

# Case study: Building a Resilient Agricultural Ecosystem for Smallholder Farmer Prosperity in Billiri, Gombe State, Nigeria

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Adaptation SME Accelerator Program

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# Executive Summary

## The Problem

Smallholder farmers in Nigeria face climate change impacts on crop yields, income, and food security. With limited purchasing power, they struggle to access information and yield-improving products, making them vulnerable. Lack of critical information hampers climate change management, and low affordability prevents access to resilient seeds. During harvest, financial obligations force farmers to sell at low prices, resulting in income and food security losses. Inadequate post-harvest infrastructure leads to pest attacks, causing up to 50% losses. Fear of losses compels premature selling, resulting in a 40% income loss compared to storing for better market conditions. This perpetuates poverty and exclusion, hindering adaptation efforts.

## Objectives

The "Building a Resilient Agricultural Ecosystem for Smallholder Farmer Prosperity" project sought to demonstrate the impact of the StorageX product in enabling smallholder farmers to increase their on-farm incomes and access financing for climate-smart agronomic advisory and climate change adaptable inputs. The project aimed to achieve this by deploying post-harvest infrastructure, providing training in post-harvest management, and establishing partnerships with commodity buyers and financial institutions. The ultimate goal was to enhance the resilience and prosperity of smallholder farmers in the targeted areas, specifically in Billiri and its surrounding regions.

## Key Activities

The key activities of the "Building a Resilient Agricultural Ecosystem for Smallholder Farmer Prosperity" project include:

- **Stakeholder Engagements:** Identification and engagement with commodity buyers and financial institutions to establish agreements and partnerships for financing and market access.
- **Post Harvest Management Training:** Providing training to smallholder farmers on effective post-harvest management techniques to minimize losses and improve the quality of their produce.
- **Deployment of Pilot Post-Harvest Infrastructure:** Leasing and setting up a warehouse equipped with necessary facilities such as grain dryers, moisture meters, weighing scales, and a Warehouse Management System to ensure optimal storage conditions for farmers' grains.
- **Financial Partnerships:** Signing agreements with financial service providers to facilitate financing for smallholder farmers, enabling them to access inputs and advisory services.

- **Promotional Materials:** Printing and distributing promotional materials such as flyers, roll-up banners, and training booklets to raise awareness about the project and its benefits.
- **Warehouse Lease:** Securing the lease of a warehouse from the local government for the storage of grains.
- **Surveys and Data Collection:** Conducting surveys to gather insights on the needs and challenges of smallholder farmers, including their access to storage facilities, information on market timing, and affordability of inputs.

## Impact

The "Building a Resilient Agricultural Ecosystem for Smallholder Farmer Prosperity" project had a significant impact. It trained 543 farmers in post-harvest management. Among them, 307 farmers stored 400 tons of grains resulting in a 20% reduction in losses, and increasing their incomes by 40% compared to selling at harvest. Additionally, 57 farmers received financing using their stored grains as collateral, while the project facilitated the successful sale of 400 tons of grains, contributing to farmers' economic sustainability.

## Way forward

To scale the project in the future, farmer service centers will be established within StorageX warehouses. These centers will serve as comprehensive hubs offering inputs, financing, market access, equipment, and data-driven advisory to farmers. Microentrepreneurs will be responsible for managing the service centers, ensuring their effective operation. Strategic partnerships with financial institutions and commodity buyers will be forged to expand financing options and market connections for farmers. This integrated approach aims to create a one-stop solution, empowering farmers, improving productivity, and fostering long-term resilience in the agricultural sector.



A community-based agent going through a post-harvest management checklist with a smallholder farmer.

# TABLE OF CONTENTS

01

**About Kitovu Technology  
Company and Partners**

02

**Introduction and Project  
Background**

03

**Post Harvest Losses and Its  
Impact on Smallholder Farmer  
Climate Resilience**

04

**Challenges Faced during project  
execution**

05

**Activities Carried out during the  
project**

06

**Key Outputs**

07

**Way Forward**





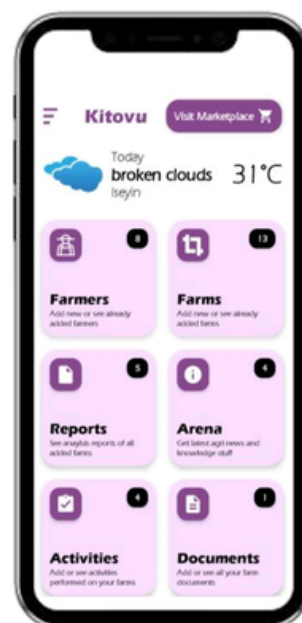
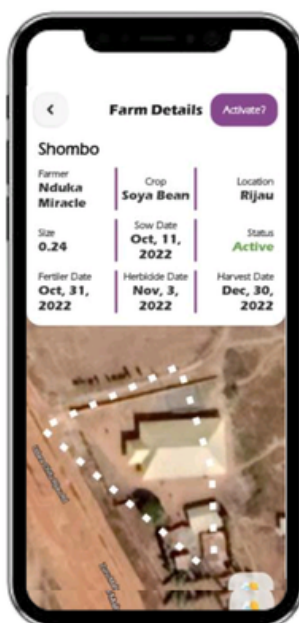
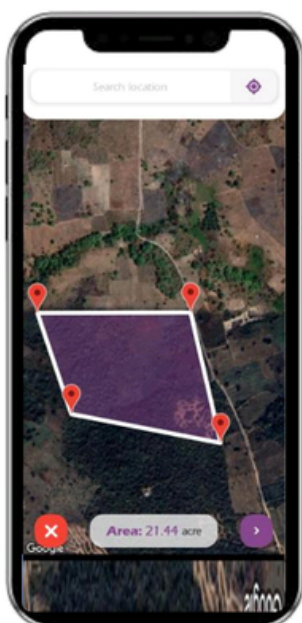
# About Kitovu Technology Company and Partners

