LAGOS FOOD BANK INITIATIVE AGRICULTURAL RECOVERY PROGRAM

BASELINE STUDY ON THE VIABILITY AND POTENTIAL IMPACT OF IMPLEMENTING AN EFFICIENT AGRICULTURAL RECOVERY SYSTEM IN NIGERIA

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Global FoodBanking Network AND Pacific Investment Management Company

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CHAPTER 1: EXECUTIVE SUMMARY

1.0 Introduction

Nigeria grapples with a substantial issue of food loss and waste, where approximately 40% of the total food production ends up as waste. This poses a significant setback, given the prevalent poverty and food insecurity in the country, with about 133 million people, a good percentage of which are multidimensionally poor (NMPI, 2022). The repercussions are particularly severe for vulnerable households, struggling to access sufficient and nutritious food, leading to malnutrition and adverse health effects, especially among women and children.

To tackle this issue, the Agricultural Recovery Program (ARP) was initiated with primary focus on mitigating food loss at the production level by salvaging surplus agricultural produce. The rescued food is then distributed to vulnerable households, addressing both the immediate need for nourishment and the environmental repercussions of food loss and waste, with a view to reducing the impact on climate change. Agricultural recovery projects are often initiated to support communities or regions affected by factors such as natural disasters, economic challenges, or other crises that could affect food production and security. These projects aim to revive or strengthen the agricultural sector, ensuring sustainable food production and livelihoods for local communities.

This study was intended to elicit baseline information on post-harvest handling of crops and livestock across the value chain (farmers, processors, marketers, and transporters) to enable an informed decision on appropriate agricultural recovery system needed to drive food security in Nigeria. The survey was carried out in all the agricultural zones in Nigeria and utilised a multi- stage sampling procedure to draw samples interviewed for the study. This Baseline Study of Agricultural Recovery System adopted mixed methodological approach. A broad range of stakeholders' consultations along the value chain activities of crops poultry and fisheries with consideration that guarantee participation of female and youth population in the data collection exercise was followed. The methodology combined quantitative, qualitative, participatory methods using tools such as questionnaires, interview schedules, Focus Group Discussion (FGDs) and Key Informant Interview (KII) with information

sources to allow triangulation of information and ensure impartiality. The quantitative data collected were entered into Statistical Package for Social Science (SPSS) for analysis. Descriptive statistics carried out included frequencies, percentages, charts, means, and standard deviations.

Results on socioeconomic information demonstrated a balanced distribution of respondents across various age categories, with 30.3% and 29.2% falling within the 26-35 and 36-45 age brackets, respectively. Most respondents were married (69.9%) and have less than 10 years of experience in agricultural farm enterprises. A significant portion of the survey participants prioritizes pepper (40.2%) and tomato (36.3%) cultivation, cassava (64.7%), maize (74.5%), cowpea production (83.3%), poultry production (86.3%) and production of dried fish (83.4%). Respondents' categories involved in processing were mainly plantain, cassava, and potatoes processors.
Manual post-harvest handling methods was predominant in all the study areas. However, most opted for sacks, traditional baskets, plastic crates, and trays to convey their farm produce during harvesting. Majority (72%) asserted that between 20-40% of their produce is wasted during harvesting, sorting, and transportation. Substantial number (70.6%) indicated that they store their farm produce under shade on the farm for more than 6 hours before it is hauled out. Drying and immediate sales of farm products were recognized as a potent and culturally adopted methods to curtail waste. Highlighted constraints to agricultural recovery systems and post-harvest handling derived from qualitative data include poor sales, weather and climate conditions, pest and disease attacks, high transportation costs, insecurity, poor road and market infrastructures.

Respondents were favourably disposed to the feasibility of agricultural recovery program for rescuing agricultural produce surplus by deploying technology, notably, cold storage and solar drying systems preservation methods to prolong shelf life and market viability. This is a major requirement for establishing food bank needed to negotiate cost and distribute excess produce to the vulnerable communities.

Accumulated post-harvest losses and wastage throughout the value chain are notably significant, with a major portion occurring during transportation (75.5%) and improper handling at the market (71.6%). Additional losses take place during harvesting processes (66.7%), representing a range of20% to 40% across the stages

from harvest to the market. Likewise, the collective post-harvest losses and wastage for specific crop categories within agricultural commodities during harvesting, sorting, transportation, and poor handling at marketing exhibit the highest wastage for tomatoes, potatoes, maize, and cowpea, respectively. These losses were estimated to fall within the 20-40% waste threshold in literature.

The survey served as a platform to raise awareness among farmers about the critical issue of food loss at various stages, including production, post-harvest handling, marketing, and transportation. The LFBI initiatives, which aim to salvage surplus agricultural produce and distribute it to vulnerable households, were clearly communicated to the respondents. The central message conveyed the importance of minimizing food waste through the adoption of efficient harvesting, storage, and transportation practices, which is a pathway for achieving food bank and distribution channels for the vulnerable households.

Identified stakeholders involved in an agricultural recovery initiative in Nigeria include Government Agencies such as Ministry of Agriculture and Rural Development, National Agricultural Extension and Research Liaison Services (NAERLS) and Agricultural Development Programs (ADPs). Others are Farmers and Farmers Groups, International Organisations - United Nations Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD) and World Bank. Non-Governmental Organisations (NGOs), Universities, Research Institutes/Centers, Community Leaders and Traditional Authorities among others.

The significance of food loss and waste has gained heightened attention due to its considerable environmental, economic, and social impacts. The environmental consequences of food waste are evident, with an annual per-capita wastage of approximately 500kg of CO_2, 250km2 of water, and 28% of arable land. This economic inefficiency results in the squandering of valuable resources that could be redirected elsewhere, both in terms of production and consumption.

In Nigeria, an estimated 40% of all food produced is lost, exacerbating food insecurity despite increased production levels. This substantial loss significantly contributes to the recent surge in food prices within the country. From an environmental perspective, food production exerts a notable toll on vital resources such as water, land, and energy.

Food loss and waste (FLW) exacerbate this strain, leading to environmental degradation and contributing to climate change.

The impact of addressing food loss and waste extends to profound social implications. Reducing losses leads to increased food availability, ensuring better access to nutritious food, especially for vulnerable populations like children and pregnant women. This expansion of affordable and healthy food choices plays a pivotal role in combating malnutrition and chronic diseases, ultimately contributing to a decrease in infant mortality.

Establishing a robust agricultural recovery system in Nigeria possesses substantial viability and the potential for significant impact. Tackling issues like insufficient infrastructure, restricted access to credit, and inconsistent policies can unlock the nation's agricultural capabilities. This approach not only promises heightened productivity but also fosters employment opportunities, diminishes poverty, and lessens dependence on food imports. Consequently, prioritizing investment in and executing an effective agricultural recovery system in Nigeria emerges as imperative for sustainable development and enduring prosperity.

1.1 A brief description of the Organization

Lagos Food Bank is a non-profit, nutrition-focused initiative committed to fighting hunger, reducing food waste, and solving the problem of malnutrition through targeted programs that seek to improve the nutrition/food intake of pregnant women and their infants who are not able to get the required nutrients during pregnancy and breastfeeding of their babies.

The Agricultural Recovery Program (ARP) is a program focused on addressing food loss at production level through the rescue of surplus agricultural produce which will be distributed to vulnerable households while also reducing the environmental consequences of food loss and waste and its impact on climate change.

In alignment with the Sustainable Development Goals 2 (Zero Hunger), 12 (Responsible Consumption and Production), and 17 (Partnerships for the Goals), the program is set to reduce food loss and waste, address food insecurity in vulnerable communities, promote sustainable practices, and foster collaborations to achieve these global development goals.

