
Foresight4Food
International Collaborative Initiative

*Background Policy Paper*

# Reducing Food Loss And Waste In Uganda

*Martin Mutambuka, PhD*
*Denis Male, PhD*

October 2024

# TABLE OF CONTENTS

# Key Messages

01 Food loss and waste (FLW) pose major obstacles to achieving a sustainable food system in Uganda.

02 Between 30-50% of food is lost within the first three months after harvest. Major contributing factors include inadequate infrastructure, ineffective post-harvest management practices, inefficient processing techniques, and market barriers.

03 FLW results in lost income for farmers and diminished profitability for businesses, affecting the economy, and also negatively impacts environmental sustainability.

04 Effective strategies to combat FLW include investing in rural infrastructure, enhancing access to affordable credit, fostering technological innovation, and establishing efficient market systems.

05 Targeted policies must be established to address infrastructure inefficiencies and enhance consumer awareness to foster a sustainable food system in Uganda.

06 Collective efforts – from the government, private sector, consumers, and farmers – are essential to achieving FLW reduction, ensuring future food security, economic stability, and environmental sustainability.

# Introduction

This paper highlights the potential benefits of reducing food loss and waste in achieving desired food system outcomes in Uganda, using a foresight approach. Foresight and scenario analysis help facilitate societal understanding, learning, and innovation necessary for food systems transformation (Foresight4food, 2024). The paper provides an overview of the current state of food loss and waste, outlining key causes and potential interventions. The authors analyze trends and critical uncertainties, develop future scenarios, and assess their implications for stakeholders in the sector. Based on these findings, policy recommendations are proposed to support the reduction of food loss and waste in Uganda.

# 1 State of food loss and waste in Uganda

Food loss and waste (FLW) refers to the reduction in quantity (e.g., weight or volume) or quality (e.g., nutrient value, taste, appearance) of food intended for human consumption. **Food loss** is the decrease in edible food mass that occurs during the production, post-harvest handling, and processing stages. It includes food lost due to spillage, spoilage, or reduced quality, such as bruising or wilting, before reaching consumers. In contrast, **food waste** is the portion of food loss that occurs at the retail and consumption stages, typically due to the discarding of food that is still edible but has spoiled or is perceived as undesirable.

FLW pose significant challenges to achieving sustainable development goals, as they directly affect the lives of millions of poor smallholder farmers (Costa, 2015). Globally, FLW accounts for about 30% of the annual harvest of grains, fruits, and vegetables (FAO, 2011; FAO, 2013). In Sub-Saharan Africa, FLW rates are estimated to be between 5% and 13% for cereals, 12% to 18% for oilseeds and pulses, and 13% to 29% for root and tuber crops (FAO, 2011). Unlike in developed regions, where most FLW occurs at the consumer level, the bulk of losses in Sub-Saharan Africa take place during production, harvesting, and post-harvest processing. For instance, the use of non-hermetic storage containers exposes produce to damage from weevils and mould (Mutungi et al., 2015).

To address FLW, Sustainable Development Goal Target 12.3 aims to halve per capita global food waste at the retail and consumer levels and reduce food losses across production and supply chains, including post-harvest losses. The FAO has instituted the Food Loss Index (FLI) as a means of tracking progress toward this target by measuring losses across key commodities. In Uganda, the FLI tracks 10 commodities – including cereals (e.g., maize, millet, rice), roots and tubers, oil-bearing crops (e.g., groundnuts, sweet potatoes), fruits, vegetables, and animal products (e.g., milk, eggs, fish). From 2015 to 2018, Uganda's FLI averaged 7.7%, indicating that 7.7% of these commodities were lost along the supply chain before reaching retail.

***Table 1: Estimates of post-harvest losses for different crops by Ugandan farmers***

| Crop | Loss at harvest (%) | Loss during transportation (%) | Loss during storage (%) | Total loss (%) |
|---|---|---|---|---|
| **Maize** | 16.40 | 0.51 | 24.55 | 41.46 |
| **Millet** | 13.09 | 0.38 | 19.74 | 33.21 |
| **Sorghum** | 14.21 | 0.47 | 19.12 | 33.80 |
| **Grain amaranth** | 8.01 | 4.58 | 13.96 | 26.55 |
| **Beans** | 10.28 | 4.99 | 15.43 | 30.70 |
| **Groundnuts** | 12.27 | 1.31 | 18.87 | 32.45 |
| **Cowpeas** | 7.90 | 0.65 | 14.00 | 22.55 |
| **Sweet potatoes** | 15.75 | 0.00 | 1.20 | 16.95 |
| **Cassava** | 15.99 | 0.95 | 3.02 | 19.96 |
| **Bananas** | 2.5 | 1.3 | 6.2 | 9.9 |

*Source: Tibagonzeka et al. (2018);*

While food loss at the consumer level in Uganda remains relatively low compared to developed countries, significant losses still occur due to improper food handling, lack of awareness, and cultural practices. A study by the United Nations Environment Programme (UNEP) and the Uganda Cleaner Production Centre revealed that Kampala generates 89 kg of food waste per capita per year, with households contributing more waste than institutions and produce markets.

