



182,909
SHFs trained

3,165
Village Based Advisors
(lead SHFs) trained

470,016
SHFs trained in
the PIATA consortia



13,571
SHFs trained

Additionally:
10 cassava processors
implemented farmer
training initiatives

WHAT TOPICS SHOULD BE CONSIDERED DURING TRAINING?

There is not one single training topic that PHL programs should focus on. Instead, training topics should be identified based on the value chain of focus and the local context. For example:

PHL programs should educate farmers on the diversity of losses in the value chain, when they can occur, and how to avoid them. By identifying the problem or loss points during the crop cycle, farmers become more cognizant of the contributing factors to both on-farm, during, and post harvest, losses. The YieldWise initiative implemented training on the diversity of losses because farmers often assume that losses only occur at the harvest, drying and storage stages.

An impact evaluation conducted in the maize value chain in Tanzania demonstrated that losses take place at different points in the value chain. Losses from the growth stage often go unaccounted for in the farms of SHFs. This therefore created the need for the YieldWise Initiative to educate farmers on the diversity of losses to ensure that each of the levels were considered, mitigated, and accounted for by farmers.



In the maize value chain, the following can lead to loss of produce:

- Dampening during unseasonal rains resulting in mold growth;
- During transportation from the farm;
- During sun-drying – poor weather may lead to insufficient drying and high losses;
- Roaming livestock may consume portions of drying grains left unguarded;
- Poor handling during threshing; Shelling or further drying can lead to scattering;
- Contamination with soil and stones, and grain breakage; Infestation by pests and rodents during storage.

Training should be based on the realities that are faced by a particular crop, vegetable or fruit. The following are the types of topics that should be included in PHL training in the four value chains of relevance to YieldWise:



- Tomato crop training should include choice of seed because this affects the establishment and eventual shelf life of tomatoes after harvesting. A key topic is also teaching SHFs on time of harvesting (at ripening) to prevent too ripe or immature tomatoes from being sold.
- Tomato SHFs should be trained on the practice of staggered cropping with the intention of preventing market glut since harvests will also be staggered, thereby reducing PHL as a result of flooded markets. Additionally, this also provides a constant market supply of fresh tomatoes.
- After harvesting, use of post harvest technologies should be encouraged so that SHFs adopt RPCs, and build ZECC.



3 TRAINING

WHAT TOPICS SHOULD BE CONSIDERED DURING TRAINING? *Continued*



Maize farmers should be trained on how the choice of seed varieties is critical to avoid those varieties that remain upright after they mature and open at the top leading to the maize cobs starting to rot after absorbing water.



Mango farmers should be trained to identify and grow diverse mango varieties that are in higher demand by both consumers and processors.

As a result of the training received through the YieldWise Initiative, mango farmers in Kenya began diversifying their mango varieties. In the Coast, the farmers needed to plant new Ngowe mango trees as their existing trees are old and production may go down over time affecting the production of the Ngowe variety fancied by processors. In Embu, the farmers have been top dressing their trees from tommy/van dyke to Kent varieties. Kent variety matures later in the season than other varieties giving farmers in Embu an added advantage in the market since with Kent they can get premium prices. This was therefore important information to train farmers on, to lead to transformative practices on their farms.

PHL programs should educate SHFs and other value chain actors on the proper know-how and use of post-harvest technologies. This is important to ensure that SHFs can see the benefit of the adoption of such technologies, and encourage their continued use.



During the implementation of the YieldWise Initiative in Kenya, mango farmers cited that it is counterproductive for them to put the fruit fly traps in their farms because they believe the traps attract fruit flies from other farms. This illustrates a potential misnomer that should be addressed through training, and demonstrates the importance of training in the adoption of post-harvest technologies.

Training should also include topics beyond the value chain of focus. For example:

- Although most PHL programs focus on a specific value chain, farm production and GAP training should incorporate other crops as SHFs usually farm more than one crop. This will promote an all-rounded approach towards improving SHFs livelihoods.
- Programs should couple financial access with financial literacy training to promote better financial management practices. Key basic skills that SHFs need include budgeting for production, accurate money management, bookkeeping for harvest and sales.
- In addition to training SHFs on GAPs, it is important for SHFs to be trained on business skills, so as to enable them to improve their bargaining power when conducting business with buyers.
- One of the challenges that limits SHFs and other value chain actors, such as traders, in accessing credit is owed to the fact that they lack formal records that financial institutions typically use to analyze their creditworthiness, and therefore inhibits their ability to obtain financing. Therefore PHL programs should provide SHFs and other value chain actors with training on effective record keeping and its importance.



WHAT ARE BEST PRACTICES FOR TRAINING MATERIALS?

Training materials should be simple, understandable and visually appealing so SHFs can learn about new farming practices with ease:

- Recognizing that SHFs often have low levels of literacy, training materials should adopt simple messaging and relatable training language without jargon.

The PHL curriculum developed for the Mango Value Chain in Kenya can be accessed [↓here](#).

The curriculum is divided in to the following modules:



- Module 1:** Understanding Post-harvest losses
- Module 2:** Causes of PHL at Pre-harvest stage - Nutrition
- Module 3:** Causes of PHL at Pre-harvest stage - Pests and Diseases
- Module 4:** Causes of PHL at Pre-harvest stage - General Husbandry
- Module 5:** Causes of PHL at Harvest stage
- Module 6:** Causes of PHL at Post-harvest stage
- Module 7:** Causes of PHL at Storage stage

- The facilitators guide, which provides a facilitators checklist, materials required and objectives for each of the above modules, can be accessed [↓here](#) and a facilitators guide for each of the modules can be found [↓here](#).
- The handbook developed for mango farmers can be accessed [↓here](#).
- A poster developed to showcase the positive impact of using fruit-fly traps to mango farmers can be accessed [↓here](#).

The PHL curriculum developed for the Maize Value Chain in Tanzania can be accessed [↓here](#).



The training materials include:

- A post-harvest management handbook by Farm to Market Alliance (FtMA) in English and Kiswahili.
- A post-harvest handling facilitators' guidebook in English and Kiswahili.



WHAT ARE BEST PRACTICES FOR TRAINING MATERIALS? *Continued*

The PHL curriculum developed for the Tomato Value Chain in Nigeria can be accessed [📄here](#).



The training materials contain the following:

- Training poster on GAPs and establishment of a new tomato farm in English and Hausa languages.
 - A guide on establishment of new tomato farms, GAPs, and best practices in post harvest loss management in English and Hausa languages.
 - Flyers on PHL adoption and correct stages for harvesting.
- Visual aids and posters are important to show SHFs both the importance and benefits of the adoption of GAPs and use of post-harvest technologies. Easy-to-understand posters with simple and local language were developed for the [📄mango](#) and [📄tomato value chains](#). The WFPs training manual for improving grain post-harvest handling and storage, which includes detailed reference materials and technical guidance, PowerPoint presentations, as well as user-friendly posters for use in the field, can be found [📄here](#).
 - Where possible, training material should be translated to local language or scientific words should be communicated through locally known words to increase SHFs understanding of the subject matter.



In the tomato value chain, Tuta absoluta is a ferocious pest that attacks tomatoes. The pest attacks both tomato seedlings and mature plants. Tuta absoluta can reduce yield and fruit quality, causing up to 100 per cent yield losses in severely infested tomato crops. In Nigeria, SHFs used local words i.e. tomato ebola, and Sharon (a popular car that moves very fast), as a nickname for the pest. Trainers therefore needed to be aware of the local nicknames used to refer to this and other pests and diseases.



3 TRAINING

WHEN SHOULD TRAINING BE DELIVERED AND WHAT ARE THE KEY MESSAGES TO BE CONVEYED?

Training sessions should be conducted in line with the crop cycle. Aligning the training with the crop cycle promotes higher retention and implementation of the practices learnt. For instance, training on correct planting and spacing during the planting season allows farmers to implement the training on their farms immediately. Therefore, aligning messages to the cropping calendar will be a complementary nudge for farmers to apply knowledge from trainings for positive outcomes.



In the mango value chain in Kenya, the training activities and recommendations to SHFs were prioritized according to the phase of the crop and calendar month, and can be found [↓here](#).



In the tomato value chain in Nigeria, training was delivered during both seasons of tomato production, the wet and dry season. In plateau states, the seasons are intertwined hence the timing of delivery was different due to the climate variation. The focus of the training during each season and can be found [↓here](#).



3 TRAINING

HOW SHOULD TRAINING MESSAGES BE REINFORCED TO SUPPORT RETENTION AND UPTAKE?

In order to ensure that SHFs maintain GAPs and the use of technologies, refresher trainings should be conducted. Refresher trainings should be conducted when SHFs have the financial means to purchase and hence adopt post-harvest technologies. This is usually upon the sale of produce from their main crops. The timing of training and refresher training is thus crucial to the adoption and utilization of post-harvest technologies.



In the mango value chain in Kenya, one of the assumptions made during implementation of the initiative is that SHFs would have access to technologies and would buy these at any time in the cropping calendar. However the initiative learned that mango farmers did not reload their fruit fly traps with new baits as they did not have money before the harvest. This illustrates the importance of the timing of training and marketing, for programs, technology manufacturers, and agrodealers, to boost sales and the adoption of technologies by SHFs.

SMS messages can be sent to SHFs each month to reinforce key training messages. Examples of SMS from the YieldWise Initiative sent to mango farmers each month in Swahili can be accessed [📄here](#) and SMS sent to Agrovets each month in English can be accessed [📄here](#).



In the mango value chain in Kenya, reinforced messaging through SMS contributed to the increase in adoption of fruit fly traps reflected in the increased sales of post-harvest loss technology companies.



Mango farmers in Kenya use fruit-fly traps made from an easily available plastic container

3 TRAINING

WHO IS BEST PLACED TO DELIVER TRAINING?

The actors identified as the most effective delivery channels for training are presented below. Programs need to determine the feasibility of implementing all, one or a combination of these, based on budget, targets and the local context of the program.



Non-Governmental Organizations (NGOs) and Government Extension Staff: Field staff (from the program) or extension officers are well placed to deliver in-person training. It is important to ensure that such staff and/or extension offices come from the locality of the SHFs who are being trained, thus ensuring that SHFs are comfortable interacting with the trainers (and vice versa) and that they have the local knowledge of the challenges and experiences of the SHFs in a specific area within a country. Such training also enables the SHFs to ask for clarification on particular methods and the ability to seek out further information.

During face-to-face training, SHFs should be grouped in to small groups, as opposed to holding large training sessions. This enables SHFs to engage with the trainer at a more personal level and allows SHFs to ask clarification questions. Group training is also beneficial as SHFs have the ability to share common challenges and solutions with other SHFs in their group.



Lead Farmers: Programs should consider encouraging stellar farmers to open their own demo farms, who can be trained and offer training to other community members (Training of Trainers). As lead farmers are typically unpaid volunteers and early adopters, it is advisable that the lead farmers offer other services to SHFs such as selling of farm inputs and offering of aggregation services. This will further promote the business case for being a lead farmer, and further contribute to the sustainability of the intervention.



In Nigeria, 13,571 farmers in the cassava value chain have been trained through lead farmers who are also trained by extension officers employed by cassava processors. The Lead farmers were responsible for training of the farmers in their respective groups using the IDH developed training manuals, while extension agents provided support for them to ensure quality delivery of the trainings. The training calendar followed the cassava production cycle to ensure that the topics being covered were aligned with the activities being carried out in the field.



Agrodealer Networks: Are also active players in the delivery of training and providing solutions to problems faced by SHFs, and they act as the last-mile channel for distribution of post-harvest technologies.



In the mango value chain in Kenya, agrodealers have invested in and are sending SMS reminders to farmers for purchasing and loading of fruit fly traps.

3 TRAINING

WHO IS BEST PLACED TO DELIVER TRAINING? *Continued*



Private Actors: Specifically input providers and loss reducing technology manufacturers, can serve the role of training SHFs. Input providers and technology manufacturers are willing to invest in training of SHFs if there is strong value proposition. As such, programs should invest in forging relationships and partnering with such actors, to allow them to see the value of investing in training of SHFs, which results in SHFs adopting technologies, and results in increased profits. This will promote the sustainability of loss reducing efforts in the value chain upon the completion of such a program. This may result in crowding in from other private actors, who will also see the business case and invest in the provision of training.



Manufacturers of hermetic bags for maize in Tanzania have continued the provision of training to farmers post the YieldWise Initiative because the sale of bags contributed to their business income and strategy of working closer with the community.

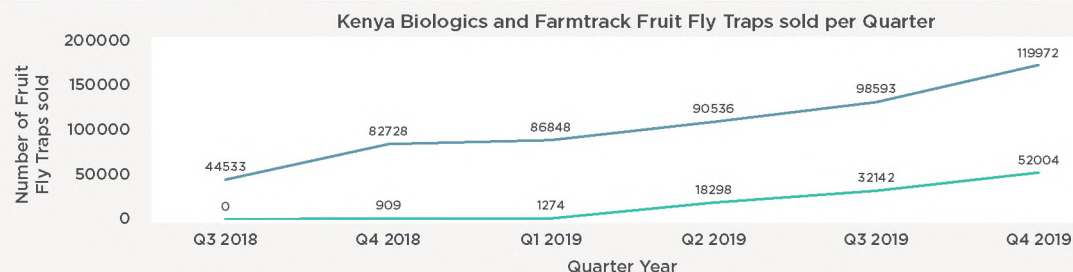


In Nigeria, East West seed, BICCO agro and other private sector partners leveraged YieldWise' farmer service centers (FSC) and farmer groups to train tomato farmers across geographies, and establish demonstration plants on GAPs and input optimization. This has expanded their market opportunity and presence and created accessibility and availability for tomato farmers.