The main objectives of Lagos Food Bank Initiative Agricultural Recovery Project are to:

- increase access to healthy, local food for food-insecure individuals and families through the food banks nutrition programs.
- curb post harvest losses which occur at the food supply chain from harvesting of crops until its consumption.
- improve nutritional status of food insecure individuals with access to fresh fruits and vegetables.
- ensure equitable distribution of collected surplus food to reach the most underserved communities and individuals.
- contribute to long-term food security by establishing a reliable and sustainable supply chain for surplus agricultural produce.
- reduce the impact of climate change by promoting sustainable consumption and production practices.
- raise awareness about the environmental consequences of food loss and waste and its impact on climate change, resource depletion and biodiversity loss.

Lagos Food Bank Initiative Agricultural Recovery Project Implementation Process involved rescuing surplus agricultural produce from farms, food markets, supermarkets, seaports, and airports which will be sorted, stored, and distributed through the nutrition focused programs of the food bank to its beneficiaries. Target beneficiaries include malnourished children and pregnant women, low-Cost School children, seniors (Persons aged from 50 and above), the disabled/destitute, patients of diet related diseases and extremely indigent families.

1.2 Objectives of the baseline study

This is to comprehensively assess the viability and potential impact of implementing an efficient agricultural recovery system in Nigeria. Specifically, the baseline study will:

a) Extent of food loss and waste along the agricultural supply chain, including primary production, post-harvest handling, transportation, storage, and distribution
b) Strategies for rescuing produce from farms.

c) Potential risks and challenges to feasibility of agricultural recovery plan in Nigeria.
d) Identify and connect LFBI with at least 6 farmers in different agricultural zones for possible agricultural recovery.
e) Categories of relevant stakeholders involved in the agricultural recovery initiative. These stakeholders include Farmers and Producers Food Markets and Supermarkets Food Transport and Logistics Companies.
f) Seasonal calendar of fruits, vegetables, cereals, roots, and tubers crops in Nigeria.
g) Culturally adopted agricultural recovery systems/postharvest handing in Nigeria.
h) The economic, environmental, and social implications of reducing food loss and waste throughout the supply chain.
i) Effects of economic, environmental, and social features on agricultural recovery system/post-harvest handling in Nigeria.

CHAPTER 2: LITERATURE REVIEW

2.0 Background Information

Nigeria, endowed with fertile land and a diverse agro-climatic zones, holds immense potential for agricultural productivity. However, the nation faces a critical challenge in mitigating post-harvest losses, especially in the realm of perishable crops. Implementing an effective agricultural recovery system is paramount to harnessing the full potential of the sector. Post-harvest losses of perishable crops in Nigeria remain alarmingly high, attributable to a lack of modern infrastructure, inadequate storage facilities, inefficient transportation systems, and limited access to market information. These losses not only impact the livelihoods of farmers but also hinder the nation's overall food security and economic development.

The agricultural sector in Nigeria is a significant economic force, which contributes 25.2 % (N10.50 trillion) to her Gross Domestic Products (GDP) in 2019. While this figure looks impressive, it was also estimated around the same period that Nigeria lost up to $10 billion due to continuous decline in agricultural production· exacerbated by poor post-harvest handling (FAO, 2019). Proper postharvest processing and handling are important parts of modern agricultural production. The adoption of improved postharvest practices can reduce a substantial amount of food losses, improve overall food quality and safety, enhance consumers' acceptance, and thus add to the value of the marketable products.

Postharvest losses manifest in quantitative or qualitative forms. Quantitative losses occur when there is a reduction in the amount of agricultural produce/ product over a particular period. Conversely, qualitative losses indicate reduction in nutrient composition, viability, visual aesthetic appeal or breakage or contamination of agricultural produce/product. Agricultural recovery system entails activities carried out from the time of harvesting, handling, storage, processing, packaging, transportation, and marketing all of which affects the quality and nutrient composition of agricultural produce. In order to fight hunger, improve income generation, ensure food security and enhance livelihoods; postharvest losses require utmost attention by the relevant stakeholders. It is imperative therefore to have efficient agricultural recovery systems to reduce postharvest losses, document appropriate information for

farmers to handle post harvest activities, which consequently will increase agricultural productivity, farmer's production capacity and improve livelihoods.

Implementing an efficient agricultural recovery system in Nigeria has the potential to have a significant positive impact on various levels—economic, social, and environmental. However, the viability and success of such a system depend on various factors, including government policies, infrastructural development, technology adoption, food bank and community involvement. Here are some key points to consider for the feasibility of agricultural recovery system in Nigeria.

a) *Government support*: The success of an agricultural recovery system in Nigeria would largely depend on strong government support. Policies that encourage sustainable agriculture, provide subsidies, and investments in rural infrastructure can contribute to viability.
b) *Infrastructural Development*: Adequate infrastructure, including roads, irrigation systems, and storage facilities, is crucial. Improving transportation networks can help farmers get their produce to market more efficiently and reduce post-harvest losses.
c) *Technology Adoption*: The integration of modern agricultural technologies, such as precision farming, drones, and efficient irrigation methods, can enhance productivity. Training programs for farmers on technology adoption should be included in the recovery plan.
d) *Financial Incentives*: Financial support, including low-interest loans and grants, can encourage farmers to invest in modern farming practices and equipment, making the recovery system financially viable.
e) *Market Access*: Ensuring farmers have access to fair and competitive markets is crucial. Strengthening market linkages and supporting the development of farmer cooperatives can improve bargaining power.
f) *Food bank*: A food bank is a non-profit organization or charitable institution that collects, warehouses, and distributes food to individuals and families facing food insecurity. The primary goal of a food bank is to alleviate hunger and ensure that vulnerable populations have access to nutritious food.

2.1 Potential Impacts of Implementing Agricultural Recovery System in Nigeria

i. Economic Growth: A more efficient agricultural system can contribute significantly to economic growth by increasing productivity and generating employment opportunities, especially in rural areas.

ii. Food Security: Improved agricultural practices can enhance food production, contributing to greater food security for the population. Diversifying crops and promoting sustainable farming practices can help mitigate the impact of climate change on food production.

iii. Poverty Alleviation: Increased agricultural productivity can lead to higher incomes for farmers, contributing to poverty alleviation. Additionally, the growth of agribusinesses and related industries can create jobs and further support economic development.

iv. Environmental Sustainability: Implementing sustainable agricultural practices can minimize the environmental impact, preserving soil fertility and reducing the use of harmful chemicals. This contributes to long-term environmental sustainability.

v. Rural Development: An efficient agricultural recovery system can stimulate rural development by improving infrastructure, healthcare, and education. This, in turn, can address the issue of rural-urban migration.

vi. Resilience to shocks: A diverse and resilient agricultural system can better withstand external shocks, such as extreme weather events or market fluctuations, contributing to the overall stability of the economy.

vii. Technology Transfer and Innovation: Implementing modern agricultural technologies can foster innovation and knowledge transfer within the farming community, enhancing overall productivity.

The viability and potential impact of implementing an efficient agricultural recovery system in Nigeria are substantial. However, success will depend on coordinated efforts involving the government, private sector, and local communities, along with a commitment to sustainable and inclusive development. Agricultural recovery in Nigeria demands a holistic approach, specifically addressing the challenges associated with post-harvest handling and losses of perishable crops. By investing in infrastructure, embracing technology, building capacity, enhancing market access, and providing robust policy support, Nigeria can unlock the full potential of its

agricultural sector, ensuring food security, economic growth, and improved livelihoods for its farmers. The time is ripe for a concerted effort to transform challenges into opportunities and pave the way for a resilient and sustainable agricultural future.