## 2 Primary causes of FLW across the value chain

FWL in Uganda can be attributed to various factors, which are explored in more detail in the following sections:

### 2.1. Poor post-harvest management

Pest infestations are a significant cause of food loss, starting in the field and continuing post-harvest and can lead to losses of 16-18% of total crop production if not properly managed (FAO, 2019). The adoption of integrated pest management strategies, which combine biological, cultural, and chemical methods, has proven effective in reducing pest-related losses.

Food loss is further intensified by the use of crop varieties with poor post-harvest traits, such as a short shelf life, high susceptibility to pests, and limited market appeal. Inefficient harvesting techniques and improper timing also contribute to losses. For instance, manual harvesting often causes physical damage to crops, diminishing their market value and shelf life, while harvesting at the wrong stage – too early or too late – can negatively impact the quality and quantity of produce.

Inadequate storage facilities at the farm level significantly contribute to FWL (Sheahan & Barrett, 2017; World Bank, 2011). Insufficient storage conditions expose freshly harvested crops to pests, diseases, and environmental factors like humidity and temperature fluctuations, with most losses occurring within the first three months of storage. Enhancing the reach of extension services could be pivotal in sharing knowledge on modernfarming techniques, pest management, and improved post-harvest handling practices.

### 2.2. Climate and weather uncertainties

Climate variability and unpredictable weather conditions are major drivers of FLW in Uganda. Erratic rainfall patterns, droughts, and floods can cause significant crop losses in the field (MAAIF, 2018). Meanwhile, frequent and prolonged dry spells, higher temperatures, floods, and a rise in pest and disease incidence, all disrupt farming practices in Uganda. These changes have led to shifts in farming seasons, contributing to increased food loss and crop damage. For example, the September 2010 floods in the Teso sub-region caused crop damage valued at UGX 8 billion – primarily through the rotting of cassava, sweet potato tubers, and groundnuts (MAAIF, 2018). Flooding also submerged crop fields and damaged vital infrastructure, disrupting the transport and supply of food.

## 2.3. Transport limitations

Transportation challenges following harvest are a significant contributor to food losses in Uganda. Poor rural infrastructure often delays the movement of produce from fields to storage or markets, increasing the risk of spoilage. During transit, produce is frequently damaged due to rough handling, inadequate packaging, and exposure to unfavourable conditions, especially in remote and rural areas (Hodges et al., 2011; World Bank, 2011).

Additionally, limited market access and fluctuating demand can exacerbate food loss, particularly during bumper harvests. Farmers may struggle to sell their produce promptly due to weak market linkages, low demand, or unfavourable prices. Strengthening market access, organizing farmers into cooperatives, and providing reliable market information are essential strategies to reduce these losses (Sheahan & Barrett, 2017).

## 2.4. Limited food processing facilities and technologies

Limited access to food processing facilities and technologies significantly contributes to post-harvest losses in Uganda. Facilities that can extend the shelf life of perishable goods, such as for drying, canning, or freezing, are essential for reducing these losses. A lack of reliable cold chain infrastructure further exacerbates post-harvest losses, especially for perishable commodities like fruits, vegetables, and dairy products. Even where processing facilities exist, inefficiencies and inadequate infrastructure, including unreliable electricity coverage, result in significant losses. Small-scale processors often face challenges accessing credit and financial services, limiting their ability to invest in improved processing infrastructure. Additionally, inadequate policies, complex regulations, poor adherence to existing standards, and limited support from government institutions have stifled compliance and led to further losses. Capacity-building initiatives and vocational training programs can empower processors with the skills needed to reduce losses and enhance productivity (Ndungu et al., 2015).

# 3 Impact of FLW on food system outcomes

The consequences of FLW can be categorized into three closely linked food system outcomes.

## 3.1. Food security

FLW can significantly decrease the availability of food in the market, reducing consumers' access to affordable and nutritious options. As a major contributor to global food insecurity, FLW is closely linked to hunger and malnutrition. According to the 1996 World Food Summit, food security exists "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life."

Contrary to popular belief, widespread hunger is not solely caused by food scarcity or declining levels of food production. It often results from failures in the food distribution system, which reduce market availability and drive up food prices, limiting access for low-income consumers. Each year, approximately 2.5 billion metric tons of food is lost or wasted globally. If saved, it could feed up to two billion people, significantly alleviating the global hunger crisis. Low-income countries like Uganda are particularly affected by food insecurity, especially in regions impacted by conflict or extreme climate-related events. With 70% of the world's extremely poor and food-insecure populations residing in rural areas, agriculture plays a vital role in combating poverty and ensuring food security).