In the mango value chain in Kenya, input providers and post-harvest technology providers have been motivated by the opportunity to engage with and directly sell to the SHF customer segment. As a result, Kenya Biologics, UPL/DECO, Farmtrack, among others, are actively training SHFs on agronomic practices across all regions where the project worked. These partners are also leveraging existing demo plots to showcase their inputs and technologies. The table below shows the number of farmers that have been trained by these private actors while the figure below represents cumulative fruit fly trap sales over quarters for Farmtrack and Kenya Biologics.

MARKET ACTOR	MODE OF INFORMATION DISSEMINATION	REGION	FARMERS TRAINED
Farmtrack	Demo	Embu	788
	Field Day	Tana River	200
	Group Training	YW Regions	2 673
	SMS	YW Regions	2 631
Kenya Biologics	Demo		378
	Field Day	Embu	631
	Group Training	Taita Taveta	379



3 TRAINING

HOW SHOULD THE BENEFITS OF GAPS AND POST-HARVEST TECHNOLOGIES THROUGH TRAINING BE SHOWCASED?

SHFs should be trained on the benefits of adopting post-harvest technologies and GAPs. Similarly, SHFs often need to see the results of implementing GAPs or technologies to adopt these themselves. Therefore, demonstration farms (or demo farms) should be used to showcase the best procedures and technologies for farming, while demonstrating the benefits and results as a result. PHL programs should work with local private partners to establish demo farms and encourage SHFs to view these plots, so they can see the impact that following best practices can have on their yields, both from a pre- and PHL perspective.



TechnoServe in Nigeria combined classroom and activity based training to ensure high adoption of GAPs. The classroom training focused on theory, principles, and knowledge sharing, while the activity based training included visits to demo farms that was aligned to the crop cycle. Hence, the lag between training and when tomato farmers commence production was minimized to prevent SHFs forgetting what they had learned.

For post-harvest technologies that can be locally made to suit the rural environment, local manufacturers should be involved in the training, so that they can demonstrate locally made technologies, for instance, solar driers, tarps, harvesting tools, and storage solutions. SHFs will also have an opportunity to ask questions in areas that clarification is needed.



A smallholder aggregation and processing plant in Kenya, which does mango processing

WHAT PLATFORMS EXIST FOR EFFECTIVELY MASS COMMUNICATING WITH FARMERS?

As SHFs are dispersed across a country, reaching each SHF individually would require a considerable investment of resources for any PHL program. To reach large numbers of people, radio and mobile are most effective. Such communication should ideally be preceded with in-person training so that SHFs are already familiar with the proposed intervention and/or technologies.



Radio

Even in the most remote communities in rural Africa, people have at least a radio. Radios serve young and old, men and women, those who are literate and those who are not. Radio presents the most effective means to provide messaging to a large audience to make informed decisions about practices that will reduce the PHL. **The following should be considered in using radio as method for training SHFs:**

- On-air call-outs to SHFs are a highly cost-effective way to include the voices of SHFs throughout all stages of a radio campaign. SHFs learn from other SHFs and the mobile phone is an excellent way to make sure their voices are included in the campaign. By calling out to SHFs, they can be reached at their convenience in their homes or fields and the cost of the call is carried by the radio station.
- Sending an SMS alert from broadcasters to listeners 30 minutes prior to a broadcast is an excellent way to encourage regular listenership of radio programs. PHL programs can collect databases of SHFs mobile phone numbers and send them SMS alerts as a way to increase listenership and foster a stronger relationship between SHF listeners and radio stations.
- On-air call-outs to experts are a cost-effective way to include a variety of expert voices in a radio campaign. Programs can air diverse voices.
- The use of Interactive Voice Response (IVR) to provide voice-based information on demand is a good method for a radio station to make its on-air information available off-air for repeat listening through a phone call.
- There are many radio stations in any locality. During the design of training programs implemented via radio, it is important to conduct research to understand which ones have high listenership from SHFs.
- Once a suitable radio station is selected, staff should be trained to be able to answer questions posed by SHFs before they are redirected to extension officers or other platforms.
- Radio is also key in the provision of pricing and market information to drive consumption of produce up and reduce PHL during glut seasons.
- The radio platform can also help anchor buyers understand challenges SHFs are facing in different stages of production, and know where to plug efforts to support SHFs.



WHAT PLATFORMS EXIST FOR EFFECTIVELY MASS COMMUNICATING WITH FARMERS?

Continued

⬇️ *Farm Radio International (FRI)* is a non-profit organization focused on using radio to help African farming communities improve their farming practices. During the YieldWise Initiative, FRI used multimedia and worked with radio partners in Kenya, Nigeria and Tanzania to develop interactive radio programs that share information about GAPs, post-harvest handling, and market tips.

The programs also connected SHFs to input suppliers and buyers and provided SHFs with the information they need to make informed decision about practices that will reduce the PHL in the tomato, maize, and mango value chains. An important contribution of the radio partners to the YieldWise Initiative was their ability to achieve scale by reaching more SHFs through radio than implementing partners are able to through their face to face interventions. Below are estimates of the potential rural adult audience reach for the different countries/value chains, where the high number of listenership especially in Nigeria is influenced by the penetration of radio in rural areas. The region has a potential listenership of 11.6 million people and two in five listeners from the baseline evaluation talked to others about the topics in the radio program.



NIGERIA: 1 413 314



KENYA: 428 250



TANZANIA: 436 207

FRI conducted a baseline study in each of the value chains in order to understand GAPs, in addition to what farmers listen to on the radio, and when they are most likely to listen to the radio. Key findings from the baseline showed that SHFs had some basic knowledge of GAPs but didn't use them due to inadequate finance to purchase the necessary tools for example, and low understanding on interpreting knowledge to practice. With this research, the program outline was developed to cater to SHFs needs.

The design of the radio programs in Kenya, Nigeria and Tanzania, including the communication objectives and key information can be accessed as follows:

- ⬇️ *Design plan for the Mango value chain in Kenya* - October 2018
- ⬇️ *Design plan for the Mango value chain in Kenya* - June 2019
- ⬇️ *Design for the Tomato value chain in Nigeria* - April 2019
- ⬇️ *Design for the Maize value chain in Tanzania* - August 2019

WHAT PLATFORMS EXIST FOR EFFECTIVELY MASS COMMUNICATING WITH FARMERS?

Continued

FRI's mobile phone interaction system, called **Uliza**, which is Swahili for “to ask”, allows for gathering and analyzing feedback and questions from radio audience members via mobile phones. Uliza was designed to encourage participatory radio by making it easier for listeners to engage with radio stations and for radio stations to visualize and interpret audience feedback.

It utilizes VOTO Mobile's IVR system and the ubiquity of basic mobile phones to enable a two-way conversation. IVR technology connects people with computer programs through voice commands and keypad inputs. It also connects SHFs with the radio stations that serve them, and to help those stations serve them better.

With Uliza, SHFs can access important messages and alerts, vote on poll questions, leave messages, and request the delivery of specific information. This allowed for the receipt of instant feedback from SHFs and collecting data every week on SHF questions, location, mapping, and pushing notifications to them.

Uliza presents data from listeners visually, making it easy for broadcasters to interpret the information and use it during broadcasts. They can air comments left in voice messages, share listeners' questions with on-the-air experts, integrate audience feedback into on-air discussions, and get feedback on radio programs.

As part of the YieldWise Initiative, FRI used the Uliza platform to allow farmers to ask questions, and collect ongoing monitoring data on behavioral change for its programs within the radio coverage regions. Listeners in the value chains mostly ask questions around production, and GAPs especially when the program is unable to answer all their questions. In the mango value chain in Kenya, the media campaign resulted in medium to high impact on knowledge, awareness and uptake of GAPs, pest management, and post harvest handling practices. Routine monitoring via Uliza also revealed areas that needed improvement such as awareness and implementation of group marketing in the mango value chain, and low implantation of protective gear with pesticide application in the tomato value chain in Nigeria.



3 TRAINING

WHAT PLATFORMS EXIST FOR EFFECTIVELY MASS COMMUNICATING WITH FARMERS?

Continued

Success story from radio training YieldWise Tomato farmers in Kano, Nigeria

Town: **Kura**

State: **Kano**

Marital Status: **Married**

Number of Children: **6**

Age: **47**



In Northern Nigeria, women are often left out of economic activities and expected to take care of the household as part of societal norms. Due to religious norms, women are also not allowed to mix with men and it is therefore not easy to find women who are part of SHFs groups. One of the women in Kano narrated her interaction with FRI where she said that her life was primarily waiting for instructions from her husband and she would receive money for the day to day running of the household management from him. She however wished to generate her own income but her spouse would limit the extent to which she could conduct business. People did not understand what she desired and her husband did not allow her to go out because he believed that she would not add any significant value to the family.

When she listened to the **FRI “Tumatur don Riba” program** and they visited her community for research, she developed interest in participation and organized a group of 6 women to start tomato farming. During harvesting, the husband agreed to support the wife and since then, he relaxed his rules about her attending training sessions. At times, her husband joins her to attend the trainings which have made her a consistent and productive tomato farmer.

WHAT PLATFORMS EXIST FOR EFFECTIVELY MASS COMMUNICATING WITH FARMERS?

Continued



Mobile Phones

Mobile phone penetration presents an opportunity for post-harvest loss programs to deliver training at scale. For example, in January 2020, there were an estimated 52.06 million mobile connections in Kenya, equivalent to about 98 percent of the population. Such a landscape therefore provides an ideal environment to integrate digital training effectively.

While SMS has the ability to provide information to a large number of SHFs, this should not be considered as the single method of training. Rather, SMS should be used by PHL programs to supplement other forms of training.

SMS should also be used for the following:

- To send invitations to meetings and training
- As reminders about dates, time and venue
- For information on any special guests or trainers
- For sales and marketing information, such as prices, specification, and the type of market and volume requirement
- Information around access to finance, such as interest rates, grace period, terms and conditions available, types of products, and financial institutions with suitable products



- As part of the YieldWise Initiative, in the mango value chain in Kenya, Farmtrack, a post-harvest technology provider, sent **24,451 SMS** to **2,631 mango farmers** to inform them of their products and time to refill their fruit fly traps via the [TechPitch bulk SMS platform](#). This has led to an increase in adoption of technologies as seen in [Page 27](#) which demonstrated increasing sales of fruit fly traps.
- As part of the YieldWise Initiative, in the mango value chain in Kenya, TechnoServe used [SMS Leopard](#) to sensitize the mango farmers on the training dates that would happen on demo plots. As a result 1,166 farmers were reached through demos.



In the tomato value chain in Nigeria, TechnoServe created an SMS line which enabled tomato farmers to text and ask questions about tomato production.



3 TRAINING

WHAT PLATFORMS EXIST FOR EFFECTIVELY MASS COMMUNICATING WITH FARMERS?

Continued

Despite the widespread access to mobile phones, in order to ensure this method of training delivery is effective, the following needs to be considered:

- Are SHFs able to charge their mobile phone devices?
- Would SHFs trust the information they receive through their mobile phones?
- In what language would farmers like to receive such information?
- Who will pay for the SMS? Initiatives that have provided information via SMS have required individual SHFs to pay a subscription fee to receive SMS alerts, therefore increasing the likelihood of use of such information if they are paying for it.



A farmer uses his mobile phone to receive information on best practices

Access to Finance



4 ACCESS TO FINANCE

INTRODUCTION

This section presents guidance regarding access to finance interventions. More specifically, it details:

- ↳ Why value chain actors require access to finance;
- ↳ The achievements of the YieldWise Initiative in access to finance;
- ↳ The constraints faced in the provision of finance to value chain actors;
- ↳ How programs can ensure farmers have access to finance;
- ↳ How programs can ensure other value chain actors have access to finance;
- ↳ The need for programs to understand which value chain actors require access to finance for post-harvest technologies;
- ↳ How should programs select partner financial institutions; and,
- ↳ What alternative models of financing work best.



4 ACCESS TO FINANCE

WHY DO VALUE CHAIN ACTORS REQUIRE ACCESS TO FINANCE?

Availability and sustainability of finance is important in agricultural value chains due to the high initial cost of investment in quality inputs and technologies required for PHL reduction. However, value chain actors, especially those located downstream, have limited access to financial services. This constrains their ability to make productivity-enhancing investments, to use technology and services, and to reduce risks.

WHAT WERE THE ACHIEVEMENTS OF THE YIELDWISE INITIATIVE?