2.2 Extent of food loss and waste along the agricultural supply chain In Nigeria

According to the Food and Agriculture Organization of the United Nations (FAO), between one quarter and one third of all food produced worldwide is never consumed (FAO, 2011). Food losses and waste occur at every stage of the value chain including during production, harvest, storage and transport, processing, and retail. Food waste occurring at the end of the chain (at the level of distributors and consumers) is particularly high in medium and high-income countries. This is mainly caused by consumer behavior and lacking coordination in the supply chain, chiefly those related to supermarkets and restaurants. In low-income countries, the most significant causes of food losses are financial, managerial, and technical limitations in the harvesting techniques, storage and cooling facilities located in difficult climatic conditions, infrastructure, packaging and marketing systems and related policy environments.

Reliable and quantitative evidence on food losses and waste is generally rare. The 2011 FAO food loss and waste estimates per region, commodity group, and stage of the food supply chain reveal relatively high losses in agricultural production, post-harvest handling and storage, and processing and packaging stage in Sub-Saharan Africa. Roots and tubers, and fruits and vegetables face disproportionately larger losses than other commodity groups. Food waste in final consumption is relatively unimportant (5% or less).

Also, for Nigeria, research into the exact figures of food losses is limited. Some survey carried out on post-harvest food losses in different parts of Nigeria revealed that as much as 20 – 30% of total grain production, 30 – 50% of root and tuber and usually high percentage of fruits and vegetables are lost with a substantial amount recorded during storage. The major problems are improper handling, lack of proper storage and packaging. For particularly vulnerable crops like tomatoes, some studies even indicate the losses can be as high as 62,5%, because farmer harvest mostly when they have buyer, harvest at fully ripe stage (90%) and most still use the traditional basket and sacks as their packaging material in conveying produce. Like most other African

governments, the government of Nigeria has adopted the Malabo Declaration, launched by the African Union in 2014, and made the reduction of postharvest losses one of their priorities and is willing to develop a national investment plan.

2.3 Drivers of food loss and waste along the value chain in Nigeria for maize, tomatoes, and catfish

A focus on improved storage and harvesting techniques, in addition to increased private sector investments and improved road infrastructure, will be critical to reducing losses, especially in the remote regions of the north. Given the long distances that perishables need to travel from the north to reach the south, and the rising middle class that will demand more nutritious, perishable foods, Nigeria will also need to increase the capacity of its cold chain as its population doubles by 2050. The design of the cooling system needs a holistic plan, with thoughtful intervention around where investments should be made. To increase private sector participation, risk mitigation measures will need to be examined as well as improving the enabling environment. Finally, food waste already accounts for majority of landfill volume in Nigeria, releasing potent methane emissions; and by 2050, with around 70% of Nigerians set to live in urban areas, this issue will further stress land scarcity challenges, associated pollution, and rising costs for municipalities. Cities will need to invest in capacity, enforcement, and facilities to make more efficient use of food waste, for composting, waste-to-energy, or animal feed purposes, to ensure Nigeria can meet its Paris Climate Agreement commitment.

For rural, marginalized communities in Nigeria, especially those in the north disconnected from demand and affected by conflict, the effects and trade-offs of losses and waste reductions of catfish in the closed economy are more pronounced. Interventions at any stage of the value chain led to neutral, if not positive outcomes, for all policy priorities. Especially important, in rural regions where food insecurity and malnutrition are highest, is the small to significant rise in food security with a 50% reduction in losses and waste at any stage.

Table 1: Drivers of food loss and waste along the value chain in Nigeria for maize, tomatoes, and catfish

<table>
<tr><th>Production</th><th>Transport, Handling, and Storage</th><th>Processing</th><th>Wholesale and Retail</th><th>Consumers</th></tr>
<tr><td colspan="3">1. Climate variability
- Agriculture insurance
- Early-warning systems
- Access to real-time market data
- Consider farm-level climate adaptation measures</td><td></td><td></td></tr>
<tr><td colspan="3">2. Poor harvest and post-harvest techniques
- Innovative models of cooperatives
- Improved storage facilities
- Improved handling practices</td><td></td><td></td></tr>
<tr><td colspan="3">3. Inadequate infrastructure connectivity between the north and south.
- Upgrade road conditions
- Improve logistical inefficiencies.
- Promote private investments</td><td></td><td></td></tr>
<tr><td colspan="3"></td><td colspan="2">4. Minimal cooling and refrigeration
- Increase cooling capacity, especially along LAKAJI Corridor
- Develop integrated cold chain from farm to fork.
- Improve urban connectivity to electricity for at-home refrigeration.</td></tr>
<tr><td colspan="3"></td><td colspan="2">5. Inadequate management of food waste
- Consumer awareness</td></tr>
</table>

	✚ Urban waste management strategies

Source: - https://documents1.worldbank.org/curated/en/703791601302657183/pdf/Nigeria-Food-Smart-Country-Diagnostic.pdf

2.4 Model structure of food loss and waste along the agricultural supply chain

The length, structure, and distribution of food loss and waste rates along the food supply chain of a country have important implications for food loss and waste reduction policies. The stylized model under the Global Framework captures six distinct stages in the food supply chain (see Figure 1). These include post-harvest losses at the farm level, as well as food loss and waste generated in Transportation, Handling, and Storage (THS), Processing Retailing, Hotels, Restaurants, and Institutions (HRI), and at-home versus away-from home consumption chain . The model highlights those interventions at one level of the chain (such as a reduction in waste rates at the retail level through improved food storage systems) can impact market prices which in turn leads to indirect effects on other stages of the supply chain. Capturing these indirect effects is critical in providing a holistic and realistic assessment of food waste reduction policies.