## 3.2. Environmental impacts

FLW has significant environmental impacts, undermining the sustainability of food systems. When food is lost or wasted, the resources used in its production – including water, land, energy, labour, and capital – are also wasted (UN, 2023). For example, raising animals requires substantial amounts of water for both growth and feed, making the wastage of meat particularly resource-intensive. Discarding one kilogram of meat is equivalent to wasting 15,000 litres of water (Mekonnen & Hoekstra, 2019). The total impact of food loss on water resources in Uganda has been estimated at 1.134 million metric tons (Kipkirui et al., 2023). The United Nations Secretary-General's High-Level Panel on Global Sustainability reported that the water used annually to grow food that is ultimately wasted would be sufficient to meet the domestic water needs of nine billion people (UN, 2023).

Rotting food in landfills impacts local biodiversity by polluting waterways and groundwater. Additionally, the disposal of food waste in landfills leads to significant greenhouse gas (GHG) emissions – particularly methane, a greenhouse gas far more potent than CO2. Worldwide, food waste accounts for approximately 4.4 gigatonnes of CO2-equivalent GHG emissions annually, exacerbating global warming and climate change (Rezaei & Liu, 2017). In East Africa, the carbon emissions from food loss were estimated at 5.53 million tons per year, with Uganda contributing 0.7 million tons (Kipkirui et al., 2023). Reducing FLW is crucial for mitigating the impacts of climate change on food systems and enhancing environmental sustainability.

### 3.3. Economic impacts

Economically, FLW represents a wasted investment that diminishes farmers' incomes and increases consumers' expenses (FAO, WFP, IFAD, 2019). A study of 10 Sub-Saharan African countries found that farm incomes could rise by 20% if avoidable losses and waste were reduced or recovered (Aragie et al., 2018). FLW decreases the overall supply of food in the market, which can lead to higher food prices and reduced access for low-income consumers. Furthermore, if food quality deteriorates to the point that it must be sold at a lower price or discarded, farmers' livelihoods are adversely affected.

Food quality issues, such as contamination from aflatoxins, microbial pathogens, agrochemicals, and veterinary drug residues, are prevalent in Uganda. According to a Partnership for Aflatoxin Control in Africa (PACA) study (2017), aflatoxin levels in Uganda's maize (20-65%), sorghum (70-100%), and groundnuts (10-20%) often exceeds maximum regulatory limits. These safety concerns reduce trade competitiveness and damage the credibility of Ugandan food brands. For example, in March 2021, Uganda's maize was banned by Kenya due to excessive aflatoxin levels (Kakuru & Akurut, 2022).

## 4 Interventions to reduce FLW

Reducing FLW demands a comprehensive approach that tackles inefficiencies across the entire food supply chain, from production to consumption. Implementing targeted interventions can significantly mitigate FLW, thereby enhancing food security, economic stability, and environmental sustainability.

### 4.1. Improved agricultural practices:

Improving agricultural practices can play a crucial role in reducing food loss at the production level. Strategies, such as adopting improved seed varieties and implementing better pest and disease management, can significantly decrease losses. Training programs that educate farmers on optimal harvesting times, techniques, and post-harvest handling practices have proven effective in minimizing FLW (Affognon et al., 2015). Additionally, equipping farmers with modern, efficient harvesting tools can help reduce physical damage to crops during harvesting.

### 4.2. Enhanced post-harvest handling and storage:

The government should invest in improved post-harvest handling and storage facilities is in order to minimize food losses. Research by Affognon et al. (2015) found that improved storage technologies – such as such as hermetic storage bags, metal silos, and cold storage facilities – can reduce post-harvest losses by up to 30% in Sub-Saharan Africa by significantly extending product shelf life and preventing spoilage. Yet, despite their effectiveness, financial investment in this sector remains limited: over the past 30 years, 95% of research investments have focused on increasing productivity, with only 5% allocated to reducing losses.

### 4.3. Processing and value addition:

Processing and value addition effectively reduces food losses by converting perishable produce into more stable, marketable products (Sheahan & Barrett, 2017). Government policies to encourage establishment of small-scale processing units by the private sector, promoting the use of solar dryers, and developing value-added products (like jams, sauces, and dried fruits) can significantly enhance food preservation and extend shelf life.

## 4.4. Efficient food distribution systems:

Improving transportation and market infrastructure is essential to reducing food losses during distribution. The Ugandan government and the private sector should team up to investments in road networks and refrigerated transport, alongside efficient market linkages, are crucial to ensuring produce reaches markets in optimal condition (World Bank, 2011). For instance, the Community Agricultural Infrastructure Improvement Programme, Project-1 (CAIIP-1), significantly improved road infrastructure, which increased farm gate prices for staple crops and reduced transportation costs and travel times by 50% (ADB, 2018). These enhancements resulted in approximately a 20% reduction in post-harvest losses for perishable goods.