Through the YieldWise Initiative, the following number of value chain actors were linked to financial institutions in the following value chains:



749

SHF accessed loans

\$176,606

financed

\$1,704.82

paid in insurance
to eFarms*



14 buyers linked to
financial institutions

\$1M accessed by
buyers and SMEs

109 SHF accessed loans

\$43,696 financed



43

Small and medium
enterprises (SMEs)
accessed loans

\$726,225

accessed by SMEs

\$3.1M in input loans
accessed by SHFs



Euro 934,045.46

(\$1,027,410) grant funding
provided to **6** processors

\$334,832 accessed
by **1,299** SHFs

\$262,343 total amount
of private sector
contribution

*eFarms is a digital lending platform that pools of investment from investors passionate about the agricultural sector and on-lends to preselected farms in form of inputs needed for the crops chosen.

4 ACCESS TO FINANCE

WHAT ARE THE KEY CONSTRAINTS IN THE PROVISION OF FINANCE TO VALUE CHAIN ACTORS?

The provision of finance to agricultural value chain actors is largely constrained by the following:

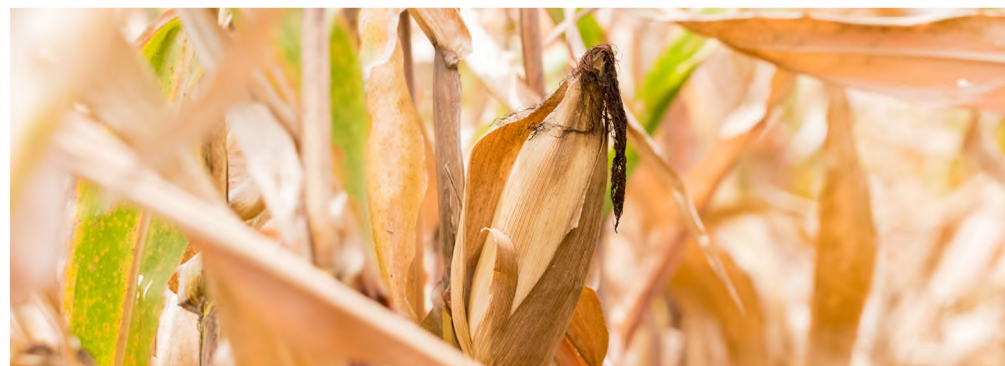
- High transaction costs of serving clients located in remote, less densely populated areas with limited infrastructure;
- High risks in agriculture (including weather, price, pests and diseases);
- Lack of trust between formal institutions and SHFs;
- Lack of collateral, especially for SHFs;
- Inadequate information on financial records and credit history; and,
- SHFs and other value chain actors are usually not aggregated, organized, or coordinated in their operations to ease disbursement and guarantee repayment.

Additionally, providing third party loan guarantees to banks to approve and disburse loans does not guarantee the immediate access and eventual repayment. During the YieldWise Initiative, less than 5,000 actors received funding through the support of the initiative. The slowed achievement of success in this pillar demonstrated the need for thought out action and early involvement of all actors in designing finance initiatives.

PHL programs should therefore design access to finance activities so as to minimize these constraints to providers in their provision of finance to SHFs and other value chain actors. For example, as discussed under the [Access to Training section](#), PHL programs should provide training on how to effectively keep records, as well as the importance of doing so. This will increase the likelihood of individual SHFs or other value chain actors accessing financing.



Pests attacking maize



Disease on maize crops

4 ACCESS TO FINANCE

HOW SHOULD PROGRAMS ENSURE *FARMERS* CAN ACCESS FINANCE?

Programs that are designing financial products targeted at SHFs should take the following in to consideration:

- During the design of the program, there is a need to conduct customer segmentation to understand the different needs for subsistence versus small or micro sized farmers. This also helps determine the financing format i.e. inputs versus cash deposit, or equity contribution capabilities and requirements that can be met by the different groups.
- Farm mapping has to be done to understand the farm's needs on inputs, and the subsequent loan amount needed. Farmers often do not know the size of their farms and often overestimate how much land they have, hence mapping is important. There is need to sensitize farmers of existing mapping technology so as to equip them with correct information to facilitate the lending process.

As part of the efforts to aid SHFs in the mango value chain by introducing digitization and monitoring, [↓Milan-Innovincy](#) has been focusing on illustrating a possible synergy between Global GAP – leading Ag standard certifying the quality of agri-products - and, the Milan-Innovincy Geodata portal. The report can be found [↓here](#).

- Programs should couple financial access with financial literacy training to promote better financial management practices. Key basic skills that SHFs needed include budgeting for production, accurate money management, bookkeeping for harvest and sales. Additionally, programs should support smallholders farmers of perishable produce to transition from subsistence to commercial production.
- Programs should explore opportunities for alternative financing for smallholder farmers and other value chain actors.



In Nigeria, the financing model adapted ensured that all aspects of the design were considered before launching the finance package. All tomato farmers were mapped to determine the size of their farms, since most farmers often overestimate this. By doing so, the program was able to determine the financing needs based on the size of the farm. Instead of giving cash to farmers, the program designed an input financing model that provides inputs based on the production cycle.

After mapping and determining the needs of the tomato farmers, TechnoServe communicates the needs to the crowdfunding partners who provide inputs to the lead farmer in an organized cluster of farmers. The inputs are stored in a secure location and released to farmers based on farm activities and needs of the crop cycle to prevent the diverting of inputs.

At harvest, Thrive Agriculture, which is a crowdfunding partner, collects tomatoes from the farmers to offset the loans, while E-Farms allows the farmers to pay in cash. Price negotiations are done based on the prevailing market prices with a slight mark up.

TechnoServe is currently working with MyCell in Nigeria to introduce liquid cash financing to farmers.

HOW SHOULD PROGRAMS ENSURE *FARMERS CAN ACCESS FINANCE?* *Continued*

- Financial products should consider the production cycle and set requirements for repayment that are informed by the crop season. Often, repayment is expected to start a month after payment is disbursed to the farmer accounts. This reduces the effectiveness of the funds, especially when finance is intended for the planting season.
- Innovative finance models can be adopted to promote access to inputs and post harvest technologies without providing cash to SHFs, and where a SHF, or a group of farmers can access input loans which are disbursed according to the production cycle.



One of the assumptions made during the implementation of YieldWise is that SHF would have access to technologies and would buy at any time in the cropping calendar. However, it became evident that maize farmers buy hermetic bags after they receive money from selling their produce. During the YieldWise Initiative, maize farmers made orders for hermetic bags during trainings conducted by the World Food Program (WFP) and Alliance for a Green Revolution in Africa (AGRA) but paid for them after harvest as an input loan.



During the YieldWise Initiative, in the tomato value chain, TechnoServe tested three farmer financing models:

Input-Output Model (Crowdfunding): As an alternative source of funds for farmers, TechnoServe partnered with [E-Farms](#) and [Thrive Agric](#). Crowdfunding has enabled the program to work with agrodealers who provide input loans to farmers, who contributed 10-20% of the equity, and then are paid back at the end of the season. This model required efforts in logistics and monitoring and was not tested in subsequent years, but revealed promise of potential viability for alternative funding sources. This financing model substantially reduced investors risk exposure through a combination of measures: activity-based input disbursement, equity contribution which elicited commitment from farmers. Yields increased from an average of 9MT per hectare to 17MT and incomes increased by an average of 47%.

One-Way Input Financing Model: The one-way input financing model was piloted with Propoor Group, a non-bank financial services provider in collaboration with Royal Blue Limited, an agricultural input supplier. They provided input credit to 20 farmers in Kaduna state with 20% equity paid upfront, and the rest paid in installments. A key challenge with this was the absence of readily available output markets for farmers and the limited capability of financial partners to finance big ticket agricultural transactions.

Out-grower Financing Model: The financial model piloted with Aldusar (a processor) had 82 farmers financed during the dry farming season. Aldusar identified the inputs required by farmers and arranged for purchase with the support from the project through provision of GAPs training. When farmers' loans were liquidated, additional harvests brought to the facility by farmer groups was paid for in full by Aldusar at

4 ACCESS TO FINANCE

HOW SHOULD PROGRAMS ENSURE *FARMERS CAN ACCESS FINANCE?* *Continued*



the prevailing market price. This model had the advantage of the ability to finance big ticket transactions through Anchor Borrowers Program and/or any other government subsidized funding programmes. However, it is limited by the plant capacity to offtake and process tomatoes in large quantities, and the lack of investment in cold storage facilities.

- Financing models should include risk exposure reduction strategies. Successful models include an equity contribution by smallholder farmers and flexible loan repayment arrangements.



In the tomato value chain in Nigeria, the program designed an equity-contribution based financing model. The program utilized technology for mapping farmers' land which allowed for accurate valuation of loan limit. The equity contribution and training on GAPs for farmers reduced financial risk for investors. In the first year, where the equity contribution was 10%, it was difficult to enroll 500 farmers. However, once farmers witnessed the impact of the input financing, many wanted to enroll in the second year where the equity contribution had grown to between 15-20%. Farmers were saving to raise the equity and access credit opportunities. In this model, instances of non repayment and default were reduced significantly.

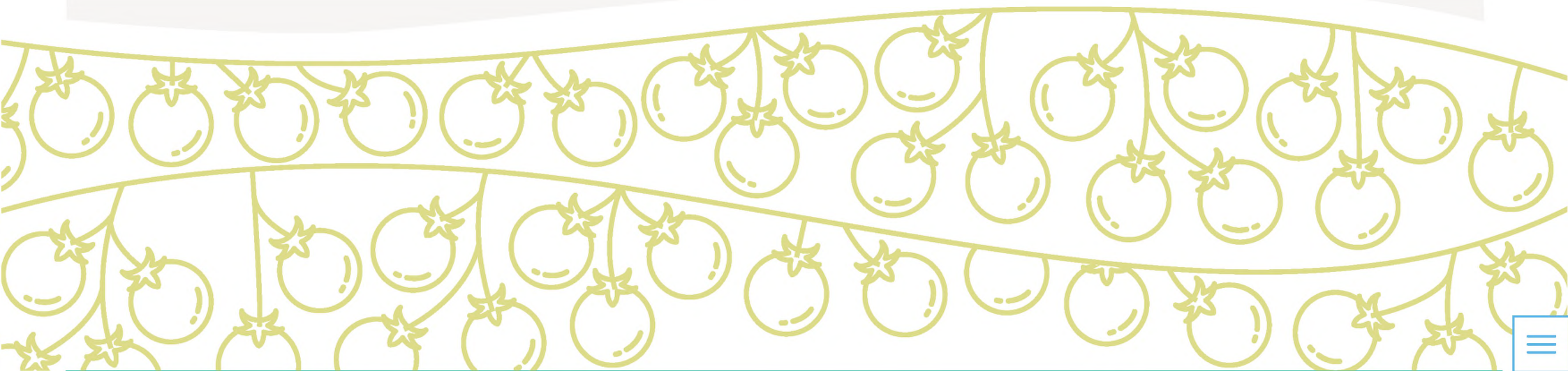
- One proven tool to increase SHF resilience is crop insurance, which helps SHFs overcome poor harvests and adapt to a changing climate. Therefore, where possible, the provision of access to finance should be bundled with crop insurance.
- The bundling of goods will also provide the business case for financial institutions which incur large costs in managing small loans to SHFs. Such loans need a tripartite agreement between the financial institution, an input provider or aggregator who has trusted SHFs in their network, and the SHFs.

4 ACCESS TO FINANCE

HOW SHOULD PROGRAMS ENSURE *FARMERS CAN ACCESS FINANCE?* *Continued*

Other key recommendations to improve lending models to smallholder farmers include the following:

- Financial partners should either develop an effective logistics system for off-taking produce or contract off-taking to a third party to avoid a logistics breakdown.
- Financial partners should make provision for performance based non-monetary incentives for lead farmers who coordinate farmers activities, off-taking and loan repayment.
- Introduce non-monetary incentives to reward credit-worthy farmers groups and/or producing communities.
- Especially for fruits and vegetables, farmers and intervention communities participating in agricultural financing schemes should not be too far apart. This is because harvest is done 5-10 times and cost of transportation is constant regardless of volume of produce transported.
- Finance should be tailored or designed around selected service providers who will be accountable for recommended farmers and incentivized on the basis of performance.



4 ACCESS TO FINANCE

HOW SHOULD PROGRAMS ENSURE *OTHER VALUE CHAIN ACTORS* CAN ACCESS FINANCE?

- Banks typically have little in-house technical capacity to assess and develop agriculture investment products. Therefore, PHL programs should work with banks and help them develop their internal capacity to develop agro-financing products that suit SHFs and other value chain actors, including agri-businesses.
- Initiatives should also work with processors, offtakers, input sellers, manufacturers and traders of post harvest technologies, and other value chain actors to understand how to position themselves and be marketable so as to access loans. There is a need for technical assistance to assist value chain actors to develop loan proposals and business plans for quick processing of loans.



During the YieldWise Initiative, in the maize value chain, AGRA partnered with [Equity Bank](#) and [Tanzania Postal Bank \(TPB\)](#) to implement a Revolving Fund. However, off-takers and processors were delayed in putting together the necessary documentation required for the loan to be appraisal by the bank. These included certification from National Environment Management Commission, building permits from government and National Construction Authority (NCA), and proforma invoices from suppliers. The ability of such actors to put together this documentation required by the bank was limited. Additionally, such actors typically have limited capacity to write business plans and therefore have to outsource for this service which takes both time and financial resources.