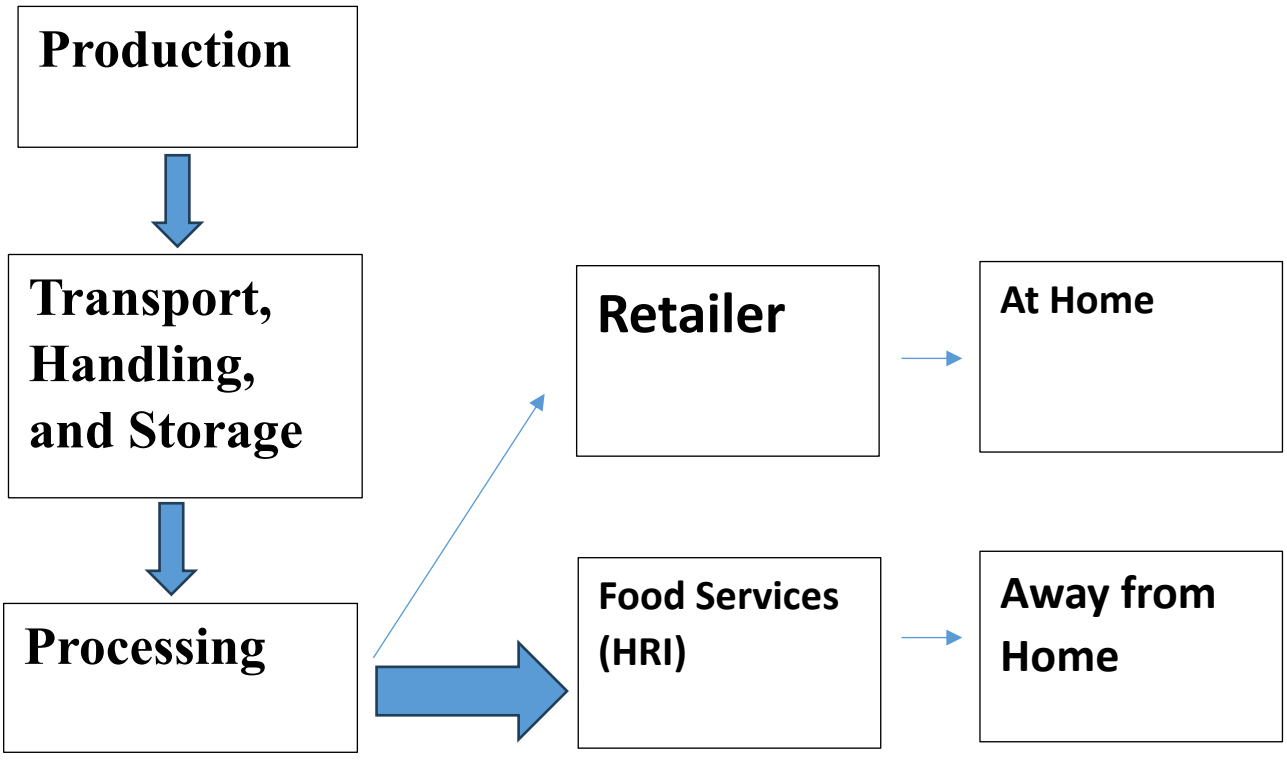


Figure 1: Stages of the Vertical Food Supply Chain

The model shows that the direction and magnitude of the indirect effects depends on the interaction of supply and demand elasticities at each level of the chain. The price elasticity of consumer demand in particular plays a key role in determining the effects of policy interventions at different stages of the supply chain. Assumptions regarding international trade are also shown to be critical. The model therefore considers three trade scenarios: a closed economy, a small open economy (in which the country exerts little influence on world prices) and a large open economy. For the latter, the elasticity of export supply (import demand) facing the country versus the elasticity of import demand (export supply) of the country are found to have important implications for the changes in producer welfare after an exogenous reduction in waste rates at the farm or THS level.

2.5 Potential risks and challenges to the feasibility of agricultural recovery plan in Nigeria

The feasibility of an agricultural recovery plan in Nigeria depends on several factors, including the comprehensiveness of the plan, effective implementation strategies, and the ability to address the specific challenges facing the agricultural sector in the country. However, implementing an agricultural recovery plan in Nigeria, like any other development initiative, is likely to face several risks and challenges. Some potential challenges to the feasibility of an agricultural recovery plan in Nigeria include:

1. *Infrastructural deficiencies*: Poor transportation infrastructure can lead to difficulties in moving agricultural products from farms to markets, resulting in increased post-harvest losses. Limited access to storage facilities and processing centers can compromise the quality and shelf life of produce.

2. *Climate change and Environmental Factors*: Nigeria is susceptible to climate change, which can lead to unpredictable weather patterns, droughts, floods, and other extreme events that affect agricultural productivity. Environmental degradation, soil erosion, and desertification can further impact the feasibility of agricultural recovery efforts.
3. *Access to Finance*: Limited access to credit and financial resources can hinder farmers' ability to invest in modern farming technologies, inputs, and practices. High-interest rates and stringent loan conditions may discourage farmers from seeking financial support.
4. *Inadequate Research and Extension Services*: Insufficient investment in agricultural research and extension services may limit the dissemination of modern farming techniques, technologies, and best practices. Lack of access to relevant information may hinder farmers' ability to adapt to changing conditions.
5. *Security Concerns*: Insecurity, including issues such as banditry, insurgency, and farmer-herder conflicts, can disrupt agricultural activities, leading to reduced productivity and displacement of farming communities.
6. *Policy and Institutional Challenges:* Inconsistent or unclear agricultural policies and regulations may create uncertainty for farmers and investors. Weak institutional capacity at the governmental level can impede the effective implementation and monitoring of recovery plans.
7. *Market Access and Trade Barriers*: Limited market access and trade barriers can affect the profitability of agricultural activities. Challenges in meeting international quality and safety standards can hinder exports.
8. *Low Mechanisation and Technology Adoption*: Low levels of mechanization and technology adoption can result in lower productivity and increased requirements. Limited access to modern farming equipment and tools may hinder the scaling up of agricultural activities.
9. *Land Tenure Issues*: Land tenure conflicts and unclear property rights can discourage long-term investments in agriculture. Inefficient land-use planning may lead to unsustainable practices and land degradation.
10. *Human Capital and skill Gaps*: Lack of skilled labour and knowledge gaps among farmers may hinder the adoption of improved agricultural practices.

Insufficient training programs may limit the capacity of farmers to adapt to new technologies.

11. *Market Price Volatility*: Fluctuations in commodity prices can impact the income and profitability of farmers, making it challenging to plan and invest in the agricultural sector. The prices of goods are determined by market forces and demand and supply, Unfortunately, there's no structure for price determination for most agricultural produce. According to the study conducted in Lagos state, Ajayi (2020) reported that the price of most agricultural produce depends on market forces and how the items move at the markets. Goods are sold at the rate farmers meet and market structures are not regulated.

2.6 Organizational challenges in implementing Food programme

Implementing a food bank program can be a valuable initiative to address food insecurity and support communities in need. However, like any organizational effort, there are challenges that may arise during the implementation of a food bank program. Some of these challenges include

1. **Resources constraints**
   - Financial Resources: Food banks often rely on donations, grants, and funding to operate. Limited financial resources can hinder the ability to purchase, store, and distribute food effectively.
   - Human Resources: Having an adequate number of volunteers and staff is crucial for the day-to-day operations of a food bank. Recruiting and retaining volunteers can be a challenge.
2. **Logistics and Distribution**
   - Transportation: Coordinating the transportation of food from donors to the food bank and then distributing it to various locations can be complex and expensive.
   - Storage Facilities: Adequate storage facilities are necessary to store perishable and non-perishable items. Lack of proper storage can lead to food spoilage and waste.
3. **Food safety and Quality**
   - Quality Control: Ensuring the safety and quality of donated food is a significant challenge. Proper inspection, handling, and storage

practices are crucial to prevent the distribution of unsafe or expired products.

- Food Allergies and dietary Restrictions: Addressing diverse dietary needs and restrictions among recipients can be challenging. A one-size-fits-all approach may not be suitable for all individuals or communities.
- Legal considerations: Understanding and adhering to legal requirements related to food donation, distribution, and liability is crucial.

4. **Community Engagement and Outreach**
    - Awareness: Creating awareness about the food bank program and its services is essential. Lack of awareness can result in underutilization of resources and services.
    - Cultural sensitivity: Understanding and respecting the cultural preferences and sensitivities of the community is vital for successful engagement.
5. **Data Management and Technology**
    - Tracking and Reporting: Efficient systems for tracking donations, managing inventory, and generating reports are critical. Lack of appropriate technology and data management systems can lead to inefficiencies.
6. **Sustainability**
    - Long-term Funding: Securing sustainable funding sources is crucial for the ongoing operation of a food bank. Relying solely on short-term grants or donations can lead to instability.
7. **Collaboration and partnership**
    - Community Partnership Building and maintaining partnerships with local businesses, government agencies, and other community organizations is important. Lack of collaboration can limit the reach and impact of the program.

Addressing these challenges requires a comprehensive and coordinated approach involving government, private sector, and community stakeholders. Sustainable agricultural recovery plans should incorporate strategies to mitigate these risks and build resilience within the agricultural sector. This may involve targeted

investments in infrastructure, policy reforms, capacity building, and the promotion of sustainable and climate-smart agricultural practices.