## 4.5. Consumer education and behavior change:

Educating consumers about proper food handling, storage, and sustainable consumption practices is essential for reducing food waste at the household level. Awareness campaigns focused on portion control, food waste reduction, and the creative use of leftovers can significantly lower waste in homes – with Stancu et al. (2016) finding that consumer education programs can reduce food waste by 10-15%.

## 4.6 Innovative technologies to improve market linkages:

Strengthening market linkages and providing farmers with reliable market information is crucial in reducing the time produce waits for buyers and ensuring timely sales (Sheahan & Barrett, 2017). Technological innovations – such as mobile apps for market information, precision agriculture, and traceability systems – can significantly streamline the food supply chain and minimize losses.

The use of information and communication technology and e-commerce also positively impacts farmers' incomes (Evans, 2018). Farmers can leverage mobile phones to access timely weather forecasts, market prices, and agricultural information through mobile apps, SMS services, and social media platforms. This information enables informed decision-making about planting, harvesting, and accessing profitable markets, ultimately reducing post-harvest losses.

# 5 Key uncertainties related to FLW in Uganda

The effectiveness of FLW reduction strategies in Uganda is influenced by various systemic and environmental uncertainties. These uncertainties involve factors that could shape future outcomes in unpredictable ways, either positively or negatively, based on internal and external dynamics. Below is an overview of the key uncertainties in Uganda's FLW landscape and the challenges in predicting their future direction.

## 5.1. Quality of food distribution infrastructure

While 95% of Uganda's food is transported by road, only 16% of the country's national road network is developed. Underdeveloped national and international rail, water, and air transport networks further contribute to food distribution inefficiencies. As a result, food aggregation, transportation, storage, and distribution primarily relies on informal, small-scale operators (FAO, 2013). Meanwhile, poor electricity coverage – currently at 35.9% nationwide – limits food processing at the point of production. The lack of industrial infrastructure restricts the quantity and types of foods that can be processed, leading to limited market access and inefficient market linkages that contribute to high FLW.

Smallholder farmers often face challenges in accessing markets due to high transportation costs, lack of market information, and market monopolies. During bumper harvests, low market prices force farmers to store produce until prices stabilize, but inadequate storage facilities remain a major cause of food loss at the farm gate.

If transportation and storage infrastructure improves, FLW could decrease as food reaches markets faster and in better condition – but uncertainty lies in whether the government of Uganda will invest in the necessary infrastructure improvements.

## 5.2. Purchasing power

Uganda has made significant progress in economic development, driven by increased foreign investment, improved infrastructure, and sound macroeconomic policies. Economic development plays a crucial role in shaping the food system, as it influences consumers' income levels and dietary patterns (Béné et al., 2019). As incomes in Uganda rise, household spending on food decreases proportionally, making food relatively cheaper and potentially leading to increased food waste.However, purchasing power remains subject to various unpredictable factors, including inflation, wage growth, economic policies, and global market dynamics. Shifts in these factors, along with unforeseen events like economic crises or technological advancements, could enhance or diminish individuals' ability to afford food.

## 5.3. Enforcement of policies and food quality standards

Food safety threats significantly hinder the availability of Ugandan produce in supermarkets and regional markets. Factors such as poor post-harvest handling, improper pesticide application, and inadequate disease control contribute to high levels of microbial and chemical contamination. Uganda has faced warnings from the European Union regarding chemical contamination in its horticultural exports, and neighbouring countries have banned imports of Ugandan cereals, dairy, and poultry products due to aflatoxin contamination (Kakuru and Akurut, 2022).

While food safety regulations are harmonized across East African Community countries, each nation is responsible for implementing and enforcing these standards. The uncertainty lies in whether Uganda will strengthen its food safety systems to meet international standards. If enforcement improves, the country's produce could access new markets, reducing FLW through higher demand. However, failure to address contamination issues could lead to further market bans and increased food loss at the production stage.

## 5.4. Shift in dietary patterns

Increasing urbanization and food safety concerns are driving a noticeable shift in consumption habits from traditional, minimally-processed diets to processed and imported foods. For instance, concerns about contamination in raw foods sold at local markets are contributing to the increased consumption of packaged and processed foods.

Processed foods generally have a longer shelf life due to added preservatives, which could lead to reduced FLW. However, overproduction of processed foods and production inefficiencies can lead to loss of edible parts or nutrients, thereby increasing FLW .

Urbanization and rising household incomes may simultaneously improve access to health information, encouraging a shift toward healthier, more sustainable, and less processed food options. However, uncertainty lies in whether traditional food consumption habits will prevail, potentially keeping FLW high, or if a shift towards processed foods will lead to sustainable consumption patterns and reduced FLW.