Kitovu Technology Company provides African smallholder farmers with the data to make smart decisions about what to grow that would sell and how to grow them optimally, so as to enable them to make more money off their farms through yield improvement and reduced post-harvest losses. We have developed several innovative products at the intersection of agriculture, supply chain, and finance, transforming African agriculture.

Kitovu Technology Company has built a suite of products that work in a complementary manner to build climate resilience for African smallholder farmers. These transformational products developed at the intersection of agriculture, supply chain, and finance, transforming African agriculture include:

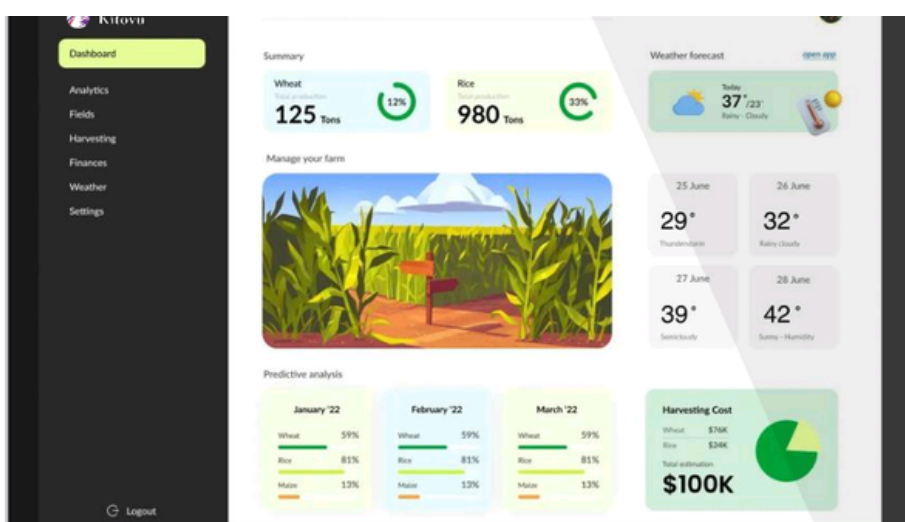


YieldMax, a digital platform that applies data science and remote sensing to provide smallholder farmers with a personalized agronomic advisory that lets them know the right fertilizers to use in the right quantities and their variable application rates, weekly crop health audits, and operational insights based on water stress and meteorological data. This lets the farmers increase their crop yields by 30% while reducing their inputs costs by 20% in the face of increased climate change and increasing soil degradation.



## 2

eProcure, a digital commodity supply service that enables processors and commodity buyers to source quality products while creating access to markets for smallholder farmers. eProcure takes a data-first approach by getting data on crop specifications from buyers for farmers to produce thereby helping to create a captive market for smallholder farmers while helping to cut down on post-harvest losses.