2.7 The economic, environmental, and social implications of reducing food loss and waste throughout the supply chain

The significance of food loss and waste has garnered increased attention due to its substantial environmental, economic, and social ramifications (Gustavsson *et al.*, 2011). The environmental impact is noteworthy, encompassing the utilization of scarce resources like land, energy, and water in food production, processing, distribution, and cooking. Globally, an alarming 30–50% of food produced for human consumption is lost or wasted annually along the food supply chain (FAO, 2012; Gustavsson *et al.*, 2011). Kummu *et al.* (2012) distinguished between food losses at production, postharvest, and processing stages and food waste at distribution and consumption stages.

While the attention has mainly focused on the quantity aspect, the issue of food quality loss has been overlooked. In Sub-Saharan Africa, incidents of acute aflatoxicosis outbreaks, leading to deaths like the 2004 incident where 125 Kenyans lost their lives, underscore the potential health implications of undetected food spoilage (Sheahan and Barrett, 2017). These food safety concerns emphasize the need for global attention not only on the quantity lost but also on the quality lost, which has direct or indirect impacts on the social and environmental fabric of societies.

The environmental toll of food waste is evident, with approximately 500kg of CO2, 250km2 of water, and 28% of arable land being wasted per person annually (FAO, 2013). This economic inefficiency translates to the squandering of valuable resources that could be utilized elsewhere, both in terms of production and consumption. In a world where 220 million people in Africa alone suffer from undernourishment, the social implications of food wastage are morally indefensible (FAO, 2016). Moreover, food waste that ends up in landfills contributes significantly to greenhouse gas emissions, exacerbating climate change (Mallinson *et al.*, 2016). Surprisingly, there is a lack of emphasis on the environmental repercussions of food waste, particularly in developing countries (Quested *et al.*, 2013).

2.7.1 Economic Implications

Addressing and minimizing food loss and waste (FLW) across the supply chain in Nigeria and Africa can yield substantial economic advantages, tackling critical issues such as food insecurity, poverty, and resource optimization. In Nigeria, an estimated 40% of all food produced is lost, exacerbating food insecurity despite increased production levels (World Bank, 2023). This contributes significantly to the current surge in food prices within the country. Consequently, any efforts directed at reducing food loss and waste could directly enhance food availability, especially in vulnerable regions, without necessitating additional land or water resources (FAO, 2020). This, in turn, translates to enhanced food security and nutrition, particularly benefiting vulnerable populations such as children and women (Morales-Opazo *et al.*, 2018).

Studies indicate that the reduction of food loss and wastage could boost farm income by 20% in Sub-Saharan Africa through the recovery of yields (Morales-Opazo *et al.*, 2018). This would positively impact the rural economic landscape as households in rural areas gain better economic options, leading to increased spending and investment within local communities (IFPRI, 2019). The resultant increase in food availability and affordability can significantly contribute to poverty reduction, particularly in food-insecure regions, empowering farmers with higher incomes to enhance rural livelihoods and contribute to economic development (World Bank, 2023).

Enhanced efficiency across the supply chain results in lower production costs, rendering agricultural businesses more competitive and profitable (WRI, 2020). Investments by both the government and private sector in initiatives aimed at reducing food loss and wastage create new employment opportunities, especially in areas such as storage, processing, and transportation, with a particular focus on engaging women and the youth population (FAO, 2020).

2.7.2Environmental implications

From an environmental standpoint, food production exerts a significant toll on resources such as water, land, and energy. Food loss and waste (FLW) exacerbate this strain, leading to environmental degradation and contributing to climate change (FAO, 2020). Addressing FLW not only minimizes resource consumption but also results in lower greenhouse gas emissions, enhanced water management, and improved soil

conservation (WRI, 2020). The decomposition of food waste releases methane, a potent greenhouse gas more than 20 times as effective as CO_2 in trapping heat. By minimizing these emissions, efforts to reduce FLW contribute to climate change mitigation.

Moreover, the reduction in food production associated with FLW leads to a decrease in energy use for irrigation, fertilizers, pesticides, and processing. This reduction contributes to mitigating dependence on fossil fuels and curbing associated greenhouse gas emissions. Given that food production demands extensive land and water resources, efforts to reduce food loss and wastage alleviate the pressure on ecosystems and biodiversity by minimizing the need for land clearing and excessive water usage. This protective measure ensures the preservation of vital ecosystems and the diversity of species within them.

2.7.3 Social implications

Addressing food loss and waste holds profound social implications. The reduction of losses results in increased food availability, providing better access to nutritious food, particularly for vulnerable populations such as children and pregnant women. This, in turn, expands the range of affordable and healthy food choices, playing a crucial role in combating malnutrition and chronic diseases and ultimately contributing to a decrease in infant mortality.

The positive effects extend to the empowerment of women, who play pivotal roles in food production and processing in Nigeria. Minimizing food loss holds potential to enhance women's income and economic independence, fostering gender equality. The ripple effect includes increased food availability and economic activity in rural areas, which can contribute to improvements in education, healthcare, and infrastructure, benefiting the entire community.

Moreover, by mitigating food scarcity and competition, the reduction in food-related conflicts and displacement promotes stability and peace within communities and across regions. Effectively addressing food loss and wastage necessitates collaboration among various stakeholders, fostering improved governance and sustainable resource management at different levels of engagement. This collaborative effort is essential for achieving meaningful and lasting impacts on social well-being.

2.8 Relevant stakeholders involved in the agricultural recovery initiative in Nigeria

The stakeholders involved in an agricultural recovery initiative in Nigeria can vary depending on the specific program or project. However, here are some key stakeholders relevant to agricultural recovery initiatives:

1. Government Agencies
    - Ministry of Agriculture and Rural Development: Responsible for formulating and implementing agricultural policies and programs.
    - National Agricultural Extension and Research Liaison Services (NAERLS): Involved in agricultural research and extension services.
    - Agricultural Development Programs (ADPs): State-level agencies responsible for implementing agricultural development projects.
2. Farmers and Farmers Groups
    - Smallholder farmers: Direct beneficiaries of agricultural recovery initiatives.
    - Farmer cooperatives and associations: Groups that represent and support the interests of farmers.
3. International Organisations
    - United Nations Food and Agriculture Organization (FAO): Provides technical assistance and support for agricultural development.
    - International Fund for Agricultural Development (IFAD): Offers financial resources to support agricultural projects in developing countries.
    - World Bank: Provides funding and technical expertise for agricultural development projects.
4. Non-Governmental Organisations (NGOs)
    - NGOs working in agriculture and rural development: Engaged in implementing projects, providing training, and supporting communities.
    - Humanitarian organizations: Involved in providing relief and recovery assistance in times of crises.
5. Research Institutions
    - Agricultural research institutions: Contribute to the development of new technologies, crop varieties, and farming practices.

6. Private Sectors
    - Agribusinesses: Companies involved in various aspects of the agricultural value chain, including input supply, processing, and marketing.
    - Financial institutions: Provide loans and financial services to farmers and agribusinesses.
7. Community Leaders and Traditional Authorities
    - Local leaders and traditional rulers: Play a role in mobilizing and coordinating community efforts in support of agricultural initiatives.
8. Academic Institutions
    - Universities and research centers: Contribute to research, education, and capacity building in the agricultural sector.
9. Development Partners
    - Bilateral and multilateral donors: Provide financial and technical support for agricultural development projects.
10. Media and communication Agencies
    - Play a role in raising awareness, disseminating information, and promoting best practices in agriculture.

Collaboration and coordination among these stakeholders are essential for the success of agricultural recovery initiatives in Nigeria. Effective communication, resource mobilization, and a shared commitment to sustainable development goals are key factors in achieving positive outcomes.

CHAPTER 3: METHODOLOGY

3.0 Scope of the Study

The baseline study will be conducted in the agricultural zones in Nigeria.