- PHL programs should initiate partnerships and broker agreements between financial institutions and strategically positioned market actors - including traders, traders' association, exporter and processors - with the aim of unlocking barriers to accessing finance and encourage the development of tailor-made financial products that enable actors to innovate, invest for the expansion of operations and increase equipment acquisition for light-to-medium processing.



During the YieldWise Initiative, TechnoServe established the AKMT, through which member traders leveraged their numbers and influence to participate in, and contribute towards, policy, developing industry standards and best practices. TechnoServe partnered with the [Agricultural Finance Corporation](#), a Government Development Finance Institution (DFI), to develop a product for mango traders. The new product was an unsecured loan where mango traders would be able to access funds using LPOs. The new unsecured loan product was custom-made for AKMT traders to access funds using local purchase orders (LPO). This leveraged the tripartite agreement signed between formal buyers (Kevian, Premier Foods, and Sunny), AFC and AKMT. The agreement allowed for the transfer of finances from the structured buyers to AFC then to individual AKMT members with LPOs. To date, four AKMT traders have been able to access finance amounting to KES 5.5 million from the AFC for capital expenditure (CAPEX) and operational expenditure (OPEX).

4 ACCESS TO FINANCE

HOW SHOULD PROGRAMS ENSURE *OTHER VALUE CHAIN ACTORS* CAN ACCESS FINANCE? *Continued*

- PHL programs should empower market actors to directly engage with financial institutions so as to seek information on financial products that suit their respective needs.



AKMT held a pre-season Annual General Meeting (AGM) where 41 members attended, and various financial institutions were invited to pitch their products. Among them were the following:

- Equity Bank, who developed a product to finance food and agriculture for working capital. The repayment is flexible to be in tune with the seasonality of different crops such as mango. Eight traders have already received the finance from the bank with KES 3.3 million disbursed. The loan mainly financed OPEX.
- Jamii Bora, who pitched a product called Daraja Loan with monthly repayment installments. The Daraja loan is a facility meant to provide clients with operating capital as they wait for their debtors to pay them.

- During the engagement with financial service providers, programs should sign a funding agreement during early stages of program implementation so as to prevent any delays in promoting access to finance, especially given the bureaucracy in large financial institutions. Bureaucratic structures are more prevalent in large institutions which slow down decision making, reduces flexibility of implementation, and can often lead to inefficiencies. Complicated decision making systems result in delays in implementation of key program aspects. The agricultural season, on the other hand, has to continue despite slowed decision-making in financial institutions, which can slow a program's progress in providing access to finance. This also prevents actors from achieving maximum outcomes should they have accessed financing.



One of the assumptions at the start of the YieldWise Initiative was that farmers would access credit from banks if it was made available. In Nigeria, the African Development Bank (AfDB) had USD 50 million to be dedicated towards lending to farmers and agricultural actors in the cassava value chain. However, no bank or financial institution was willing to bear the risk of currency fluctuation. The decision-making process was also stalled due to the arising challenge in forex risk mitigation. The financing initiative was therefore halted due to the risk of receiving the loan in dollars and on-lending in Naira.

4 ACCESS TO FINANCE

WHICH VALUE CHAIN ACTORS REQUIRE ACCESS TO FINANCE FOR *POST-HARVEST TECHNOLOGIES*?

- While PHL programs may focus on the provision of access to finance for SHFs, with the intention of accessing finance for the adoption of new technologies, it is important to first learn whether farmers can afford such technologies without loans during the design of a program.
- Similarly, it is important to understand which other value chain actors, such as traders and Farmer Based Organisations (FBOs), need access to finance. Such actors are more likely to require access to finance to cover high cost technology such as solar-drying equipment and cooling systems. Further, many aggregators (traders) need access to finance for working capital.
- Access to finance is also required by agrodealers, cottage processors and exporters in order for them to take competitive advantage of market opportunities and technologies. Financing can enable such companies to 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).
- PHL programs should consider the above in their design.



4 ACCESS TO FINANCE

HOW SHOULD PROGRAMS SELECT PARTNER FINANCIAL INSTITUTIONS?

The selection of partner financial institutions influences the success of PHL programs. Specifically, it is important for programs to select financial institutions which:

- Are already serving the actors that the program is targeting and are willing to serve these actors. Such actors have already built credibility, trust and have an existing relationship with processors, traders, and farmers. As such, those in need of financing do not have to move to a new financial institution altogether, which can be a tedious process in some contexts.
- Are easily accessible to the target market. The financial institution should have either branches, or agents located close to their villages and town centers. Long distances to financial institutions have been cited as one of the inhibitors to accessing financing, especially for SHFs since this increases the transaction costs. On the institution's side, proximity to the loan client allows them to access and follow up with clients for check-in and/or repayment visits.
- Can develop innovative financing models to promote higher uptake of financial products. Most lending institutions have stringent requirements which most businesses are not able to meet, and they chose to seek other forms of financing.
- Do not offer financing that is restricted to one product since most businesses, like agrodealers, trade in multiple farmer inputs.

The example below demonstrates a case in Tanzania where the selection of the partner financial institution was not practical because of lack of the key considerations.



During the YieldWise Initiative, AGRA partnered with Equity Bank and TPB to implement a Revolving Fund, for SMEs to access loans for post-harvest technologies including hermetic bags, silos, cocoons and fabrication of metal silos. Additionally, the Tanzania Agriculture Development Bank (TADB) was given a matching fund for anchor buyers and processors to invest in Post-Harvest Handling equipment such as silos, milling machine, threshers, dryers and weighing bridge to enable them to buy more maize from farmers. All the borrowed funds were limited to PHL technologies whose demand and margins did not justify taking up the SME loans so most borrowers wanted their whole business process to be financed. The absorption for the revolving fund was very low and only about 15% of the money was borrowed. One of the banks selected did not have extended countrywide coverage and was hence unreachable to most agrodealers. Additionally, the funds were available on usual bank lending rates of about 17% p.a. on reducing balance. SMEs rejected this due to the uncertainty of selling all post harvest technology by the end of the season.

Through the market facilitation model, initiatives are able to spur the demand of financing from institutions, modeled to suit needs of market actors. For instance in Kenya, offtakers in the mango value chain were able to access loans once financial institutions understood forward contracts and developed a loan product for them. Additionally, SMEs in Tanzania have been able to access loans based on agreements with offtakers of the produce.

4 ACCESS TO FINANCE

WHAT ALTERNATIVE MODELS OF FINANCING ARE AVAILABLE?

Mainstream financial institutions need not be the only source of finance for value chain actors. Farmers and value chain actors need financing models that:

- Have favorable interest rates;
- Finance different stages of production or business processes;
- Provide patient financing that consider the crop production cycle.

The Anchor Borrower Program (ABP) model was implemented in the cassava and tomato value chains during YieldWise. The Central Bank of Nigeria (CBN) launched the program in 2015 to create a linkage between anchor companies involved in the processing and SHFs who require key agricultural inputs and commodities. The ABP addresses key challenges in access to finance especially for farmers who often cannot meet formal institution requirements and are unable to start repayments immediately after accessing the loans. The ABP ensures the provision of farm inputs in-kind and cash (for farm labor) to SHFs to boost production of produce, stabilize input supply to agro-processors and address the country's negative balance of payments on food. At harvest, the smallholder supplies his/her produce to the agro-processor (anchor) who deducts the loan, and pays the remaining cash equivalent to the farmer's account. The infographic below summarizes ABP.



4 ACCESS TO FINANCE

WHAT ALTERNATIVE MODELS OF FINANCING ARE AVAILABLE? *Continued*



Prior to the implementation of the ABP in the tomato value chain, the Kano state government developed a financing scheme for tomato farmers. The scheme experienced high default rates: out of 4000 farmers who accessed financing, only 3 repaid their debt. The high default rate was partially because farmers were aware that they were borrowing funds that were backed by the government, and the implications of default would therefore not be dire for them. This however resulted in private sector actors shying away from financing farmers, or where they provide funding, stringent requirements are set which farmers are often unable to meet.



Given the learnings from the initial financing scheme, Dangote Tomato Processing Ltd implemented the ABP by purchasing products from farmers who were registered under the program. The Federal Government under the ABP had register 10,000 tomato growers to benefit from the intervention during the dry season farming. To further boost supply and make Nigeria self-sufficient in tomato production, the company inaugurated a N2.8 billion (US\$7.6m) greenhouse nursery in January 2020 to supply tomato seedlings to farmers. The program also requires the SHFs to sell directly to Dangote to ensure that the loan amount is recovered, instead of requiring cash payment from the participants.

One of the challenges faced by Dangote in the administration of such farming was side-selling, which is addressed in the [📁 Market Linkages section](#). Additionally, the logistics costs of transporting tomatoes from farms located further from the factory made it difficult for the factory to uptake from farmers located further away making it economically nonviable. Despite this, the company was looking to add more clusters of farmers to supply tomatoes and sustain the production of tomato paste.



WHAT ALTERNATIVE MODELS OF FINANCING ARE AVAILABLE? *Continued*



Several financing schemes have also been run with different levels of success in the tomato value chain in Nigeria:

- CBN through Nigeria Incentive-Based Risk Sharing System for Agricultural Lending, (NIRSAL) is currently implementing learning from previous phases of ABP to fine tune the current intervention. Additionally, the CBN is leveraging learnings from implementing partners such as TechnoServe to adjust its approach. For example, the Kano branch of CBN is interested in financing wet season production of tomatoes using contiguous lands.
- The commercial agricultural credit scheme (CACS) was established to fast-track the development of the agricultural sector; enhance national food security; reduce the cost of credit in agricultural production; increase national output; generate employment; and raise the level of foreign exchange earnings in Nigeria. The fund was available to participating banks to finance commercial agricultural enterprises at a maximum interest rate of 9 per cent. Additionally, each State Government could borrow up to N1.0 Billion (USD 2.746M) for on-lending to farmers' cooperative societies and other areas of agricultural development provided such initiatives/interventions are in line with the objectives of CACS. The fund released N407.362 billion (USD 1.12B) to 487 projects (436 valued at N327.362 billion (USD 900M) to private projects while 51 valued at N80.0 billion (USD 220M) to State Government Projects) by the end of 2016.
- Majority of commercial banks in Nigeria also have different agricultural schemes. For instance, the Union Bank of Nigeria (UBN) and United Bank for Africa (UBA) developed the Agriculture Strides was successful in providing below single digit interest rates through credit products. A key obstacle to growth of agriculture finance schemes is high interest rates and which bar most value chain actors from accessing financing. The ABP and CASC facility are therefore more affordable for SHFs than loans from commercial banks.



Access to and use of Post-Harvest Technologies



5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

INTRODUCTION

This section presents guidance regarding post-harvest technology interventions. More specifically, it details:

- ↳ Why post-harvest technologies are important;
- ↳ The achievements of the YieldWise Initiative in post-harvest technologies;
- ↳ The technologies that are most relevant for the tomato, maize, mango and cassava value chains;
- ↳ How the adoption of post-harvest technologies should be promoted; and,
- ↳ What discourages the use of post-harvest technologies and how can these be mitigated.



Mango harvesting



PICS storage bag



Cassava bag

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

WHY DO VALUE CHAIN ACTORS REQUIRE ACCESS TO POST-HARVEST TECHNOLOGIES?

Technologies play an important role in PHL reduction. There are a wide range of post-harvest technologies that can be adopted to improve losses throughout the process of pre-harvest, harvest, cooling, temporary storage, transport, and handling. 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, such as the crates which can be used for any tree fruit or fruity vegetable.

WHAT WERE THE ACHIEVEMENTS OF THE YIELDWISE INITIATIVE?

Through the YieldWise Initiative, SHFS and value chain actors were linked to different post harvest technologies across the following value chains:



8 SMEs selling post-harvest technologies
15,670 SHFs used post-harvest technologies
30,000 Reusable Plastic Crates (RPCs) purchased by the RPC association
30 percent of the SHFs used ZECC

Additionally: The first cold chain association for West Africa was seeded. For more information, [download the Report](#) on the challenges and opportunities in creating a Nigerian cold chain development association.



123,596 fruit fly trap baits were used
23,622 complete fruit fly traps kits, and
24,758 fruit fly trap containers were sold
This accounts **29%** of mango farmers in Kenya, covering **22%** of the total mango acreage in Kenya.



Over **104,500** units of hermetic bags were distributed by SMEs
672 silos were sold
11,134 tarpaulins were sold
214 farmer organizations received:
234 digital weighing scales,
860 tarpaulins,
229 moisture meters

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

WHAT TECHNOLOGIES ARE MOST RELEVANT IN THE MAIZE VALUE CHAIN?



Post-harvest technologies that should be used to decrease crop losses for the maize value chains and their suppliers, include, but are not limited to the following:

HERMETIC BAGS AND COCOONS

Bags that preserve cereals and pulses without the use of pesticide dust. The hermetic grain storage bags are made of an outer Woven Polypropylene (WPP) bags and the inner polythene liners that cuts off oxygen to weevils and other pests. The inner liner also blocks moisture reducing the risk of aflatoxin contamination.