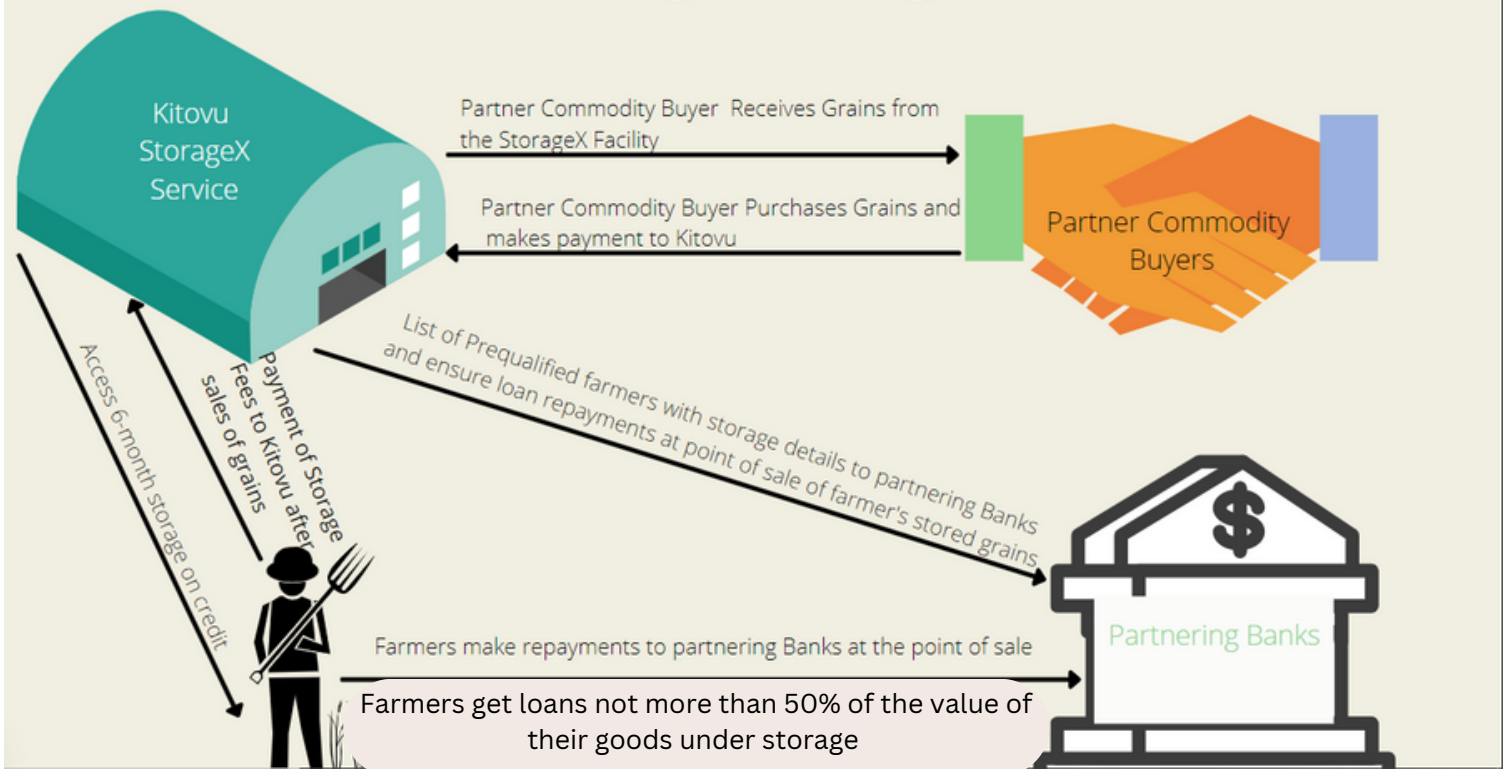


## 3

StorageX, a platform that leverages Electronic Warehouse Receipts Technology to provide access to effective storage and access to finance with their goods under storage as collateral. Through StorageX, smallholder farmers are able to access post-paid storage at our storage infrastructure and leverage their goods under storage as collateral to receive financing. The storageX storage infrastructures are equipped with WareGaurd, Kitovu's proprietary IOT based warehouse management system, and dryers plus other equipment to ensure that stored grains are in optimal storage conditions.



# Introducing StorageX



**The Adaptation SME Accelerator Program (ASAP) and The Lightsmith Group**  
([www.climateasap.org](http://www.climateasap.org)) ([www.lightsmithgp.com](http://www.lightsmithgp.com))



ASAP is a program dedicated to assisting small and medium-sized enterprises (SMEs) in adapting to climate change impacts. It offers tailored support and resources to vulnerable SMEs in developing countries. ASAP focuses on capacity building, mentorship, and access to financing, helping SMEs identify climate risks and implement resilience strategies. The Project aims to integrate climate resilience into SMEs' business models and foster sustainable practices. Through its targeted efforts, ASAP contributes to enhancing the adaptive capacity of SMEs in the face of climate challenges. ASAP is led by the Lightsmith Group with funding from the Global Environment Facility's Special Climate Change Fund and the Inter-American Development Bank. ASAP is facilitated by Conservation International.



# The Global Environment Facility (GEF) ([www.thegef.org](http://www.thegef.org))



GEF is an international institution that funds projects to address global environmental challenges. It supports initiatives in areas like biodiversity conservation, climate change, sustainable land management, and pollution reduction. The GEF collaborates with governments, civil society, and the private sector to promote sustainable development and environmental protection. It plays a key role in facilitating international cooperation and fostering innovative solutions for global environmental issues.

# Conservation International (CI) ([www.conservation.org](http://www.conservation.org))



Conservation International (CI) is a global nonprofit organization dedicated to protecting nature and its biodiversity. It works in partnership with governments, communities, and businesses to implement science-based conservation initiatives. CI focuses on preserving ecosystems, promoting sustainable practices, and empowering local communities. Through its efforts, CI aims to ensure a healthy and prosperous planet for future generations.