## 5.5. Knowledge and awareness of implications of FLW

Extension services in Uganda provide smallholder farmers with essential agricultural information, training, and resources to improve their productivity and livelihoods. However, the ratio of extension workers to farmer households was only 1:1,800 in 2019 – well below the internationally recommended ratio of 1:500 (MAAIF, 2019). This low penetration of extension services contributes to poor agronomic and post-harvest handling practices, which are major drivers of FLW at the farm gate. A recent report warned that, due to limited awareness, 5-15% of produce is lost at the farm level, and if market systems are not improved, FLW in the fruits and vegetable sector could reach up to 80%.

However, the lack of awareness about FLW extends to consumers, leading to irresponsible food purchasing, consumption, and handling behaviours. Informed consumers are more likely to be mindful of portion sizes, invest in food storage solutions, and consider recycling or reusing food materials.

The key uncertainty is whether the government and civil society will expand extension services and improve education for both farmers and consumers. If farmers receive training on best practices in post-harvest handling and storage, and consumers are educated on responsible food consumption, FLW could significantly decrease. However, if the extension system remains under-resourced, FLW is likely to remain high.

## 5.6. Access to credit

To invest in technologies that reduce FLW, smallholder farmers and small-scale processors across the agricultural value chain require access to affordable credit. Although the government has introduced various funding initiatives, such as the Parish Development Model (PDM), Agricultural Credit Facility (ACF), and Uganda Agricultural Insurance Scheme (UAIS), these interventions have limited coverage due to political interferences and poor management; and have not adequately reached the rural poor.

Additionally, the politicization of these initiatives often leads to funds not being used for their intended purposes or repaid to the national pool. Specifically with the PDM, issues such as unclear implementation guidelines and a lack of functional structures in some districts further hinder its effectiveness.

The uncertainty lies in whether these programs will expand and effectively reach rural farmers. If credit access improves, farmers could invest in better storage and processing facilities, reducing FLW. However, if credit remains inaccessible or politicized, farmers will continue to struggle with inadequate resources, resulting in high FLW.

*Table 1 summarizes the key uncertainties and illustrates how they may vary in the future.*

*Table 1: Possible variations related to critical uncertainties that could affect FLW in Uganda*

| Critical uncertainties | Uncertainty variation | |
|---|---|---|
| **Quality of food distribution infrastructure** | Poorly developed transport, food processing, and distribution infrastructure | Well-developed infrastructure to support food distribution and processing |
| **Purchasing power** | Low purchasing power means food is relatively expensive and thus low FLW | High purchasing power means food is relatively cheap and thus high FLW |
| **Enforcement of policies and food quality standards** | Poor implementation of government policies due to corruption and unqualified technocrats | Policies on FLW fully implemented by qualified public, private, and NGO entities |
| **Shift in dietary patterns** | People consume unprocessed food with short shelf life, leading to high FLW | Increased consumption of processed, safe, and healthy food, reducing FLW |
| **Knowledge and awareness of implications of FLW** | Poor awareness of the impact of FLW on food security and incomes of farmers, leading to high FLW | Farmer and consumer awareness reduces loss at all nodes post-harvest |
| **Access to credit** | Poor access to credit causes farmers to struggle with inadequate resources, leading to high FLW | Highly accessible credit enables farmers to invest in better storage and processing facilities, reducing FLW |

# 6 Future scenarios regarding FLW and implications for key players

An impact-uncertainty matrix was used to identify the most critical uncertainties affecting FLW in Uganda, based on both their level of uncertainty and potential impact. This foresight tool helps pinpoint the key drivers with the greatest influence on FLW and the highest level of unpredictability in how they might evolve.

Figure 1 illustrates the impact-uncertainty matrix and highlights that the two most significant uncertainties are the quality of food distribution infrastructure and knowledge and awareness of the implications of FLW.

| Uncertainty | | | | |
|---|---|---|---|---|
| | High | | ○ Shift in dietary patterns | ○ Quality of food distribution infrastructure<br>○ Knowledge and awareness of implications of FLW |
| | Medium | ○ Enforcement of policies and standards | ○ Access to credit<br>○ Purchasing power | |
| | Low | | | |
| | | Low | Medium | High |
| | | | *Impact* | |

***Figure 1: Impact-Uncertainty Matrix for the most important uncertainties influencing FLW in Uganda***

This analysis led to the creation of four plausible future scenarios (Figure 2) that could arise from various combinations of the two selected significant uncertainties.