Types include: Purdue Improved Crop Storage Bags; Agro Z Bags; Super Bag; Zero Fly Bags

PROVIDERS OF TECHNOLOGY

↓ *Pee Pee Tanzania Limited* (PPTL) (PICS Bags)

↓ *AtoZ Textile Mills* (Agro Z Bags)

↓ *GrainPro* (Super Bag and Cocoons)

↓ *Vestergaard* (Zero Fly Bags)

TARPAULINS

A heavy-duty waterproof cloth, originally of tarred canvas that are used for the purposes of drying maize under the sun.

PROVIDERS OF TECHNOLOGY

↓ *AtoZ Textile Mills*

SILOS

A structure made of metal or plastic used to store maize and other grains. Silos range in size and can be sourced for maize storage depending on farmer's needs, to store maize for up to 18 months.

Silos have the added advantage of protecting the produce from rodents and rats.

PROVIDERS OF TECHNOLOGY

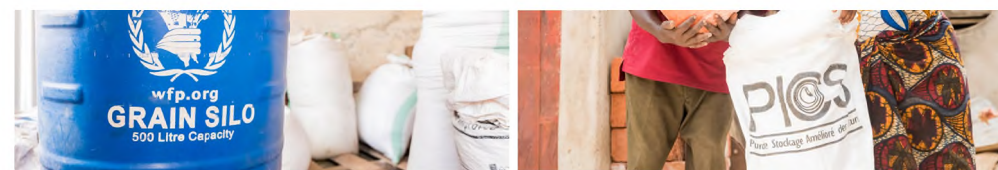
↓ *Intermech Engineering Ltd* (Metal Silos)

↓ *Smileplast* (Plastic Silos)

↓ *Cimbria*

MOISTURE METERS

Moisture meters allow for the measurement of the moisture level in the grains harvested by SHFs in a group and help them observe quality trends and prevent storage losses.



Silo

PICS bag

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

WHAT TECHNOLOGIES ARE MOST RELEVANT IN THE CASSAVA VALUE CHAIN?



Post-harvest technologies that should be used to decrease crop losses for the cassava value chains and their suppliers, include, but are not limited to the following:

CASSAVA STORAGE BAGS

Storage bags of one tonne capacity that are ideal for processors to prevent the deterioration of cassava root.



Cassava storage bags

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

WHAT TECHNOLOGIES ARE MOST RELEVANT IN THE MANGO VALUE CHAIN?



Post-harvest technologies that should be used to decrease crop losses for the mango value chains and their suppliers, include, but are not limited to the following:

DRYERS

Machine that uses solar or electricity to dehydrate mangoes and dry them in order to increase their shelf life.

TARPS

Large plastic covers/surfaces used to protect mangoes from weather effects including rain, moisture, or direct sunlight.

FLY TRAPS

A container with chemicals like bactrolure or metarhizium anisopliae ICIPE 69 that attracts fruit flies and eventually kills them, either directly by chemical exposure or through secondary transmission to other fruit flies.

PROVIDERS OF TECHNOLOGY

📍 [Kenya Biologics](#)

📍 [Farm Track Consulting](#)

CRATES

Plastic rectangular containers that protect/preserve quality of mangoes by reducing impact damage during transport.

PROVIDERS OF TECHNOLOGY

📍 [Agro Z](#)

COLD STORAGE

Technologies which slow the deterioration of mangoes while preserving quality. There are a diverse range of options that exist, including low-cost cold storage technologies to boost SHFs resilience and income.

For example: The charcoal cooler, which can be constructed just like a house, but its walls, which are made of charcoal, are sandwiched by chicken wire mesh; and, the zero energy brick cooler, which can be constructed of bricks – a double brick wall (inner and outer wall) with sand in between the walls.

PROVIDERS OF TECHNOLOGY

Locally constructed using locally available materials. The construction/fabrication of such technologies, including the materials required can be found [📍here](#).



5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

WHAT TECHNOLOGIES ARE MOST RELEVANT IN THE TOMATO VALUE CHAIN?



Post-harvest technologies that should be used to decrease crop losses for the tomato value chains and their suppliers, include, but are not limited to the following:

RAFFIA OR PALM BASKETS

Woven baskets used for the bulk packaging of tomatoes for transportation by road. Raffia baskets contribute to loss of tomatoes during transportation.

PROVIDERS OF TECHNOLOGY

Raffia Baskets Traders Association

SOLAR DRYERS

Wire mesh, tarps, etc that is used to create a drying table for sun dried tomatoes.

PROVIDERS OF TECHNOLOGY

Locally sourced from crafters



ZECC for tomatoes

CRATES

Plastic rectangular containers that protect/preserve the quality of tomatoes by reducing impact damage during transport. These are stackable and/or collapsible.

PROVIDERS OF TECHNOLOGY

📍 [Celplas Industries Limited](#)



Tomatoes in a crate

EVAPORATIVE COOLING CHAMBERS

Non-energy reliant cooling chamber that relies on the principle of evaporative cooling. Cooling chambers can reduce temperature to between 10 and 15 degrees Celsius. Morning and evening watering of the structure is important to keep the moisture content constant.

PROVIDERS OF TECHNOLOGY

Locally constructed using locally available materials. Additionally, best practices for producing and using evaporative cooling chambers and clay pot coolers developed by MIT Design Lab can be found in [📍here](#).

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

HOW CAN THE ADOPTION OF POST-HARVEST TECHNOLOGIES BE PROMOTED?

In order to encourage adoption of post-harvest technologies, programs should take the following into consideration:

SHFs must be convinced of the return on their investment. SHFs often lack the necessary capital required to invest in post-harvest technologies. This therefore requires linkages to a reliable market that will provide a fair price for the product's quality. When SHFs receive prices that do not reflect the efforts made from the use of post-harvest technologies, they are discouraged from adopting the practices in the longer term.

Some techniques that have proven return on investment to SHFs include:

- Selling technologies at discounted prices for farmers to try at home and see the value in purchasing more;
- As discussed under the [Access to Training section](#), setting up demonstration plots which show use of technologies and the resulting harvest and impact; and,
- As discussed under the [Access to Training section](#), training farmers to keep track of their financial records, including the amount of money received from the sale of their produce, aids in convincing farmers of their return on investment in post-harvest technologies.
- Using farmer testimonials to encourage other farmers to adopt technologies.

SHFs need to be trained on the benefits of adopting technologies. SHFs need to be educated on the benefits of adopting post-harvest technologies in order to encourage their adoption. As discussed under the [Access to Training section](#), demo-plots allow farmers to be educated on the tangible benefits of the use of GAPs and post-harvest technologies, by observing for example, the size of a fruit, its color, and in some cases the quantity produced in a certain acre and/or tree.



Without access to post-harvest technologies, mango farmers in Kenya would harvest mangoes by shaking the trees to drop the fruit, compromising the quality due to bruising as they were caught or, worse, fell to the ground.



In the maize value chain in Tanzania, the use of hermetic bags meant increased food availability at the household level, controlled timing of crop sales, and as a result, an improvement in household income. Farmers were able to store their produce for a long period of time without being infested by pests and without use of chemical pesticides.

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

HOW CAN THE ADOPTION OF POST-HARVEST TECHNOLOGIES BE PROMOTED?

Continued

The examples show how farmers can fetch higher prices from the sale of their produce through the use of post-harvest technologies and the adoption of GAPs. As discussed under the [Access to Training section](#), training farmers to keep track of their financial records, including the amount of money received from the sale of their produce, also allows farmers to observe increases in profits, and thus will be educated on the financial benefits of their use of post-harvest technologies.

Programs should promote technologies that can be used by farmers for more than one crop. For example, technologies that are used in the maize value chain can be adopted for other crops such as beans, soy beans, pigeon pea, green grams and other legumes. This should be put into consideration to increase uptake of post-harvest technologies that are introduced through a program.

Affordability of post-harvest technologies should be considered during program design to ensure continuous farmer buy-in. Programs should focus their efforts on promoting the technologies that are affordable to farmers and therefore are more likely to be adopted. Additionally, as discussed under the [Access to Finance section](#), programs should facilitate relevant access to finance for other value chain actors to be able to adopt more costly post-harvest technologies.



In the maize value chain in Tanzania, plastic and metal silos were an expensive technology and were therefore not as readily taken up in comparison to hermetic bags. This was reflected in the divergence in the uptake of different post-harvest technologies amongst maize farmers, where farmers purchased 104,500 units of hermetic bags and only 672 silos. It was reported that 70% of the farmers did not have money at the time they were offered the silos for purchase.

Farmers must be able to access post-harvest technologies. The technologies that farmers have been exposed to through training must be accessible and supplied by local agro-dealers. The involvement of technology distribution companies aids in the promotion, training and establishment of distribution channels for technology and thus faster adoption by farmers. As access to post-harvest technologies require last mile efforts to ensure that demand in remote areas is met, programs should partner with manufacturers of these technologies who can play a role in their marketing and distribution.

As discussed under the [Access to Training section](#), when manufacturers are present during training sessions this means that farmers can either purchase or place orders for technologies after their initial exposure. **Manufacturers of technologies e.g. hermetic bags need to do more on training to raise awareness of the farmers using these technologies.** Farmers need to see the differences between using the promoted technologies versus the technologies that they have been using.

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

HOW CAN THE ADOPTION OF POST-HARVEST TECHNOLOGIES BE PROMOTED?

Continued

For instance, maize farmers need to see the advantages of using double-lined hermetic bags versus the normal gunny bag without the lining. Manufacturers will need to invest more initially which is inevitable for raising awareness on the use of technologies.

- There is opportunity for manufacturers to engage and work with well organized farmer organizations and using agreements, the FOs can work as agrodealers/agents that sell and promote these technologies. By doing so, the technologies will be easily accessible to the majority of beneficiaries within their localities without necessarily going far to fetch them.

It is important to consider the logistical constraints and end-user needs in the design of the post harvest technologies, to ensure higher adoption.

Key logistical constraints to be considered include the availability of transport in the access and/or use of the technology, ease of access to technical support in case of breakdown, and supporting infrastructure such as electricity for operating the technologies.

The government is a key stakeholder in the development and provision of the necessary infrastructure such as road networks and electricity. Programs should therefore engage national and local governments in the initial stages of a program, to not only increase buy-in, but also to promote awareness.



At the start of the YieldWise Initiative in the tomato value chain in Nigeria, cold chain solutions were thought to be key to reducing PHL. The project team dedicated resources to the promotion of cold chain solutions to extend the life of harvest and prevent losses. These were however not affordable and readily available for farmers, hence the adoption was very low. The team had to use adaptive management techniques which sought alternative ways to meet the program's objectives based on the information that the proposed solution was not relevant for farmers. This led to the program's focus of promoting and working with cottage processors to offtake tomatoes and increase farmers' incomes especially during the dry season when there is a market glut. The program also promoted the use of a ZECC for extending the shelf life of tomatoes especially during the dry season. ZECCs are built using locally available materials and do not need power to run and are therefore more favorable for program farmers. Due to the availability of construction materials and low maintenance costs, dry season use of ZECC increased from 0.6% at baseline to 30% in 2019.



Tomatoes in ZECC

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

HOW CAN THE ADOPTION OF POST-HARVEST TECHNOLOGIES BE PROMOTED?

Continued

Programs should consider promoting technologies that are locally available in the countries they are operating. If such technologies are manufactured locally, they may be more affordable to farmers. Alternatively, programs should facilitate opportunities for local manufacturing.



In Tanzania, plastic silos for maize are not available in the local market, and are imported from Uganda and the price of US\$110 is too high for farmers.

Programs should consider the practicality of technologies when introducing these to farmers. This includes the ease of using the technology, the technology's application to multiple crop production stages or value chains, and the availability of storage for the technology when not in use. The technologies must be able to be practically used and/or stored, not only to encourage adoption, but also continued use to result in impact for farmers. A customer journey map of the mango farmer in Kenya can be found [↓ here](#).



An innovation challenge was launched by the YieldWise Initiative in the cassava value chain in Nigeria to encourage the development of a technology that would increase the shelf life of cassava and would be a 'silver bullet' solution. The challenge was successful where the storage bag technology adopted was able to increase the shelf life from 48 hours to 8 days. The bag was already in use in Latin America and was therefore a transferable solution. It was however not relevant to processors because it was very heavy and needed a machine to lift the cassava into the bag. Additionally, the bags only have a volume of one tonne but a truck carries 30 tonnes so a processor would need about thirty bags per truck, all lifted by a forklift. Therefore, while this was a good solution, it was not practical for cassava processors.



Farmers in Tanzania prefer plastic silos to metal silos because of the following reasons:

- (i) plastic silos are easier to use;
- (ii) plastic silos can be used for other purposes including water storage; and,
- (iii) plastic silos can be kept inside farmers houses while metal silos have to be kept outside.
- (iv) metal silos were not readily available as the technology had to be imported from Uganda

For future initiatives, this kind of challenge could be resolved by linking the program to Small Industries Development Organization (SIDO) and Vocational Education Training Authority (VETA), which are government Institutions, so that the technologies could be locally fabricated in local standards.

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

HOW CAN THE ADOPTION OF POST-HARVEST TECHNOLOGIES BE PROMOTED?

Continued

When introducing new technologies, programs should prevent disruption of employment in the value chain.