# Introduction and project background



Coordinating delivery of stored grains to commodity buyers at the end of the storage cycle

# Introduction

The "Building a Resilient Agricultural Ecosystem for Smallholder Farmer Prosperity" project, which took place at Billiri, Gombe State of Nigeria, is aimed at empowering smallholder farmers to enhance their on-farm incomes and access necessary resources for climate-smart agriculture. The project focuses on the implementation and demonstration of the StorageX product, which enables farmers to store their produce and gain access to financing and climate-adaptive agronomic advisory services. Through the deployment of post-harvest infrastructure and stakeholder engagements, the project aims to address the challenges faced by smallholder farmers in the Billiri region of Nigeria.

## Project background

Smallholder farmers play a crucial role in Nigeria's agricultural sector, accounting for a significant portion of food crop production. However, they face numerous challenges, including climate vulnerabilities, limited access to information and resources, and financial constraints. Rising temperatures, unpredictable rainfall patterns, and extreme weather events have adversely affected their crop yields, income generation, and food security.

Despite their critical contribution to food production, smallholder farmers often live in poverty and lack purchasing power. This hinders their ability to access vital information, high-quality inputs, and storage infrastructure necessary for effective post-harvest management. As a result, they are forced to sell their produce at low market prices or face substantial post-harvest losses due to inadequate storage facilities and pest infestation.

The "Building a Resilient Agricultural Ecosystem for Smallholder Farmer Prosperity" project sought to address these challenges by introducing innovative solutions and creating an enabling environment for smallholder farmers. By implementing the StorageX product and establishing post-harvest infrastructure, the project aimed to enhance farmers' access to financing, climate-adaptive advisory services, and proper storage facilities. This enabled farmers to store their produce, mitigate post-harvest losses, and sell their crops at favorable market conditions, ultimately improving their incomes and overall prosperity.







# Post-Harvest Losses and Its Impact on Smallholder Farmer Climate Resilience



# Post Harvest Losses and Its Impact on Smallholder Farmer Climate Resilience

Post-harvest losses pose a significant challenge to smallholder farmers in Billiri, Gombe, Nigeria, and across Africa, impacting their climate resilience and overall agricultural productivity. These losses occur during the handling, storage, and transportation of harvested crops, resulting in financial setbacks for farmers who heavily rely on their yields for income and food security. Smallholder farmers in Billiri face numerous challenges when it comes to post-harvest management.



Limited access to appropriate storage facilities, inadequate knowledge of proper handling techniques, and lack of financial resources to invest in effective storage infrastructure contribute to significant crop losses. Unpredictable weather patterns, including temperature fluctuations and irregular rainfall, further exacerbate the vulnerability of farmers, making them more susceptible to pest infestations, spoilage, and mold growth.

The impact of post-harvest losses on smallholder farmer climate resilience is multifaceted.

Firstly, these losses directly undermine the financial resilience of farmers, as they are unable to realize the full value of their harvested crops. Reduced incomes limit their ability to invest in climate-resilient agricultural practices, such as purchasing high-quality seeds, adopting sustainable farming techniques, or accessing improved inputs. Consequently, farmers become trapped in a cycle of poverty and limited capacity to adapt to changing climatic conditions.

Furthermore, post-harvest losses hinder food security at both individual and community levels. As farmers lose a significant portion of their harvests, they struggle to meet their own nutritional needs and may face food shortages. This vulnerability is further compounded by the increasing frequency of extreme weather events, which disrupt agricultural activities and exacerbate the risks of post-harvest losses.

The reduction of post-harvest losses is crucial for enhancing smallholder farmer climate resilience in Billiri, Gombe, Nigeria. By addressing the challenges associated with storage and handling, farmers can maximize their yields, improve food security, and increase their incomes. Through collaborative efforts, implementation of climate-resilient solutions, and empowering farmers with knowledge and resources, it is possible to mitigate post-harvest losses, enhance climate resilience, and contribute to the overall sustainable development of smallholder agriculture in the region.





**Challenges  
faced  
during  
project  
execution**





# Challenges Faced During Project Execution

1. Time constraint: Time emerged as a significant constraint, as the project had to be carried out within a short timeframe. This created pressure to organize and implement the activities efficiently, particularly considering the closing storage window for farmers. This also meant that we didn't have enough time to get financial partners who would finance warehouse receipts for goods stored by the farmers.
2. Low participation of women: Religious constraints posed a challenge to engaging women farmers, resulting in low turnout and limited access to training and resources. Measures were taken to recruit more women agents to address this constraint and increase women's participation.
3. Financial limitations: We were forced to turn down over 90% of the farmers who wanted loans backed by their goods under storage as collateral. For a lot of farmers, the ability to access loans this way was a major attraction in the value proposition offered by StorageX. As a result, smallholder farmers who would ordinarily have stored, but facing financial constraints were affected; they had no ability to store their harvest without any guarantees of financing from the project. As a result, we had less farmers storing than initially anticipated.
4. Input Sourcing Difficulties: Due to the geopolitical situation involving the Russia-Ukraine conflict, farmers faced difficulties in accessing fertilizers. This led to the loss of some farmers who preferred receiving inputs instead of loans. The project team actively sought alternative solutions and explored partnerships to ensure farmers could access quality inputs but outcomes were limited.