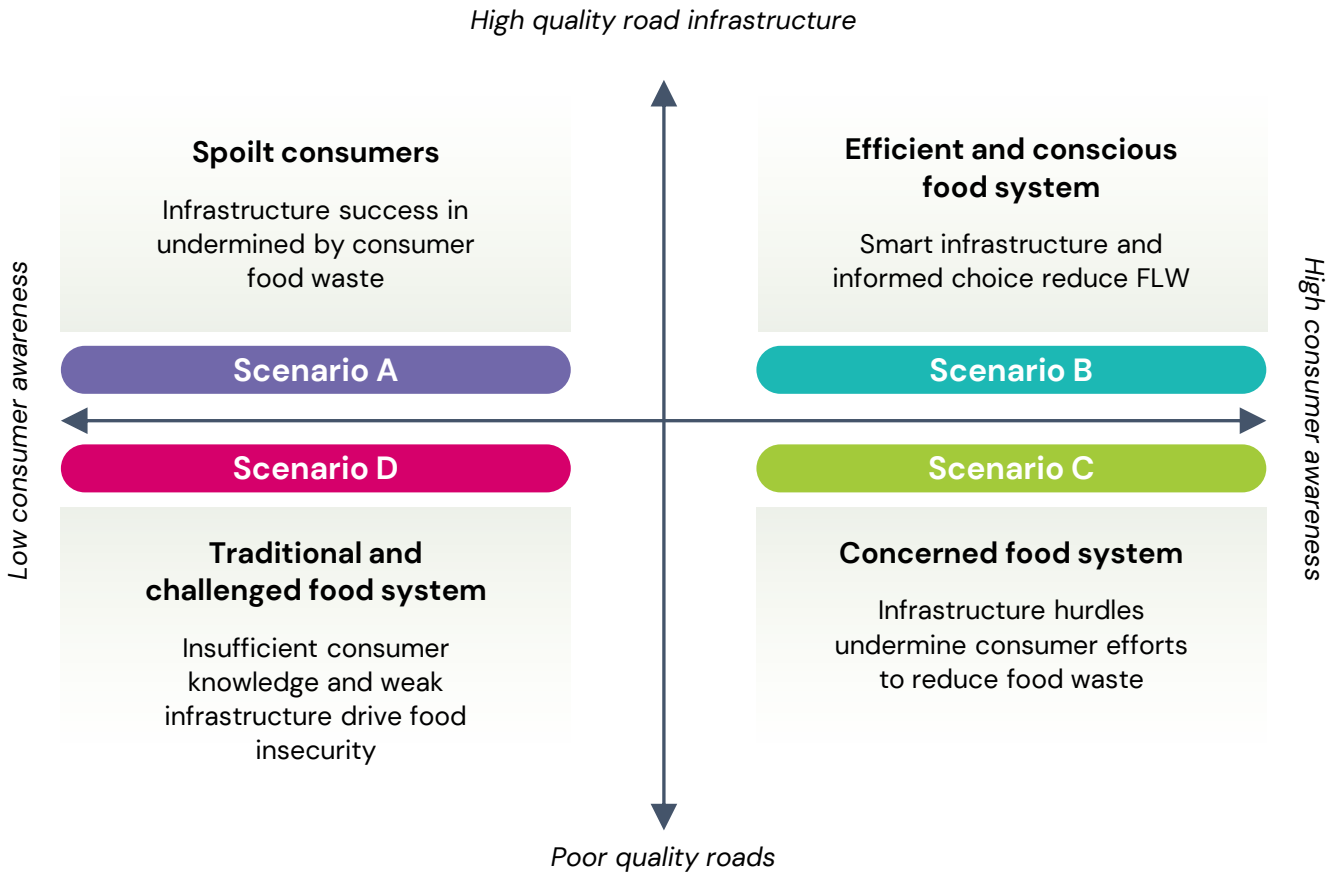


***Figure 2: 2x2 matrix showing future scenarios of food loss in Uganda***

Each scenario, below, outlines how these uncertainties may interact and shape the effectiveness of FLW reduction efforts in Uganda. We also highlight their potential implications for key players in the FLW ecosystem: the government, private sector, consumers, and farmers/small-scale processors.

## 6.1. Scenario A: Spoilt consumers

In this scenario, Uganda has a well-developed food distribution infrastructure that is undermined by low consumer awareness of FLW. Although efficient infrastructure reduces post-harvest transportation losses and lowers food prices, poor consumer awareness results in significant waste at the household level.

### Potential implications:

**Government:** Needs to implement stronger consumer education programs and policies to address food waste. Continued investment in infrastructure and public awareness is crucial.

**Private sector:** Should invest in consumer education and marketing strategies to promote waste reduction practices.

**Consumers:** Benefit from affordable food due to efficient distribution, but low awareness of FLW results in significant household waste. This undermines the benefits of lower prices and may eventually increase food costs.

**Farmers/small-scale processors:** Enjoy improved market access and reduced transport losses but face challenges from high consumer waste, which may affect demand stability.

## 6.2. Scenario B: Efficient and conscious food system

In this scenario, significant investments in road infrastructure enable efficient food distribution and market access. High FLW consumer awareness leads to conscious purchasing, consumption, and waste management. Together, these factors significantly reduce FLW.

### Potential implications:

**Government:** Must focus on maintaining and upgrading road infrastructure while implementing educational campaigns to sustain high consumer awareness. Ensuring farmers' access to credit will also facilitate better market access.

**Private sector:** Has an important role in investing in technologies and practices that cater to conscious consumers, such as sustainable processing and efficient supply chains. Can also provide credit services and bring markets closer to smallholder farmers.