Programs should focus on empowering stakeholders through capacity building to make the necessary shifts to improved, formalized operations.



- Raffia basket dealers play a vital role in the tomato value chain in Nigeria. They provide support to traders and farmers moving tomatoes from farms to markets across the country. They also provide baskets on credit to these actors every season. During the YieldWise Initiative's implementation in Nigeria, there was significant resistance from basket dealers due to fear that adopting crates, one of the post-harvest technologies encouraged by the program, may disrupt or negatively impact their livelihoods. However, this perception is changing through consistent awareness campaigns for about 4 months with leaders of basket associations, undertaken by YieldWise Nigeria and its partners. The raffia traders are being transitioned to join RPC associations, where they are encouraged to transition to selling RPCs because baskets will eventually be phased out.
- Two raffia trading association have transitioned into the crates business for leasing to traders during harvest periods. They are in the process of buying a truck that will facilitate the transport of tomatoes to other regions, and return of crates and other goods to the North. This will solve a key challenge in the use of RPC since the main challenge is creating logistics to accommodate the returning of empty crates.
- TechnoServe facilitated a partnership agreement between RPC associations and a manufacturer to implement an incentive based system for the purchase of crates. The association receives N200 (USD 0.50) for each crate purchased, and with this, the RPC association has been able to purchase a truck at virtually no cost. The association has also set up a depot in Lagos to reduce the handling costs of moving produce from one market to another hence preventing further produce loss.
- While targeting basket dealers may not have presented the best logistical option for the value chain, this approach was necessary and needed to be promoted simultaneously with other logistics solutions, such as cold chain options.



5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

HOW CAN THE ADOPTION OF POST-HARVEST TECHNOLOGIES BE PROMOTED?

Continued

Programs should consider influencing other value chain actors such as traders and processors in the adoption of technologies.

Additionally, this should be coupled with policy influence to ensure that market actors are adopting the use of post harvest technologies.



Once market actors in the tomato value chain in Nigeria such as traders and processors create a demand for tomatoes harvested in crates and offer a better price for it, farmers are more likely to purchase crates to meet quality demands.

Additionally, the city of Lagos instituted a regulation to prevent the sale of tomatoes in raffia baskets in the major markets. Although this is not currently fully implemented, the Nigerian Business Group is lobbying to push for the implementation of the regulation, which will result in higher loss prevention in markets.

In order to ensure that post-harvest technologies are readily available, and in some cases, are affordable, programs can encourage the development and use of fabricated tools using locally available materials so as to ensure local solutions to challenges.



For example, in the picture on the left, a fabricator in Tharaka Nithi county in Kenya holds up fabricated harvesting tools for Mangoes. Adding foam to cushion the bottom of the basket is a further upgrade (see the fabricators right hand), and prevents damage when the mangoes fall in to the basket.

In Tanzania, the YieldWise Initiative partnered with HELVETAS who trained local artisans to fabricate metal silos.

At the same time, with the local fabrication of post-harvest technologies, there needs local/regional standards and specifications to ensure quality post-harvest technologies are released into markets.

5 ACCESS TO AND USE OF POST-HARVEST TECHNOLOGIES

WHAT DISCOURAGES THE USE OF POST-HARVEST TECHNOLOGIES AND HOW CAN THESE BE MITIGATED?

In general, high prices for post-harvest technologies discourage their adoption.

Some of the high prices are as a result of the following:

- Agrodealers (who are willing to act as agents for the manufacturers and distributors by consolidating orders from SHFs) add their profit margins to the sale price of technologies, which results in prices different from the introductory manufacturers' price.
- Government's taxation policies that, for example, impose taxes on some of the post-harvest technologies or the materials used to manufacture them. In Tanzania, the government has a tax on plastic which is the raw material used to manufacture plastic silos. Without distinguishing of end product in taxation, manufacturers pass on the tax to the consumer which is reflected in the high silo prices.

Programs should engage government to inform policy and in order to avoid ad hoc policy making which often negatively affects SHFs and their access to and use of post-harvest technologies.

Lack of knowledge or the proper know-how can also mitigate the impact of post-harvest technologies, thus discouraging and/or limiting their use by SHFs.

Therefore, as discussed under the [Access to Training section](#), the provision of training is an important factor for the adoption, and encouragement thereof, of GAPs and post-harvest technologies. The training delivered should be practical and activity oriented for better results on adoption. SHFs are more likely to adopt a new innovation if they see themselves benefiting from the promoted technologies.

During the implementation of the YieldWise Initiative in Kenya, mango farmers cited that it is counterproductive for them to put the fruit fly traps in their farms because they believe the traps attract fruit flies from other farms. This illustrates a potential misnomer that should be addressed through training, and demonstrates the importance of training in the adoption of post-harvest technologies.

Aggregation



6 AGGREGATION

INTRODUCTION

This section presents guidance regarding aggregation interventions. More specifically, it details:

- ↳ Why aggregation is important and what need it meets;
- ↳ The achievements of the YieldWise Initiative in aggregation;
- ↳ The key actors in produce aggregation that should be part of the design process;
- ↳ How aggregation centers should be established;
- ↳ Where aggregation centers should be located;
- ↳ How aggregation centers should be run; and,
- ↳ Where SHFs should sell the aggregated produce.

WHAT IS THE NEED FOR AGGREGATION?

Aggregation is the first step in marketing. Relatively small-scale supplies from individual farms need to be economically transported, sorted, processed, and stored by processors, wholesalers, exporters and retailers. The aggregation of produce reduces the costs of collecting produce by the traders as a result of the smaller distance and through the assurance of volumes.

Producer Organisations (PO) and cooperatives can take many forms, but those studied are characterized by: ownership and control by the producers i.e. SHFs, function as rural businesses with commercial aims, and engage in collective marketing. **For SHFs, aggregating through POs can potentially:**

- Reach new markets, as pooling produce creates bulk supply which is attractive to buyers;
- Improve the price received for produce (or reduce costs of farm inputs), through economies of scale, better market information and negotiation with buyers, and sometimes through collective storage;
- Offer members access to finance, inputs and technical assistance to improve production;
- Add value to the product, for example through processing and packaging;
- Coordinate production of a new, specialized commodity that requires specialized knowledge and inputs; and,
- Act as a political voice for SHFs, advocating for more favorable policies.

6 AGGREGATION

WHAT WERE THE ACHIEVEMENTS OF THE YIELDWISE INITIATIVE?

Through the YieldWise Initiative, the following number of farmers were aggregated in the following value chains:



25,819 farmers were aggregated, with **14,428 (56%)** selling produce through aggregation centers



38,451 Metric Ton (MT) sold (**25%** of which was sold through aggregation centers)

32,420 farmers were aggregated, with **7,235 (22%)** selling produce through aggregation centers



86,757 farmers were aggregated, with **9,752 (11%)** selling produce through aggregation centers

224,334 MT of maize aggregated



17,789 farmers mobilized and registered to industrial processors in 2019



6 AGGREGATION

WHO ARE THE KEY ACTORS IN AGGREGATION ACTIVITIES?

Programs should co-design aggregation activities with actors in the value chain, while ensuring their buy-in. This means that programs should not design aggregation activities, but rather encourage traders or offtakers to design and implement these. Aggregation activities should therefore support offtakers and traders to set up such aggregation centers.



During the YieldWise Initiative, the hypothesis was that building aggregation centers would reduce loss and would provide an incentive for traders to source from the centers due to reduced cost. The Initiative learned that traders were not interested in sourcing from aggregation centers and therefore the aggregation centers that were established through the YieldWise Initiative were largely unused. **The following were identified as reasons for the limited use of the mango aggregation centers:**

- Traders employed harvesters, who harvested and picked the mangoes on the farms. The harvested mangoes on the farms were all collected by a truck and repacked in cartons for transportation to the fresh, export or processing market. This was the preferred model of sourcing as the trader is in control of the quality of the mangoes and associated costs of logistics. It also reduced the burden of transport and harvesting logistics from the farmer, who often would rather sit and wait for traders to come to the farm instead.
- Traders were not interested in sourcing aggregated mangoes since they claimed that they are highly priced by farmer organizations.
- The traders did not have confidence in the ownership of the already aggregated produce. They had a belief that the aggregated mangoes might have been paid for by another trader, who they may know and would not like to be in any conflict.

However, some processors preferred to work with and found value in sourcing mangoes from aggregation centers. The YieldWise Initiative learned that the aggregation centers are useful to other actors such as processors e.g. Azuri foods who order mangoes and source from aggregation centers. Azuri was more likely to get desired quantities and quality since some aggregation centers have Post-harvest technologies, such as from Karurumo aggregation center.



Mangoes on a rack



Mango harvesters using a harvesting tool

6 AGGREGATION

HOW TO FORM AGGREGATION GROUPS?

Proper outreach and sensitization should be done before forming groups to prevent exploitation - as some members may want to benefit from the group through taking advantage of the 'handouts' from development initiatives. Most farmers belong to multiple dormant groups which became active at the start of a program. This decreases the sustainability of program outcomes since these groups are not founded on mutual trust and benefit.

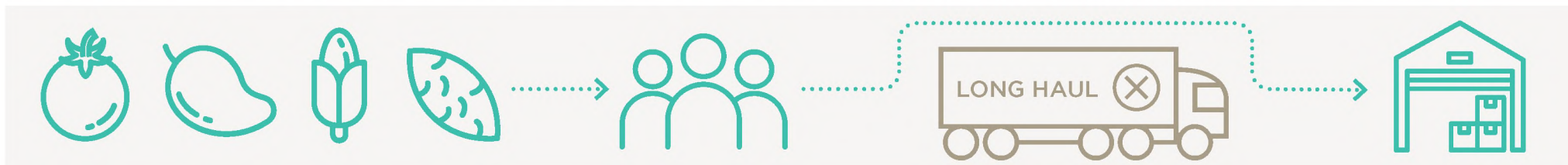
Instead of creating new groups, work with existing ones. In some value chains such as tomato, aggregation occurs organically through established groups which have already built trust and some level of stability over time and are therefore more willing to learn and grow their aggregation capabilities. The YieldWise Initiative worked with groups that had been trading exclusively in one value chain, for instance rice selling, to include tomato growing and marketing in their activities.

- The focus for such groups is therefore structuring the aggregation to run efficiently, building better infrastructure such as shaded centers, and providing technology or equipment to facilitate a more efficient aggregation process.

WHERE SHOULD AGGREGATION CENTERS BE LOCATED?

Aggregation centers should be in close proximity to where the agricultural production is taking place, eliminating the need for long haul transportation from the farm-gate. Farmers often cite the cost of transport the aggregation center as a barrier and they prefer having the buyer send brokers to their farms to pick the produce. Brokers take advantage of farmers and buy the produce at very low prices, especially when there is a market glut, which discourages farmers.

Aggregation requires good infrastructure. Most farmer groups already had an existing aggregation center albeit very informal, or in old warehouses. Old warehouses that often need repairs or rebuilding, for example, do not serve as good aggregation centers since they are costly to rehabilitate.



6 AGGREGATION

HOW SHOULD AGGREGATION CENTERS BE RUN?

There is a need for aggregation centers to be entrepreneurial in nature, diversify their services, and develop income generating activities such as agro shops, thereby ensuring they have equipment such as weight scales and moisture meters, as well as the availability of skilled labor for maintenance of technology. The center managers should be trained to run the aggregation center as a business, which will support their sustainability.

Government and private sector companies are potential investors in aggregation centers where they lease the aggregation facility to a buyer or manager to operate. The support of the government, private sector and FOs can be enhanced by creating an enabling environment to foster and regulate contract farming and help protect both FOs and off-takers so as to reduce the risk for both parties.



The YieldWise Initiative's tomato value chain in Nigeria modeled partnership with other actors in the value chain to set up well managed centers by establishing the Post-Harvest Hub through a cost sharing arrangement with a farmer association that provided the land. YieldWise Nigeria invited other value chain actors to partner in the Hub project by providing services such as cold storage, production inputs, mechanization services, and various products. The project team facilitated the signing of a management agreement between the farmers association and a buyer/processor.

To improve the efficiency and effectiveness of the hub model, the Initiative introduced FSC which are run by enterprising model farmers. The FSC is owned and operated by the agri-preneur who also has a model farm where community farmers are able to gather and learn best farming practices. YieldWise increased its efforts to ensure that the FSC was a one stop shop for the community, where they are able to receive video, instructional, and practical training, access financial service and quality inputs, receive production advice, and aggregate produce to be sold to offtakers. This promoted the creation of an 'organic' hub which did not depend on the private sector or government for management.



Tomatoes in a solar dryer

6 AGGREGATION

WHERE SHOULD THE AGGREGATED PRODUCE BE SOLD?

The best practice in aggregation is to identify a market or a buyer before aggregating the produce. Farmers are often unwilling to meet the costs of aggregation unless they are sure of who is buying their crop and at what price.

Farmers' willingness to aggregate produce without an assured buyer is usually low and they would rather wait for a buyer to go buy from the farm instead of banking on the uncertainty of aggregating without a buyer. Cash strung farmers are also less likely to wait for a few days or weeks, depending on the value chain, to sell. Some aggregation centers, especially for food crops with longer shelf life, have tackled this challenge by providing farmers a fraction of their payout amount when produce is delivered. The farmers then receive the full payment once produce is sold at better prices later.