# Activities carried out during project execution



# Activities carried out during the project

The Project kicked-off on the 5th of December, 2022. The project covered Billiri, and surroundings; Balanga and Kaltunga, which are catchments to the warehousing and post harvest infrastructure to be deployed at Billiri. In the course of the project, we carried out some key activities as follows:

- 1** **Stakeholder Engagements:** The project team actively engaged with commodity buyers and financial institutions. Through identification and establishment of agreements and partnerships, they aimed to secure financing options and market access for the smallholder farmers involved in the project. These engagements were crucial for creating sustainable opportunities and linkages for the farmers. A total of 331 individuals participated in stakeholder engagements, including agents, farmers, and ecosystem stakeholders.
- 2** **Post Harvest Management Training:** Smallholder farmers were provided with comprehensive training on effective post-harvest management techniques. The focus was on equipping farmers with the knowledge and skills to minimize grain losses and improve the quality of their produce. The training covered areas such as proper drying, storage, and pest control measures to ensure that farmers could preserve their harvests effectively. 543 farmers, including 79 women, received comprehensive training in post-harvest management techniques. The training covered aspects such as proper drying, storage, and handling practices to minimize post-harvest losses.
- 3** **Baseline and Close out Surveys of Smallholder farmers**  
The project conducted surveys to gather valuable insights on the needs and challenges of smallholder farmers. The surveys covered various aspects, including farmers' access to storage facilities, their knowledge of optimal market timing, and the affordability of agricultural inputs. The data collected helped the project team better understand the farmers' circumstances and tailor their interventions accordingly.

The baseline survey enabled us to understand the number of farmers without access to effective storage solutions, the average Post-Harvest Losses in Tons, and the percentage of farmers that cannot afford climate smart advisory and inputs without some sort of financing or subsidy. The survey was conducted among 73 respondents, revealing some critical and important insights into the challenges faced by smallholder farmers. The findings highlighted the significant need for access to storage facilities, financing options, and information on market timing for optimal income generation.

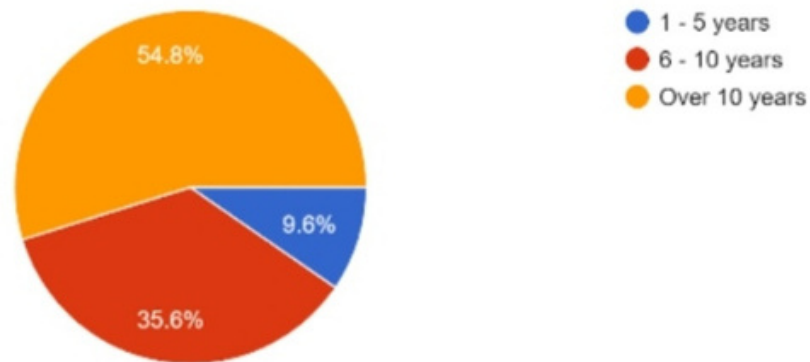


From the baseline survey, we found that:

- 54.8% of the respondents who have been farmers for over 10 years, yet 81.1% of them cannot afford to pay for inputs upfront without any form of input financing or subsidies.

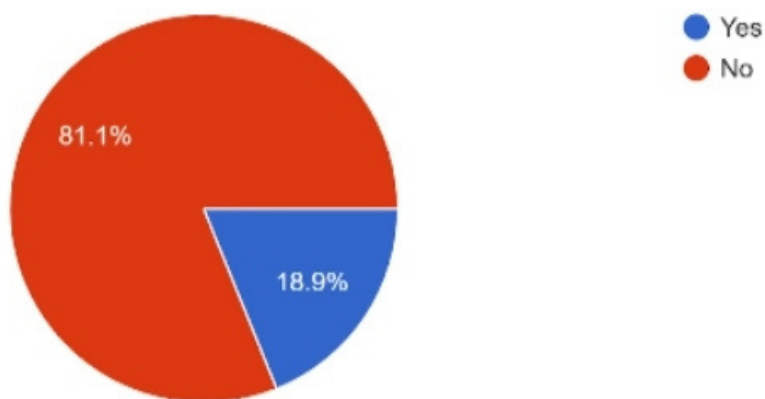
#### How long have you been farming?

73 responses



#### Are you able to pay upfront for inputs like fertilizers and advisory services?

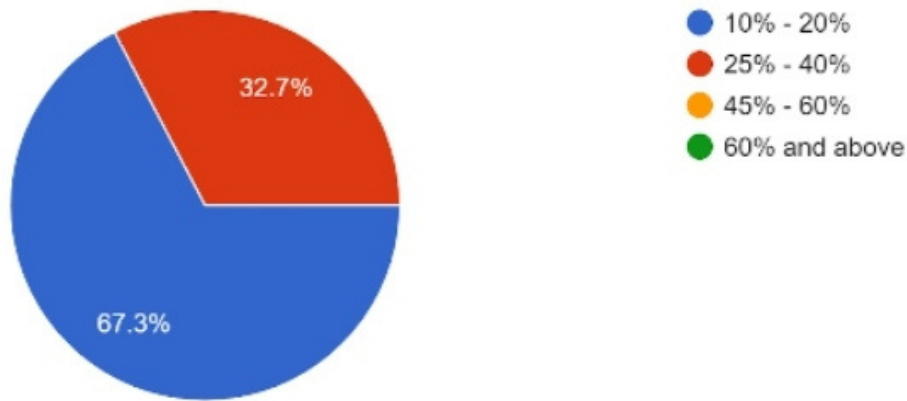
53 responses



- 
- 67.3% of the respondents lost between 10-20% of their harvest due to lack of access to storage and post harvest infrastructure.