**Consumers:** With high FLW awareness, consumers engage in mindful purchasing, storage, and waste reduction, complementing efficient food distribution and supporting food security and sustainability.

**Farmers/small-scale processors:** Improved transport infrastructure affords them efficient access to markets, higher profits, and economic stability. This encourages the adoption of better practices and investments in modern storage and processing facilities, ultimately reducing FLW and enhancing food security and sustainability.

## 6.3. Scenario C: Concerned food system

In this scenario, consumer FLW awareness is high and they engage in efforts to reduce waste. However, poor road infrastructure hampers food distribution and market access, resulting in significant losses during distribution. That said, consumers' proactive measures could help mitigate the inefficiencies caused by infrastructure limitations.

### Potential implications:

**Government:** Must prioritize infrastructure improvements while continuing to support consumer education. Investments in rural roads and transport networks are critical.

**Private sector:** Should invest in alternative distribution methods and local solutions to bridge infrastructure gaps.

**Consumers:** Poor infrastructure limits the impact of their FLW efforts. They often rely on local markets for fresher food, minimizing losses during transport.

**Farmers/small-scale processors:** Struggle with transport inefficiencies, leading to higher post-harvest losses and production costs. However, strong consumer awareness ensures steady demand for high-quality produce, prompting farmers to rely more on local markets.

## 6.4. Scenario D: Traditional and challenged food system

This scenario depicts a challenging environment, whereby poor infrastructure severely limits food distribution and consumer awareness about FLW remains low. With high FLW levels and minimal opportunities for improvement, the result is severe food insecurity, economic losses, and environmental challenges.

### Potential implications:

**Government:** Has a critical role in addressing infrastructure and consumer awareness. Urgent investments in road networks and comprehensive food waste reduction campaigns are necessary.

**Private sector:** Faces significant challenges in logistics and market predictability, with limited investment opportunities for new technologies due to low awareness of FWL.

**Consumers:** Low awareness and poor infrastructure contribute to severe food waste and insecurity. Wasteful habits persist, exacerbating food shortages and environmental issues.

**Farmers/small-scale processors:** Severely affected by transport inefficiencies and market access issues, leading to high post-harvest losses and production costs. They experience economic instability and increased pressure to improve on-farm storage and preservation methods.

# 7 Policy recommendations

The following recommendations address the two key uncertainties – food distribution infrastructure and consumer awareness – and their implications for Uganda's FLW future. Each recommendation is designed to be robust in various scenarios, to steer the country away from negative outcomes, and provide targeted interventions to support the key players in creating sustainable food systems.

## 7.1. Investment in food storage, processing, and rural road network

This action targets the challenges highlighted in Scenarios C and D. Public Investment in efficient infrastructure is essential to minimize food loss throughout the food chain, reduce prices, and ensure food security. Improvements in rural roads, storage, and processing facilities will enable faster and better quality food transportation, reducing losses.

Additionally, these investments will allow the private sector to introduce advanced post-harvest handling technologies and provide smallholder farmers and processors with improved market access. The government and civil society should also offer extension services on effective post-harvest management technologies.

## 7.2. Support small-scale food processing infrastructure and research and development

This recommendation is particularly relevant to Scenario C. The government should encourage private sector investment in post-harvest technologies and processing facilities through tax incentives and public-private partnerships. Supporting small-scale processing and investing in research and development can help mitigate losses during transportation and storage. Enabling farmers and processors to add value closer to the farm gate can reduce spoilage before products reach markets.

## 7.3. Mainstream awareness of FLW in all agricultural development policies

This recommendation relates to Scenarios A, C, and D. To replicate the positive outcomes of scenario B, FLW reduction should be integrated into all agricultural policies. The government and civil society should also lead efforts to educate the public – through awareness campaigns targeting farmers, traders, and consumers – about sustainable consumption and food handling practices, which would reduce waste at all food chain levels.

## 7.4. Develop efficient local, regional, and international market linkages

This recommendation is relevant to Scenarios C and D. To address the poor infrastructure and market inefficiencies that create barriers for farmers and contribute to high post-harvest losses, it is crucial for the government, civil society and private sector to ensure formation of stronger market linkages through organising farmers into cooperatives. Improved market access will enable farmers to reach broader markets, reduce unsold produce, and stabilize prices, while minimizing losses during peak harvest periods.

## 7.5. Expand access to affordable credit

This recommendation highlights positive lessons that can be learned from Scenario B. Farmers and small-scale processors across all scenarios need access to affordable credit to invest in necessary infrastructure and technologies. Expanding credit access will empower these stakeholders to enhance their storage, processing, and distribution capabilities, thereby supporting food security, profitability, and sustainability across the value chain.