Programs should diversify target markets and types of buyers to maximize the opportunity for the sale of farmer produce through the aggregation centers. While programs need to target organized and anchor buyers in market linkages, often, the buying capacity of these buyers may not be able to absorb the volume produced by farmers. Therefore, there is a need to pursue partnerships with open market traders and dealers, who are often the groups responsible for buying the largest volume of produce.



Cassava aggregated

Market Linkages



7 MARKET LINKAGES

INTRODUCTION

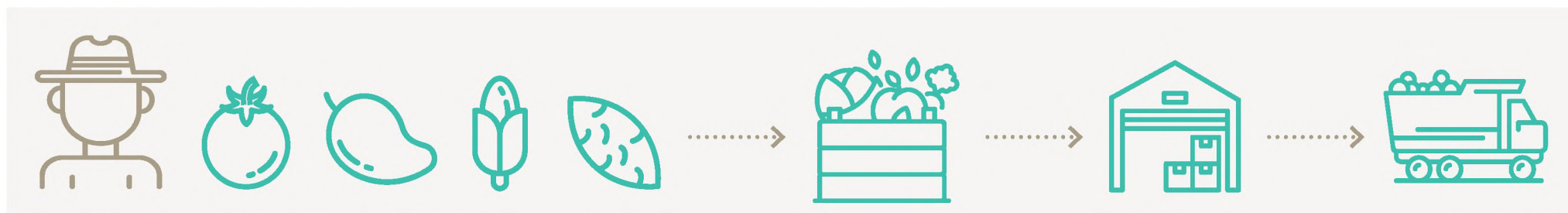
This section presents guidance regarding market linkage interventions. More specifically, it details:

- ↳ Why market linkage is important and is needed by producers;
- ↳ The achievements of the YieldWise Initiative in market linkages;
- ↳ What offtaker considerations should be in place when creating markets for producers;
- ↳ What producer-level considerations are important in market linking; and,
- ↳ Which alternative buyers can offer sustained offtaking of produce.

WHY IS THERE A NEED FOR LINKAGES TO BUYERS?

Agricultural value chains are changing rapidly, with transactions increasingly based on chains that involve coordinated links between farmers, traders, processors and retailers. A lack of access to consistent and viable markets for SHFs is a primary root cause for PHL and are pivotal for improved livelihoods. Additionally, PHL programs, through GAPs and increased harvests, focus on increasing agricultural productivity. However, if farmers do not have a market for their produce, they will not be able to translate higher yields into improved livelihoods. Farmer to market linkage increases market access for SHFs, in contrast with only selling surplus to local markets. It is important to strengthen market linkages with grouped farmers to link them to markets, which helps improve their welfare.

Market linkage partnerships aimed at providing a guaranteed market for farmers and thereby preventing PHL, have been tested and had varying level of success in the YieldWise countries.



WHAT WERE THE ACHIEVEMENTS OF THE YIELDWISE INITIATIVE?

Through the YieldWise Initiative, the following market linkages were made in the following value chains:



2,073 MT purchased by processors supplying anchor buyers.

107,911 MT purchased by other buyers for other processors and fresh market.



2,274 MT purchased by processors supplying anchor buyers.

128,400 MT purchased by other buyers for other processors, fresh market, and exporters.



260,975 MT of maize cumulatively aggregated and sold.

96% sold through alternative spot buyers.



21,241 MT sourced from block farmers.

25,669 MT sourced from community farmers.

89,633 MT sourced from non-project farmers.



WHAT OFFTAKER CONSIDERATIONS SHOULD BE IN PLACE WHEN CREATING MARKETS FOR PRODUCERS?



Programs should consider financing options for offtakers to enable them to purchase desired quantities from farmers, thereby preventing PHL. Access to finance is a key challenge for offtakers in the process of creating markets. Offtakers often desire to purchase more produce but are constrained by the limited cash available for buying from farmers. There is an opportunity for the provision of financing to allow offtakers to not only purchase more produce, but also to improve their facilities to increase capacity and process faster and more efficiently. Forward contracts can be used as documentation for accessing purchase loans, which enable offtakers to purchase more produce, especially during market glut seasons.



Market interventions need to understand the intricacies of the informal systems i.e. there is need to understand how to include middlemen and informal aggregators since they provide an important market to farmers, especially for the fresh produce markets. They are often ignored in interventions due to predatory pricing on farmers. Middlemen are however important in reaching farmers in remote regions where buyers usually do not venture and should therefore not be excluded from market access initiatives, but instead incorporated by formalizing and creating structures in the informal market.



In the mango value chain, as part of the YieldWise Initiative, TechnoServe had not placed enough emphasis on brokers and traders who supply to the fresh market, and sometimes to processors and exporters. Initially therefore, when the farmers applied GAPs and good post-harvest handling practices, some YieldWise farmers still experienced high losses due to the higher harvest, and lack of market access, since brokers had not been intentionally included in the YieldWise supply chain. This learning resulted in the instituting of a Market-led phase of the Initiative that promoted the organization and formalization of the informal traders to support better trading terms and practices for both traders and farmers.



Supply contracts should consider prevailing market prices to ensure that the offtaker and farmers are satisfied with the transaction. Supply contracts can be difficult to implement initially given their non-binding nature, but if prevailing market prices with a mark up are agreed upon, this can ensure that the farmers make a profit even when prices are low. Contract farming schemes can enhance a major win-win through the provision of quality inputs (seeds and fertilizers), which will result in high quality and quantity yields for processors and potentially enhance producer loyalty.

WHAT OFFTAKER CONSIDERATIONS SHOULD BE IN PLACE WHEN CREATING MARKETS FOR PRODUCERS? *Continued*



Forward contracts need to allow for the consideration of existing market prices, for both buyers and sellers. Given that most are not enforceable, the distortion of market prices could lead to default of respective parties. When market prices are higher, farmers tend to side sell thereby breaching agreements with offtakers and processors.



In both maize and tomato value chains in Tanzania and Nigeria respectively, the YieldWise Initiative worked with offtakers and processors to promote contract farming. Issues that arose were primarily around market price fluctuation, where farmers would not honor the contract when the market prices were higher, and then rush to supply the offtaker once market prices dropped. On the other hand, offtakers would also want to pay lower than the contracted price when market prices were very low. Additionally, contracts were not enforceable by law. The program therefore worked with the offtakers and processors to initiate open price contracts that purchase at a slight mark up above the prevailing market price. This would allow the farmers to receive better prices than the market, while still making sales especially during the glut seasons.

WHAT PRODUCER-LEVEL CONSIDERATIONS ARE IMPORTANT IN MARKET LINKING?



Programs should capacitate leaders and key farmers to understand markets within FBOs. FBO leaders should be trained as if they are leading corporate bodies so that the organization is led in a professional and sustainable manner. When leaders and agri-preneurs are trained to understand markets, farmers are able to access market information and conduct their own market research which allows them to know where there is greater demand, and the existing market prices. Such information prevents buyers from taking advantage of farmers who do not have market demand and price information. The YieldWise Initiative trained FBO leaders to conduct market research by visiting different fresh markets to understand prevailing market prices, and know how best to price the members' produce for traders and offtakers.



Farmers should be trained on the need for consistency and building trust with offtakers and anchor buyers. Such training shows the importance of honoring contracts for both parties. As depicted in [Page 48](#) in the Access to Finance Section, farmers often engaged in side-selling are primarily as a result of purchasing delays by contracted buyers. Farmers engaged in side-selling are primarily as a result of purchasing delays by contracted buyers. Cash starved farmers are often impatient and risk averse, so they sell to the first buyer when the contract buyer is

WHAT PRODUCER-LEVEL CONSIDERATIONS ARE IMPORTANT IN MARKET LINKING? *Continued*

unavailable, particularly when market prices are not stable and farmers fear to hold or aggregate produce. Contracted produce amounts are often part of company strategy so a breach of contract therefore stalls the company's progress in achieving its targets, especially when farmers divert produce to the market in a bid to receive better prices. Open contracts which allows the buyers and processors to purchase at existing market prices, sometimes with a higher markup so that farmers can have profits, have been tested in the YieldWise Initiative to increase farmer consistency.



PHL programs should promote collective bargaining power through the formation of trader associations. Trader associations are legally recognized entities which enable them to negotiate on behalf of the members for inputs, access to finance, and access to markets.



Through the YieldWise Initiative, in the mango value chain in Kenya, the AKMT was able to sign two separate MOUs with technology providers (Farmtrack Consulting and Kenya Biologies Ltd) which allowed the traders to act as distributors/agents of the two fruit fly trap manufacturing companies. AKMT was able to negotiate the wholesale price of the traps for the traders with Kenya Biologies bringing theirs down to KES 200 (\$2.00) and KES 250 (\$2.50) for Farmtrack traps. The traders stood to make a margin of about KES100 (\$1.00) from selling either product. This effort was mainly geared towards increasing last-mile distribution of PFIL technology to SFIFs that makes pest-free areas an achievable goal all the while creating new income streams for AKMT members.

WHICH ALTERNATIVE BUYERS CAN OFFER SUSTAINED OFFTAKING FROM FARMERS?

Cottage processors are a proven alternative to anchor buyers and offtakers for farmers' produce.

Farmers usually know where to take their produce since trading markets are already established, but during glut seasons they lack buyers due to market saturation. Local cottage processors are a market for the produce of farmers for food processing to add value to crops, therefore utilizing the abundance of produce at harvest time. When too much product goes to the fresh market, the oversupply can cause prices to drop. Due to supplies exceeding demand, some of this yield goes to waste and can be spoiled before it is purchased. Therefore cottage processing has the potential to greatly strengthen the value chain and significantly reduce PHL.

Food processing enables the following:

- Absorbing surplus yield
- Adding value to farm products
- Preserving nutritional value
- Creating local jobs
- Expanding local infrastructure and capacity

Cottage processors are more effective in expanding processing activities therefore initiative should improve their capacity to run efficiently and increase output. Cottage processors are therefore important in providing pertinent value addition to farmers, given that anchor buyers are often located far from farms and have more bureaucratic structures for SHFs to navigate. Processors often cite access to finance for working capital and technology purchase as a challenge to adequately serving producers. In designing PHL initiatives, it is therefore important to ensure that cottage processors' needs are incorporated in the design phase. Although they run smaller plants, cottage processors are sometimes more efficient since they run at almost maximum capacity, especially during the market glut season.



Tomatoes can be processed in to the following products:

Tomato sauce, Tomato paste, Tomato juice, Sun dried tomatoes



Mangoes can be processed in to the following products:

Mango juice, mango chutney, mango jam, dried mangoes



Cassava can be processed in to the following products:

Cassava crisps, high quality cassava flour, animal feed, beer, and starch which is a base ingredient for multiple manufacturing processes



Maize can be processed into: Flour, corn oil, crisps, starch, corn gluten and beer

WHICH ALTERNATIVE BUYERS CAN OFFER SUSTAINED OFFTAKING FROM FARMERS? *Continued*

Cottage processors are more effective in expanding processing activities therefore initiative should improve their capacity to run efficiently and increase output. Cottage processors are therefore important in providing pertinent value addition to farmers, given that anchor buyers are often located far from farms and have more bureaucratic structures for SHFs to navigate. Processors often cite access to finance for working capital and technology purchase as a challenge to adequately serving producers. In designing PHL initiatives, it is therefore important to ensure that cottage processors' needs are incorporated in the design phase. Although they run smaller plants, cottage processors are sometimes more efficient since they run at almost maximum capacity, especially during the market glut season.



The YieldWise Initiative worked with cottage processors to support them in refining their business processes, guide them in accessing finance, and connect them to SHFs who produce quality produce suited to their processing needs.

In Nigeria, Smiley'z Mobile Kitchen won a grant outside the YieldWise Initiative but needed access to farmers with high quality tomatoes for processing. The company was connected to program farmers who, although initially struggled to meet quality specifications, were trained by field officers and thereafter, the processors witnessed improvement in the quality of tomatoes supplied. Smiley'z has a price ceiling where they are able to meet costs of production and still make profits. The processor has achieved a good relationship with farmers by purchasing at the price given by farmer groups, which is usually higher than market price but within the processing price ceiling, which is a win-win for both parties. The processor was able to process 12MT per month and had a season target of 47MT.

Secondly, some cottage processors and market actors were isolated from producer communities, which increased transportation costs. TechnoServe developed the Tomato Market Influential Platform which is a web-based program for linking buyers and farmers. In Kaduna, through the app, they linked processors with farmer groups that produced the correct kind of tomatoes. SIMKAY, a processor who was initially sourcing from Kano, was also linked to farmers in Kaduna thus improving market linkages.