What percentage (%) of your harvest is lost or goes bad due to lack of access to storage services?

52 responses



At the end of the project, we carried out a close out survey. The Close out survey was administered to 103 smallholder farmers who stored their grains at StorageX infrastructure. From the survey, we realized that a better majority of the farmers who stored with us, regardless of if they obtained financing from us, or not, were able to earn increased incomes by taking advantage of market price appreciation, which then positioned them to better afford quality inputs.

## 4

### Identification and Signing Agreements with Commodity Buyers and Financial Institutions

The project team established agreements with financial service providers to facilitate financing options for smallholder farmers. This enabled farmers to access inputs such as seeds, fertilizers, and agrochemicals, as well as advisory services. The partnerships aimed to improve the farmers' purchasing power and enable them to invest in their agricultural activities effectively.

## 5

**Deployment of Pilot Post-Harvest Infrastructure:** As part of the project, we leased a warehouse and set up with essential facilities. This included grain dryers, moisture meters, weighing scales, and a Warehouse Management System. The infrastructure aimed to provide optimal storage conditions for farmers' grains, reducing post-harvest losses and preserving the quality of the produce. To raise awareness about the project and its benefits, the team developed and distributed promotional materials. These included flyers, roll-up banners, and training booklets. The materials served as informative resources, highlighting the importance of post-harvest management and the opportunities available through the project.

Through these key activities, the project aimed to build a resilient agricultural ecosystem that would empower smallholder farmers in Billiri and the surrounding regions, leading to their prosperity and improved livelihoods.







# Key outputs



## Key outputs

The "Building a Resilient Agricultural Ecosystem for Smallholder Farmer Prosperity" project yielded significant outcomes. It encompassed the training of 543 farmers in post-harvest management. Notably, 307 farmers successfully stored 400 tons of grains, resulting in a remarkable 20% reduction in post-harvest losses, an estimated \$23,000 in value saved as a result of the project. By employing our leased and well-equipped warehouse, equipped with our innovative IoT-based warehouse management system, Wareguard, along with essential tools such as dryers, moisture meters, and a thresher, farmers could optimize their storage practices.

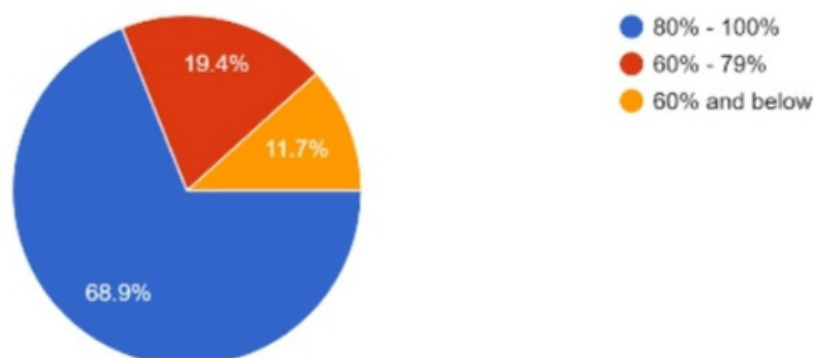
Additionally, the project fostered financial partnerships, with agreements signed with Eccoba, while advanced discussions with Wema Bank, Vbank, and Safe Haven Microfinance Bank are underway. This financial collaboration aimed to provide farmers with access to crucial financing options. Ultimately, these initiatives contributed to the project's success, empowering smallholder farmers to enhance their economic sustainability and mitigate post-harvest losses effectively. **Additionally, from the close out survey, we realized that:**



68.9% of the farmers who stored with us were able to preserve 80-100% of their harvest from going bad.

What percentage (%) of your harvest did you preserve from going bad due to access to StorageX services?

103 responses

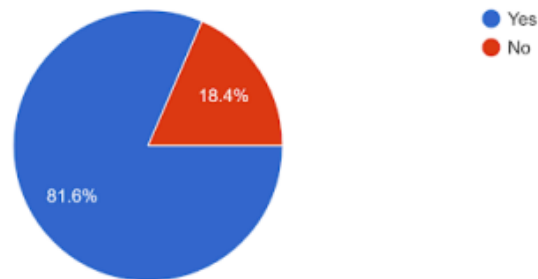




81.6% of the farmers who stored made enough income to be able to pay upfront for inputs.