# References


- ADB. (2018). Uganda: Community Agricultural Infrastructure Improvement Programme, Project -1. African Development Bank.
- Affognon, H., Mutungi, C., Sanginga, P., & Borgemeister, C. (2015). Unpacking postharvest losses in sub-Saharan Africa: A meta-analysis. World Development, 66, 49-68. https://doi.org/10.1016/j.worlddev.2014.08.002
- Aragie, E., Balié, J., & MoralesOpazo, C. (2018). Does reducing food losses and wastes in sub-Saharan Africa make economic sense? Waste Management & Research: The Journal for a Sustainable Circular Economy, 36(6), 483–494. https://doi.org/10.1177/0734242X18770247
- Béné, C., Prager, S. D., Achicanoy, H. A., Toro, P. A., Lamotte, L., Cedrez, C. B., & Mapes, B. R. (2019). Understanding food systems drivers: A critical review of the literature. Global Food Security, 23, 149-159. https://doi.org/10.1016/j.gfs.2019.04.009
- Costa, S. J. (2015). Taking it to scale: Post-Harvest Loss Eradication in Uganda 2014–2015. UN World Food Programme, Kampala, Uganda.
- FAO. (2011). Global food losses and food waste: Extent, causes and prevention. Food and Agriculture Organization of the United Nations.
- Evans, O. (2018). Digital Agriculture: Mobile Phones, Internet & Agricultural Development in Africa. MPRA Paper, Article 90359. https://ideas.repec.org//p/pra/mprapa/90359.html
- FAO. (2013). Food wastage footprint: Impacts on natural resources: Summary report. Food and Agriculture Organization of the United Nations.
- Foresight4food. (2024). Transforming food systems requires futures thinking. Foresight4Food. https://foresight4food.net/our-approach-an-overview/
- Hodges, R., Bernard, M., & Rembold, F. (2014). APHLIS – Postharvest cereal losses in Sub-Saharan Africa, their estimation, assessment and reduction. European Commission, JRC Technical Reports.
- Kakuru, M., & Akurut, T. (2022, March 17). Uganda's food loss and waste dilemma: The role of post-harvest handling. Economic Policy Research Centre. https://eprcug.org/press-releases/ugandas-food-loss-and-waste-dilemma-the-role-of-post-harvest-handling/
- MAAIF (2018). National Adaptation Plan for the Agricultural Sector. Ministry of Agriculture, Animal Industry and Fisheries. November, 92. https://www.agriculture.go.ug/2019/09/05/the-national-
- adaptation-plan-for-the-agricultural-sector-nap-ag/
- Mekonnen, M., & Hoekstra, A. Y. (2019). The green. Blue and grewy water footprint of farm animals and animal products. UNESCO-IHE I, Value of Water(Research Report Series No.48).
- Mrema, G. C., & Rolle, R. S. (2002). Status of the postharvest sector and its contribution to agricultural development and economic growth. In FAO agricultural services bulletin (Vol. 152). Food and Agriculture Organization of the United Nations.

# References


- Mutungi, C., Affognon, H. D., Njoroge, A. W., Manono, J., Baributsa, D., & Murdock, L. L. (2015). Triple-layer plastic bags protect dry common beans (Phaseolus vulgaris) against damage by Acanthoscelides obtectus (Coleoptera: Chrysomelidae) during storage. Journal of Economic Entomology, 108(5), 2479-2488. https://doi.org/10.1093/jee/tov197
- Parfitt, J., Barthel, M., & Macnaughton, S. (2010). Food waste within food supply chains: Quantification and potential for change to 2050. Philosophical Transactions of the Royal Society B: Biological Sciences, 365(1554), 3065-3081. doi:10.1098/rstb.2010.0126
- Rezaei, & Liu. (2017). Food loss and waste in the food supplky chain. FAO. https://openknowledge.fao.org/server/api/core/bitstreams/36cb45bc-392c-41fb-97f1-90ca1f16ee7f/content
- Sheahan, M., & Barrett, C. B. (2017). Food loss and waste in Sub-Saharan Africa: A critical review. Food Policy, 70, 112-121.
- Stancu, V., Haugaard, P., & Lähteenmäki, L. (2016). Determinants of consumer food waste behaviour: Two routes to food waste. Appetite, 96, 7–17. https://doi.org/10.1016/j.appet.2015.08.025
- Tibagonzeka, J. E., Akumu, G., Kiyimba, F., Atukwase, A., Wambete, J., Bbemba, J., & Muyonga, J. H. (2018). Post-harvest handling practices and losses for legumes and starchy staples in Uganda. Agricultural Sciences, 9, 141-156. https://doi.org/10.4236/as.2018.91011
- UN. (2023). Reducing food loss and waste: Taking action to transform food systems. Food loss and waste reduction. Retrieved September 29, 2023, from https://www.un.org/en/observances/end-food-waste-day
- World Bank. (2010). Improving the rural road network: A means to reduce poverty. World Bank.
- World Bank. (2011). Missing food: The case of postharvest grain losses in Sub-Saharan Africa. World Bank.