Cottage processing



Processed tomato

WHICH ALTERNATIVE BUYERS CAN OFFER SUSTAINED OFFTAKING FROM FARMERS? *Continued*



Value addition has the potential to increase revenues for farmer organizations in the value chains. The YieldWise initiative in Kenya's mango value chain worked with the University of Nairobi to establish 'Zero Loss Centers' which are owned and run farmer groups and are equipped with low-cost cold storage technologies (such as the 📦 *Coolbot Cold Room*, 📦 *Charcoal Cooler* and 📦 *Zero Energy Brick Cooler*). Through these centers, farms can fetch better market prices for high season harvest due to increased shelf life of stored mangoes. They also can process the mango into pulp or dried fruit which fetches significantly higher market prices compared to fresh mangoes. Unpublished data shows that a ton of fresh mangoes aggregated at the zero loss center can fetch \$150 to \$250 per Ton while at farm gate price, a ton of fresh mangoes goes for less than \$100. On the other hand, ready to drink juice can fetch \$600 to \$1,000 per ton while dried mango chips can fetch \$1,000 to \$3,000 per Ton in the local market.



GSI Cooler



Charcoal Cooler



Brick Cooler

Partnership, Policy, and Government



8 PARTNERSHIPS, POLICY & GOVERNMENT

INTRODUCTION

This section presents guidance regarding partnerships, policy, and engaging with government. More specifically, it details:

- ↳ Why partnerships are important;
- ↳ How implementing partners should work together;
- ↳ Why it is important to engage government for policy reform; and,
- ↳ What are the key steps towards informing policy and supporting government for PHL reduction.

WHY IS THERE A NEED FOR PARTNERSHIPS?

As this Toolkit has demonstrated, the factors that contribute to PHL are vast and its solutions require a coordinated effort across diverse sectors and stakeholders. The sustainability of any PHL intervention lies in the longevity of the outcomes and impacts created by coordinated effort that involves stakeholders at all levels of the agricultural value chain.

Facilitating partner relationships is key to allowing market actors to operate independently and ensuring systemic change such that PHL reduction initiatives continues to scale with minimal intervention from donors or investors. Government, private sector, and non-governmental organizations are key in scaling of post harvest losses.



8 PARTNERSHIPS

HOW SHOULD IMPLEMENTING PARTNERS WORK TOGETHER?

Implementing partners should complement each other's efforts, and responsibilities should be clearly described in a partnership agreement to prevent duplication of efforts. Ideally, each partner should implement a key aspect of the program but not entirely separate their activities, but instead build on work conducted by other partners. This work should be coupled with feedback meetings held at least annually amongst all partners and stakeholders in order to promote learnings on what has or has not worked within the partnership.



In Tanzania, AGRA worked with three main implementing partners to ensure that the initiative was successful at all levels, and that the strength of each partner organization was maximized. CSDI was the partner in charge of high-level stakeholder engagement, and leading conversations with key institutions within the government and private sector. RUDI and BRITEN were primarily in charge of grass root interaction and training of farmers, and engagement with farmer-facing stakeholders such as agrovet owners. Their key strength was having an established network of local trainers who were able to engage well with farmers and promote buy-in at this level. The partnership was also managed by a partnership agreement with roles and deliverables clearly outlined to ensure that expectations were communicated and managed well.



8 POLICY AND GOVERNMENT

WHY POLICY AND GOVERNMENT?

The Africa Union (AU) recognizes that reducing PHL is a key pathway to food and nutrition security in the world. In its summit in Malabo in 2014, the AU committed to ending hunger by, among other things, reducing the current levels of PHL by 50%, by 2025 in what became the **Malabo Declaration**. To this effect, since 2014 African countries have developed and are still developing national strategies to promote food security and for reducing post harvest losses.

The Rockefeller Foundation has been instrumental within African countries by not only supporting governments with technical support of implementing food loss reduction initiatives, but also by promoting cross learning within regions and across the continent. The Foundation held the first post-harvest loss conference and has been supporting countries to understand what and how to prioritize initiatives and has also supported the World Bank in its investment on the SDG bonds. Additionally, several policies and the related strategies have been informed by the work conducted by the YieldWise Initiative.



In the mango value chain, The Rockefeller Foundation's Food Initiative launched the **Komesha Fruit Fly** Campaign, a partnership with the Government of Kenya, US Agency for International Development (USAID), Research Triangle Institute and others to support fruit fly control and create PFAs to reduce PHL in mangoes. "Komesha" is a Swahili word for stop or destroy. The campaign aims to increase productivity and quality of mangoes offered for local and export markets by enhancing the technical knowledge of farmers and other stakeholders on the management of key pests and post-harvest handling and by creating PFAs.

The campaign is spearheaded by the Mango Technical Working group (TWG) which is working with interested stakeholders from the agriculture sector including farmers, traders, researchers, innovators, policymakers, development partners, government departments and private sector actors/investors to address the economic implications of fruit fly in mango value chain. This is in response to the recognition that transforming the mango sector will require a systems approach – it is not only about the fruit fly, but all the interconnected components required, such as market access, affordable financing, rural road infrastructure, consumer demand, integrated pest management (IPM), agro-processing.



8 POLICY AND GOVERNMENT

WHAT STEPS ARE KEY TO INFORMING POLICY AND SUPPORTING GOVERNMENTS?

During the implementation of an initiative, a key step is the Identification of key policy priorities within a country and/or a produce chain. Policy priorities are categorized into: **Achievable Wins**, or policy changes with the potential to have an immediate impact on PHL and to support SHFs in the tomato value chain; **Compound Challenges**, or policy changes encompassing multiple actors or agencies and requiring an extended bureaucratic process or financial commitment by the Federal Government; and, **Countrywide Roadblocks**, or policy changes necessitating major financial commitments.

Once the policy priorities have been identified, it is important to **develop an advocacy strategy**. The advocacy strategy defines how the targets for the agreed upon priorities will be achieved, and who are the main stakeholders. The advocacy strategy can be broken into seven key stages as follows:

- Step 1:** Connect policy changes to the government's guiding agricultural policy platforms and priorities
- Step 2:** Leverage trusted interlocutors to build support for policy changes
- Step 3:** Build awareness among critical government agencies with implementing authority who often serve as the government's technical advisors
- Step 4:** Directly engage leading policymakers at the highest levels who have authority to make decisions
- Step 5:** Engage state or local governments since these are strong influencers to policy change at the national level. Where possible, train governments on how to partner with interventions to promote co-learning and longevity of program impact. Implementers should work directly with the government to set up project desks within local and national ministries.
- Step 6:** Utilize directed messaging that is shaped around each individual stakeholder that is communicated by leading allies
- Step 7:** Maintain pressure via consistent engagement through targeted follow up and staff level engagement

Lastly, conduct the stakeholder mapping to understand which are the key public, private, and non-governmental stakeholders. This process also allows the initiative to understand the roles each stakeholder plays and their level of influence within the value chain and ecosystem.

8 POLICY AND GOVERNMENT

WHAT STEPS ARE KEY TO INFORMING POLICY AND SUPPORTING GOVERNMENTS? *Continued*

The YieldWise Initiative implementing partners have developed advocacy strategies and stakeholder maps for the Mango, Tomato, and Cassava value chains which provide valuable insight on potential influence areas for future initiatives, and stakeholders to engage which can be accessed [↓ here](#). The corresponding policy analysis documents can also be found [↓ here](#).

Additionally, Rockefeller Foundation has supported the [↓ AU Commission](#) and conducted research for policy development and strategies for country specific plans to reduce post harvest losses. The Foundation supported Zimbabwe and Tanzania to develop a post-harvest management strategy which can be found [↓ here](#).

The Rockefeller Foundation also commissioned a [↓ Land Rights Toolkit](#) which targets to help implementers of agricultural initiatives understand the importance of considering land rights, improve their capacity to identify land rights issues and barriers for vulnerable groups such as women in their projects, and help implementers develop solutions to address challenges that are identified.



In the tomato value chain, Pyxera Global Nigeria implemented the YieldWise Initiative in four states of Kano, Kaduna, Jigawa, and Katsina, i.e. ‘the Tomato Triangle+’, with an aim to strengthen the value chain and reduce post harvest losses. The initiative brought together stakeholders, including government and policy makers, to operationalize the partnership, develop targets and foster collaboration between public, private, and social sectors to reduce losses within the value chain. Despite the success on most Achievable Wins, the program experienced lower levels of success for public sector targets due to difficulty of the government following up with its assigned tasks and responsibilities.

The initiative, now led by TechnoServe, built upon this learning and set up program desks in key ministries to ensure that learnings are shared, and follow up is conducted on a regular basis.

Initiatives should consider developing project dashboards that will be a repository of previous initiatives’ achievements and learnings. Such a platform should be managed by a party that will be in the ecosystem longer, such as the agricultural ministry. This will promote continuous learning, and projects building upon efforts of previous initiatives.

WHAT STEPS ARE KEY TO INFORMING POLICY AND SUPPORTING GOVERNMENTS? *Continued*



In Tanzania, implementing partners recognized the importance of engaging the local and national governments to create a sustainable solution to reduction of PHL in the maize value chain. By focusing its advocacy on ‘Achievable Wins,’ the Foundation was able to support critical changes to the regulatory framework that carried the potential for high impact on SHFs and the maize value chain in Tanzania. The team developed an advocacy strategy and stakeholder map that allowed for the identification of key national and local leaders that would influence PHL reduction policy. The initiative also located key industry thought leaders who could support the YieldWise in continuous engagement and dissemination of information on PHL.

YieldWise efforts in Tanzania culminated in the development of the National Post Harvest Management Strategy, which is one of Tanzania’s key deliverables of the AU-FAO Post Harvest Project funded by the Rockefeller Foundation. The Strategy supports the sustainability of the YieldWise Initiative since it was adopted by the country thereby providing mechanisms to interventions for achieving, monitoring and measuring the impact of PHL reduction. Continues efforts on reduction of food losses can now be implemented with better guidance in Tanzania beyond the life of the project thus securing the Rockefeller Foundation’s legacy.

- The Advocacy and Stakeholder Map for Tanzania can be found [↓here](#).
- The Policy Analysis in the Maize value chain can be found [↓here](#).
- Access the National post-harvest Management strategy document for Tanzania [↓here](#).



Appendix

Resources and Materials



APPENDIX RESOURCES AND MATERIALS

↓ *AccessAgriculture's* website hosts quality, scripted training videos in support of sustainable agriculture in developing countries that can be downloaded and used as training materials by organizations implementing PHL programs, across the 16 categories shown in the table below. All the videos created are available in multiple local languages. For more information about the use and viewing of these materials, ↓ *visit this page*.

Example videos can be viewed in the following links:



- ↓ *Managing aflatoxins in maize before and during harvest*
- ↓ *Managing aflatoxins in maize during drying and storage*



- ↓ *Staggering production of tomatoes*
- ↓ *Making a cooling chamber for tomatoes*














↓ *Shamba Shape Up* is an East African TV show that contains timely, tested and effective agricultural information to SHFs through an entertaining approach. The episodes can be viewed here:

- | | | |
|-------------------|-------------------|--------------------|
| ↓ <i>Series 1</i> | ↓ <i>Series 5</i> | ↓ <i>Series 9</i> |
| ↓ <i>Series 2</i> | ↓ <i>Series 6</i> | ↓ <i>Series 10</i> |
| ↓ <i>Series 3</i> | ↓ <i>Series 7</i> | |
| ↓ <i>Series 4</i> | ↓ <i>Series 8</i> | |

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APPENDIX RESOURCES AND MATERIALS

Category	Sub-category	Category	Sub-category	Category	Sub-category
1 	<ul style="list-style-type: none"> Maize Other Cereals Rice Sorghum & Millets Wheats 	6 	<ul style="list-style-type: none"> Beverage Crops Chillies Coffee Herbs & Spices Other Crops Plant Fibres 	10 	<ul style="list-style-type: none"> Cereals Fruits & Nuts Legumes Other IPM Roots, Tubers & Bananas Vegetables
2 	<ul style="list-style-type: none"> Bananas & Plantains Cassava Other Roots & Tubers Potatoes Sweet Potatoes 	7 	<ul style="list-style-type: none"> Animal Health Cattle Horses & Donkeys Other Livestock Pigs Poultry Rabbits Sheep & Goats 	11 Mechanization	
3 	<ul style="list-style-type: none"> Edible Fungi Leaf Vegetables Onions Other Vegetables Tomatoes 	8 	<ul style="list-style-type: none"> Fish Culture Other Aquaculture Processing Shellfish Culture 	12 	<ul style="list-style-type: none"> Administration Conflict Resolution Farm Management Finance Gender Group Approaches Inputs Marketing Other Business Skills Post-Harvest
4 	<ul style="list-style-type: none"> Beans Cowpeas Groundnuts Other Legumes Pigeon Peas Soya Beans 	9 	<ul style="list-style-type: none"> Agroforestry Conservation Agriculture Cross-Slope Barriers Forest Management Integrated Crop-Livestock Integrated Soil Fertility Management Sustainable Land Management Pastoralism & Rangelands Rainwater Harvesting Smallholder Irrigation 	13 	<ul style="list-style-type: none"> Extension Approaches Other Approaches Participatory Approaches Seed Production & Dissemination
5 	<ul style="list-style-type: none"> Bananas Cashews Dates Mangoes Other Fruits Other Nuts Pineapples Shea Nuts 			14 	<ul style="list-style-type: none"> Beekeeping Biodiversity Conservation Climate Change Adaptation Food Safety Nutrition Other Agricultural Practices

REDUCING POST-HARVEST LOSS



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