Are you able to pay upfront for inputs like fertilizers and advisory services after using StorageX services?

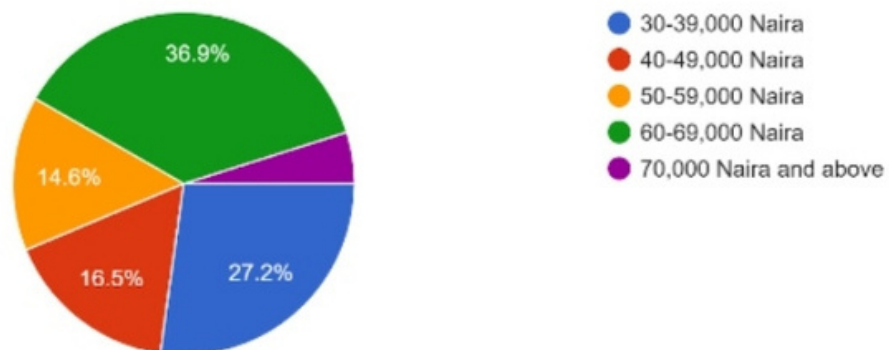
103 responses



36.9% of the farmers who stored with us made between 60,000 to 69,000 Naira (approximately \$78 to \$89 USD) in increased income per ton of grain, just by storing with us and taking advantage of market price appreciations. This was as a result of a 50% increase in the prices of commodities within the storage period.

How much extra money did you make per ton of grain stored?

103 responses

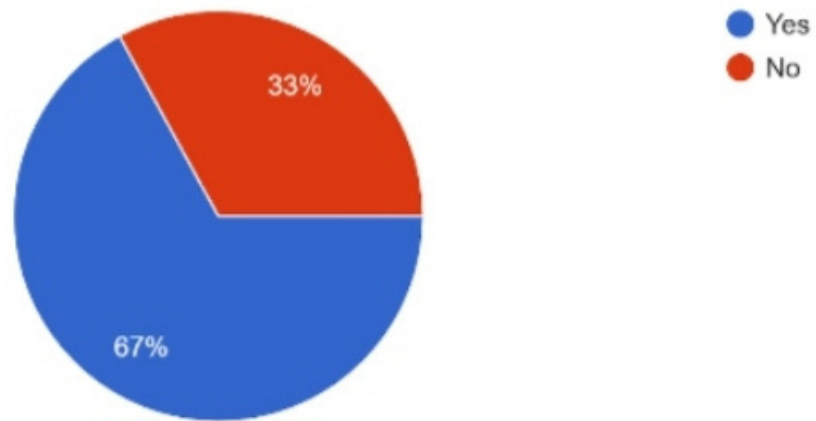


67% of the respondents applied for financing but couldn't get from us, due to financial constraints of the pilot project.



## Did you apply for a StorageX loan but didn't get?

103 responses



# Way forward



# Way forward

The Way Forward for this project involves scaling it by establishing farmer service centers within StorageX warehouses. These centers will serve as comprehensive hubs providing farmers with a range of services including inputs, financing, market access, equipment, and data-driven advisory. To ensure the smooth operation of these service centers, microentrepreneurs will be appointed to manage them effectively. Furthermore, strategic partnerships will be formed with financial institutions and commodity buyers to expand financing options and forge valuable market connections for farmers. We have signed an agreement with one financial service provider to provide up to \$100,000 in financing to farmers, and discussions are at advanced stages with two more. These could unlock close to an additional \$200,000 to support the farmers. We have also signed vendor agreements with two commodity buyers. These would be essential for expanding the work at Billiri, as well as expanding to other locations.

This integrated approach aims to create a one-stop solution that empowers farmers, enhances productivity, and fosters long-term resilience in the agricultural sector. By leveraging the infrastructure and resources of StorageX warehouses, the project can be scaled to reach a larger number of farmers and offer them holistic support for their agricultural activities. The farmer service centers will act as key facilitators, enabling farmers to access vital resources, information, and financial services conveniently. By bridging the gaps in inputs, financing, and market access, this approach aims to address the challenges faced by smallholder farmers and promote their overall prosperity.

Through collaborative efforts with financial institutions and commodity buyers, farmers will have increased opportunities to secure funding and establish sustainable market linkages. By embracing this comprehensive and integrated model, the project seeks to transform the agricultural landscape, fostering innovation, productivity, and resilience among smallholder farmers. The ultimate goal is to create a scalable and replicable model that can be implemented not only in this region but also in other areas with similar agricultural challenges.