3.0.1 Sample and Sampling Procedure

Production hubs of vegetables, fruits, cereals, roots and tubers, poultry, and fishery in all the agricultural zones in Nigeria would be purposely selected. Thereafter, dominant communities in the selected agricultural zones and crop group's commodity with the value chain actors will be purposively selected.

Table 2: Sample and Sampling Procedure

Agricultural Zones	Selected States	Dominant Agricultural Commodities	Value chain actors
Northeast	Bauchi & Borno	Cowpea & Fish	Farmers, Transporters, and marketers
Northwest	Kaduna & Kano	Maize & Tomatoes	Farmers, Transporters, and marketers
North central	Kwara & Niger	Rice & Sweet Potatoes	Farmers, processors, Transporters, and marketers
Southeast	Anambra & Imo	Leafy Vegetables & Fruits	Farmers, processors, Transporters, and marketers
Southwest	Osun, Oyo & Ondo	Fruits, Cassava, Plantain & Poultry products	Farmers, processors, Transporters, and marketers
South-South	Rivers & Delta	Plantain, Pineapple & Vegetables	Farmers, processors, Transporters, and marketers

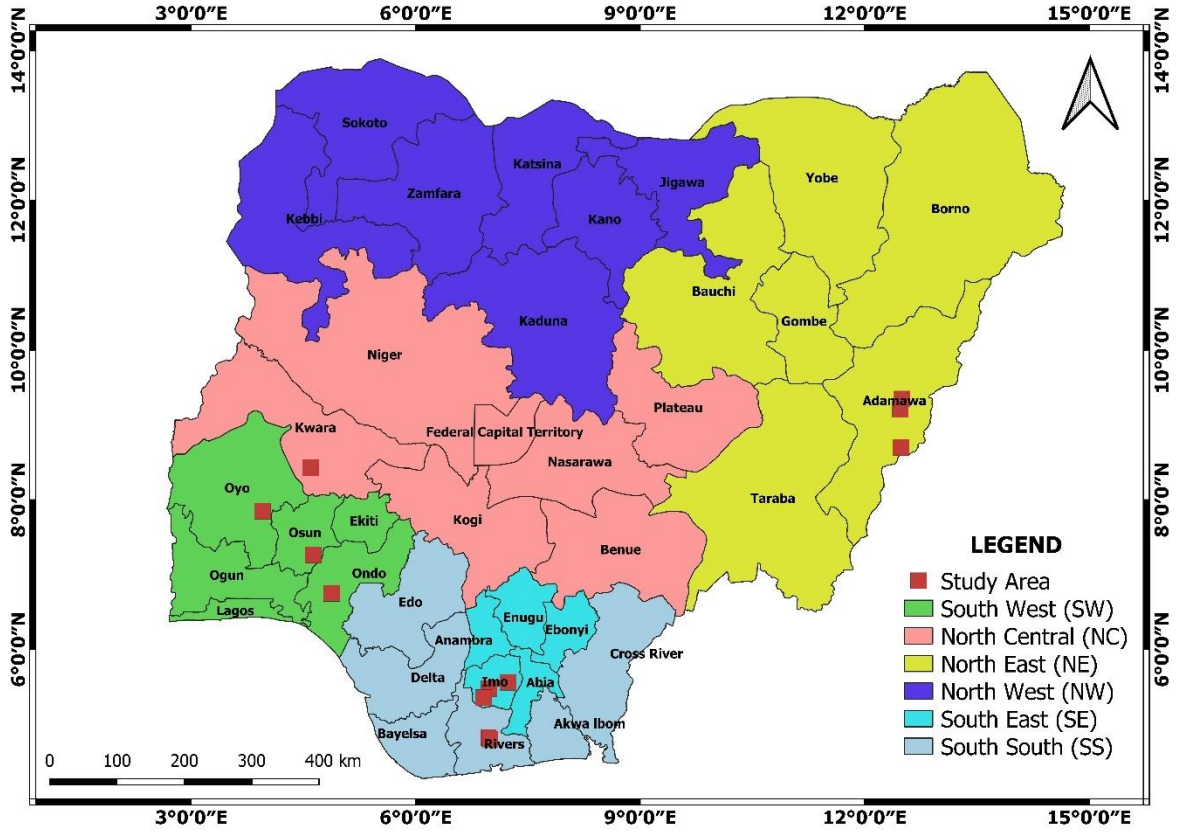


Figure 2: Map of Nigeria showing specific study locations

3.1 Approach to Methodology

The Baseline Study of Agricultural Recovery System adopted mixed methodological approach. A broad range of stakeholders were consulted along the value chain activities of crops, poultry and fisheries with consideration for the participation of female and youth population in the data collection. Quantitative, qualitative, participatory methods using tools such as questionnaires, interview schedules, Focus Group Discussion (FGDs) and Key Informant Interview (KII) with information sources to allow triangulation of information and ensure impartiality were adopted in this study.

Table 3: Methodology deployed for baseline study objectives/ research questions.

S/N	Objectives and research questions	Methodological Approach

1.	Extent of food loss and waste along the agricultural supply chain, including primary production, post-harvest handling, transportation, storage, and distribution	Survey, FGD* & KII
2.	Strategies for rescuing produce from farms.	Survey, FGD* & KII
3.	Potential risks and challenges to feasibility of agricultural recovery plan in Nigeria.	Survey, FGD* & KII
4.	Identify and connect LFBI with at least 6 farmers in different agricultural zones for possible agricultural recovery.	Survey, FGD* & KII
5.	Categories of relevant stakeholders involved in the agricultural recovery initiative. These stakeholders include Farmers and Producers Food Markets and Supermarkets Food Transport and Logistics Companies.	Survey, FGD* & KII
6.	Seasonal calendar of fruits, vegetables, cereals, roots, and tubers crops in Nigeria.	Survey, FGD* & KII
7.	Culturally adopted agricultural recovery systems/postharvest handing in Nigeria.	Survey, FGD* & KII
8.	The economic, environmental, and social implications of reducing food loss and waste throughout the supply chain.	Survey, FGD* & KII
9.	Effects of economic, environmental, and social features on agricultural recovery system/post-harvest handling in Nigeria.	Survey, FGD* & KII

3.3 Data Analysis Techniques

The quantitative data collected were entered into Statistical Package for Social Science (SPSS). Descriptive statistics carried out included frequencies, percentage, charts, mean, and standard deviation.