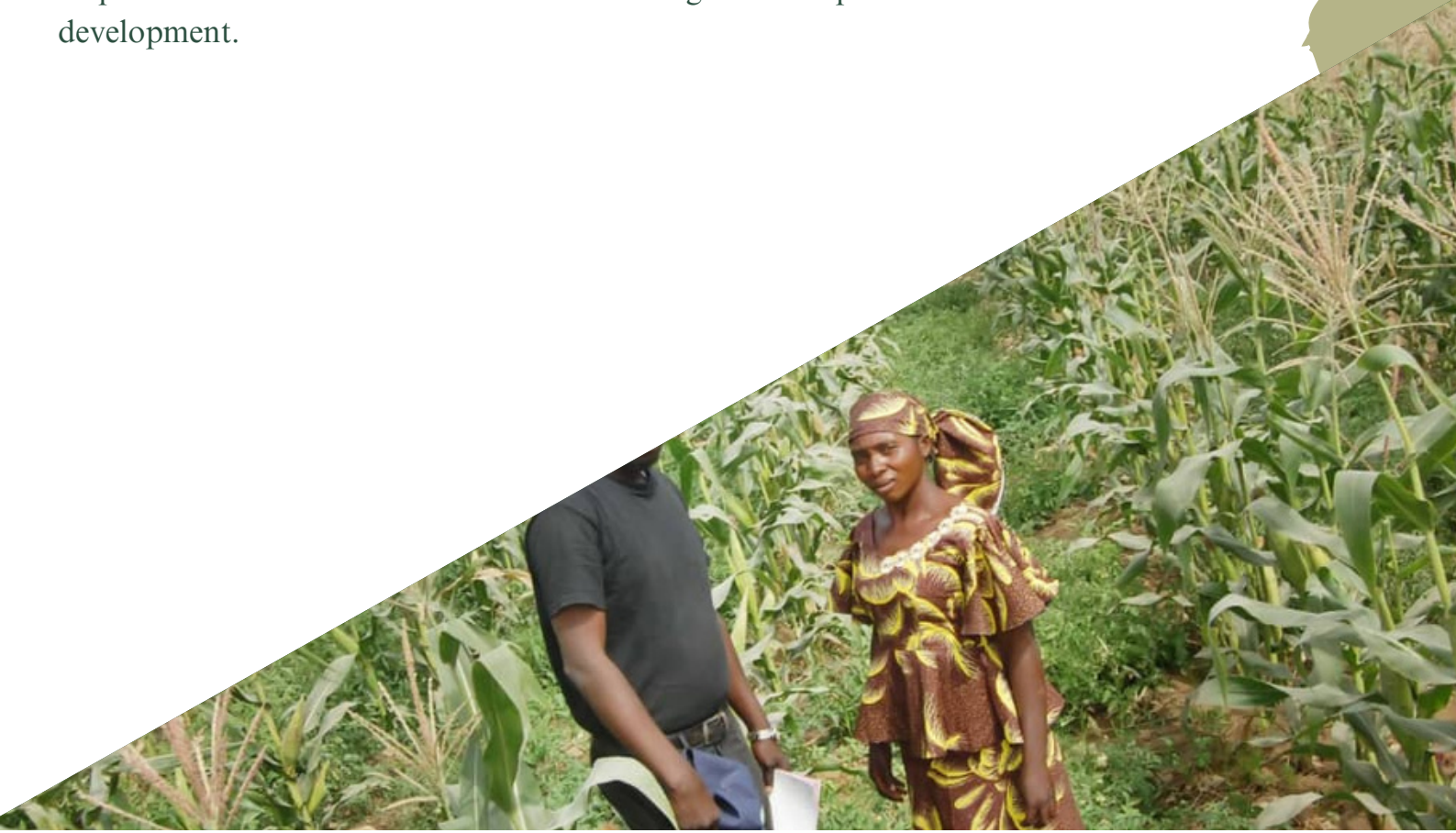
Additionally, in the course of running this project, we have spoken to different organizations, from Senegal, Kenya, Rwanda, Tanzania, Ghana, and Zambia; and there is a huge demand for the StorageX service across Africa as it meets a significant need for a huge gap in the African agricultural value chain. And that gap is the gap of post harvest infrastructure access.

Bridging that gap would ensure a significant increase in smallholder farmer incomes which in turn means they can afford quality climate-adapted inputs and technology enabled services that support them with mitigating the impacts of climate change.

To successfully implement these and further scale the impact of StorageX across Africa, thereby helping build a resilient food system, Kitovu Technology Company urgently needs patient capital for not just financing the Electronic Warehouse Receipts which are a huge part of the attraction for smallholder farmers, but also to build out the StorageX Storage Infrastructure. Partnerships with financial institutions are also crucial.

The "Building a Resilient Agricultural Ecosystem for Smallholder Farmer Prosperity" project successfully implemented strategies to address post-harvest losses, provide access to financial services, and enhance smallholder farmer livelihoods.

By fostering stakeholder collaborations, adopting innovative storage solutions, and promoting knowledge transfer through the train-the-trainer approach, the project laid the foundation for a more resilient and prosperous agricultural ecosystem in the Billiri area. The lessons learned from this case study can guide future initiatives aiming to empower smallholder farmers and transform agricultural practices for sustainable development.



**For inquiries regarding the project and collaboration opportunities please contact us at the following email:**

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**Website: [www.kitovu.com.ng](http://www.kitovu.com.ng)**

**Thank you**