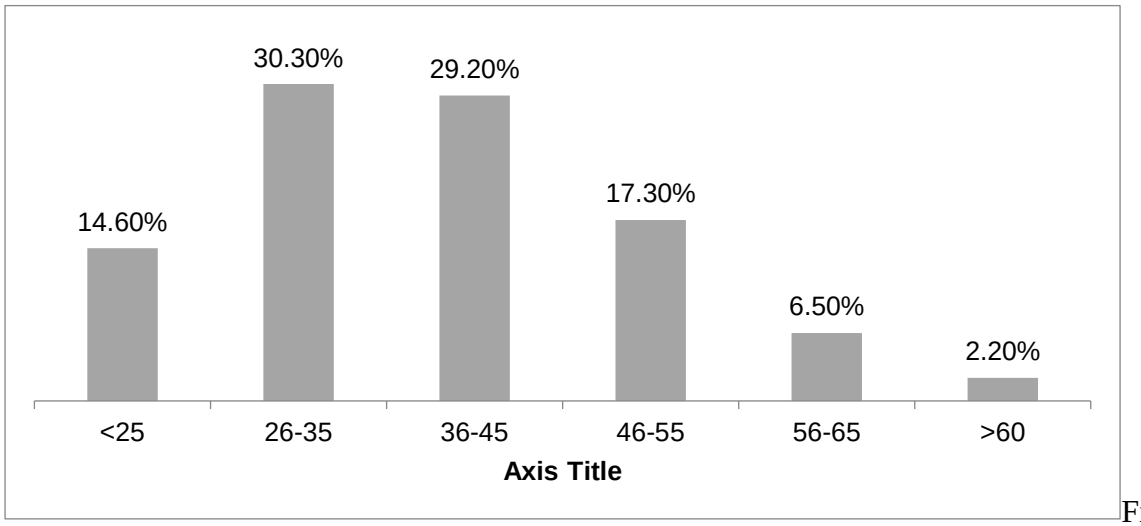
CHAPTER 4 : RESULT AND MAJOR FINDINGS

4.0 Respondents' Socioeconomic Information

4.1.1 Age Distributions

The statistical breakdown in Figure 3 demonstrates a balanced distribution of respondents across various age categories, with 30.3% and 29.2% falling within the 26-35 and 36-45 age brackets, respectively. This highlights a significant portion of respondents being in the middle age range, indicating their sustained activity and capacity to manage the demands of their agricultural ventures effectively. Additionally, the data shows that 17.3% and 14.6% are aged between 46-55 and less than 25 years, respectively. Only a marginal fraction of the population is above 66 years old.

Collectively, the mean age of the respondents is 38.6±11.7, reflecting a relatively young demography still within the active age range. This implies that they remain dynamic and open to exploring innovations that could enhance their capacities and ensure the long-term sustainability of their enterprises.



Figure

Figure 3:Age distribution of respondents

4.1.2 Marital Status Distributions

Most respondents were married (69.9%), while 27.0% and 3.8% are single and widowed, respectively, as indicated in Figure 4. The trend in their marital status reflects societal recognition of the value placed on responsibility. Importantly, irrespective of their marital status categories, there is a consistent demonstration of

love for their agricultural enterprises, a strong willingness to sustain their ventures, and an enthusiastic commitment to addressing challenges within the agricultural recovery system. This shared determination is evident across all response categories, highlighting their dependency on these enterprises along various nodes of the value chain for their livelihoods.

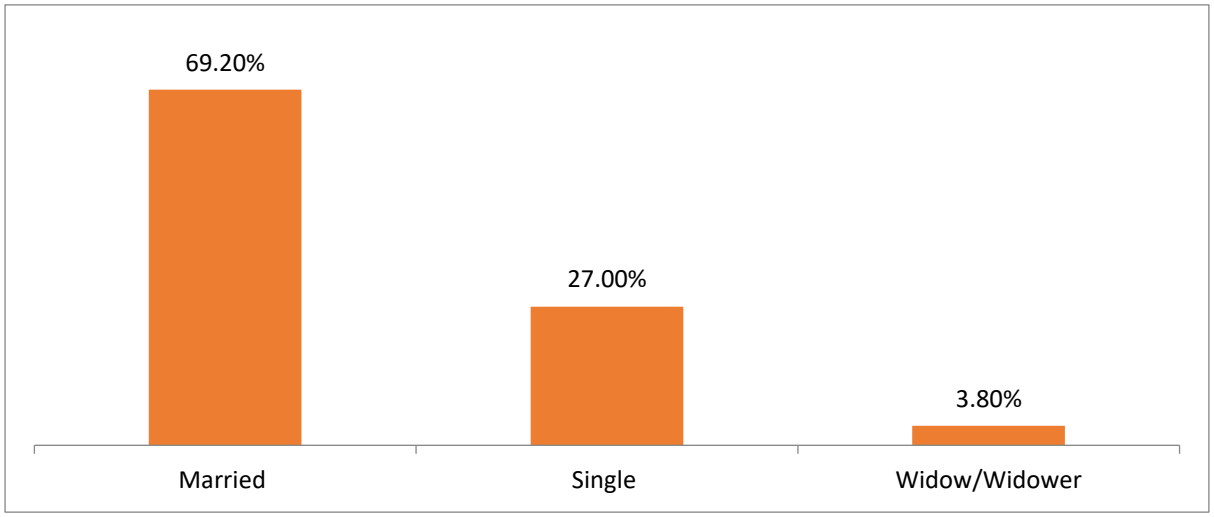


Figure 4: Marital status of respondents

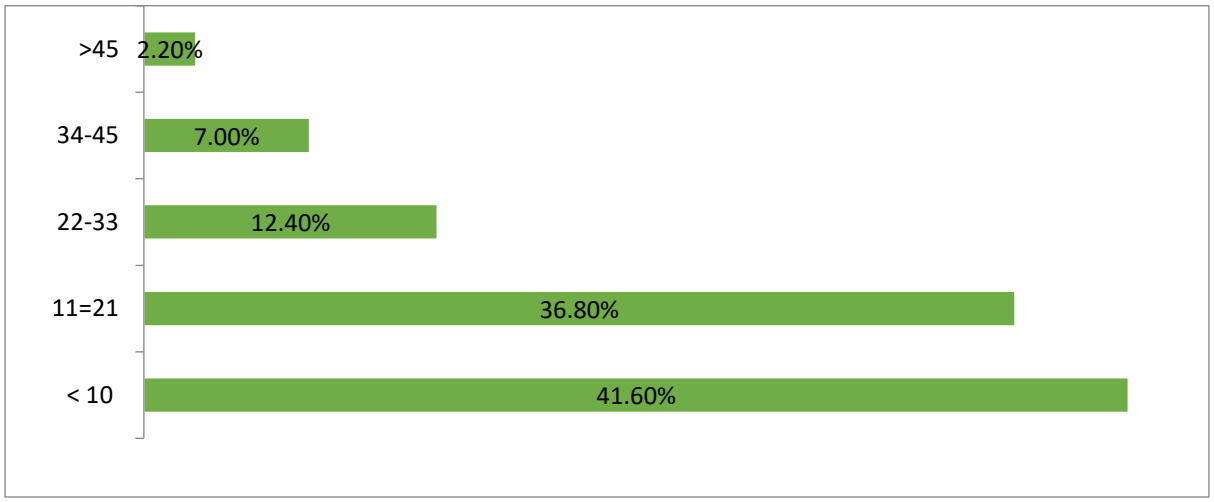


Figure 5:Years of experience Distributions

4.1.3 Years of Experience Distributions

Data from Figure 5 indicates that 41.6% of respondents have less than 10 years of experience, with 36.8% and 12.4% falling within the 11 to 21 and 22 to 33 years of experience categories, respectively. Additionally, 7% and 2.2% have between 34 and 45 years of experience and less than 46 years old, respectively. Considering the cumulative statistics, the average years of experience for the respondents stand at 15.3±10.59. This highlights a substantial level of experience along various nodes of the

value chain, indicating that they possess the knowledge necessary to implement effective measures for agricultural recovery in their respective farming activities.

4.1. Respondents' category based on their involvement in fruits and vegetables farming

The data depicted in Figure 6 illustrated the distribution of fruits and vegetables farmers in the study area. A significant portion of the survey participants prioritizes pepper (40.2%) and tomato (36.3%) cultivation. The predominant focus on these crops can be attributed to favourable agro-climatic conditions conducive for their growth. Additionally, the demand from consumers and the presence of a readily available market further motivates farmers to engage in the production of these vegetables. The extended shelf life of these fruit and vegetables, in comparison to leafy vegetables, serves as another contributing factor to their cultivation. The data also indicates a lesser but notable involvement in the cultivation of cucumber (8.8%) and spinach (7.8%). The cultivation of cucumber is driven by the accessibility of a ready market within and around the production catchment area.

> ''Cucumber cultivation is carried out in three cycles annually, which reduced our production costs and consequently translated into more profitable income from our sales. It's noteworthy that the same infrastructure is utilized for all three production cycles. Another factor motivating engagement in cucumber production is its resilience to "transfer-shock." By harvesting before full ripening, we can transport the cucumbers to their respective demand destinations within the country in excellent condition''.

Response of male farmer during key Informant Interview (KII) at Igodan, Ojitipupa, Ondo State.

Garden eggs, cabbage, and carrots make up 2.9%, 0%, and 2.0% of the overall vegetable production, respectively. The limited representation of these vegetables in the farming population can be attributed to the specific climatic needs of these crops, which are not well-supported by our current climate conditions. Additionally, the perishable nature of these crops, leading to a quick deterioration, may contribute to the farmers' reluctance to cultivate them. Furthermore, the demand for these crops is comparatively lower than that for the previously mentioned crops, further explaining the lower level of engagement in their production.

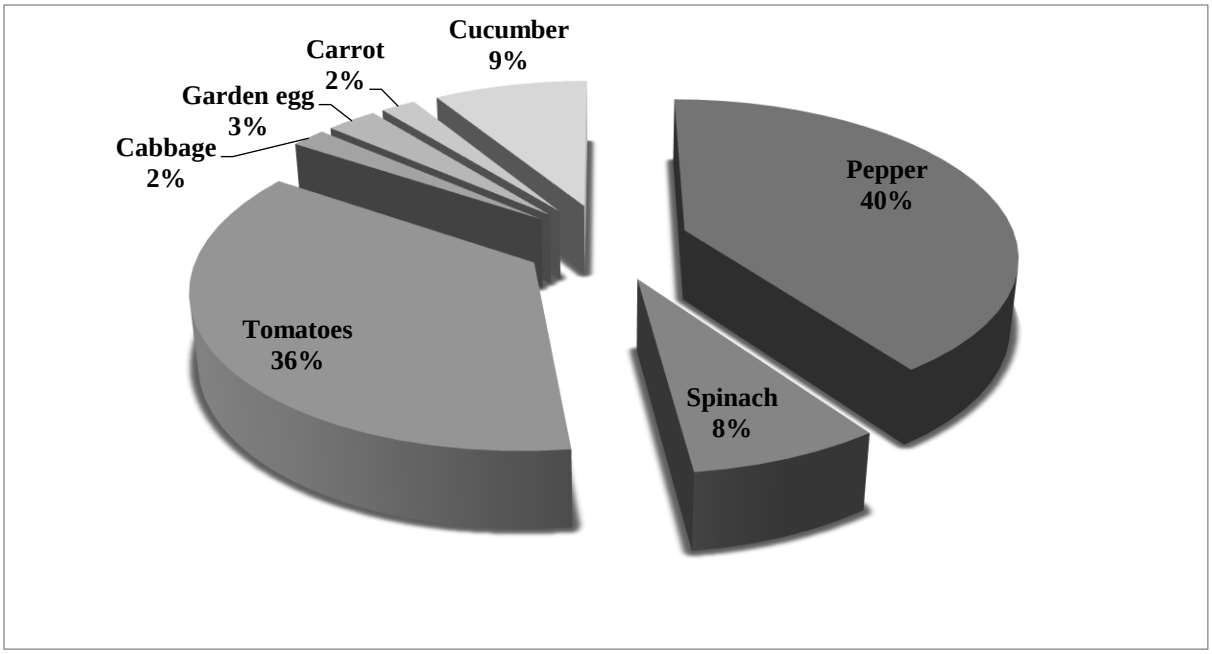


Figure 6: Distribution of respondents' involvement in fruits and vegetables farming

4.1.1. Respondents' category based on their involvement in roots and tubers farming.

The data presented in Figure 7 outlined the percentage of respondents involved in root and tuber production. Majority (64.7%) engaged in cassava cultivation, benefiting from the favourable soil and climatic conditions in the country. Cassava is recognized for its resilience to harsh environmental conditions and is a crucial staple in many households, driving its production. Furthermore, the versatility of cassava, allowing for conversion into various food items, coupled with its extended shelf life at ambient temperatures, adds to its appeal.

In addition to cassava, respondents also cultivate potatoes (22.6%) and yams (12.7%). The production of these items is influenced by their role as major sources of carbohydrates in household diets. Some of the produce from the field is earmarked to meet the dietary needs of households, reflecting the demand for these food items.

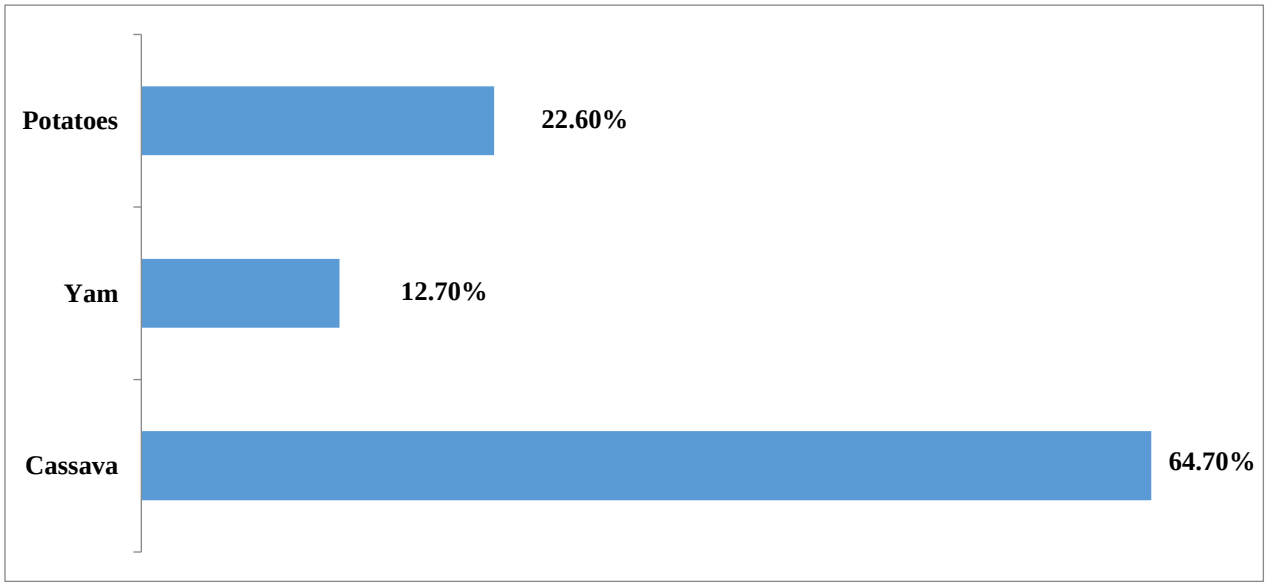


Figure 7: Distribution of respondents based on their involvement in roots and tubers farming

4.1.2. Respondents' category based on their involvement in cereals farming.

Figure 8 indicated that the majority (74.5%) of respondents were actively involved in maize production. The significant engagement in maize cultivation can be attributed to the substantial demand for maize in both subsistence and commercial quantities. Maize serves as a key staple, directly consumed, and plays a major role in the production of various food cereals. Moreover, the widespread use of maize as a crucial ingredient in animal feed, particularly for poultry, contributes to farmers' extensive involvement.

Qualitative insights suggest that farmers opt for maize production due to its short gestation period. With a grasp of climate dynamics and adequate irrigation support, farmers can achieve multiple production cycles within a year. Additionally, farmers also cultivate sorghum (23.5%), recognizing its value as a protein source in both animal feed and human diets. The positive considerations for sorghum production include friendly agronomic practices, a short gestation period, and a readily available market, driven by its significant potential after value addition, both nutritionally and economically.

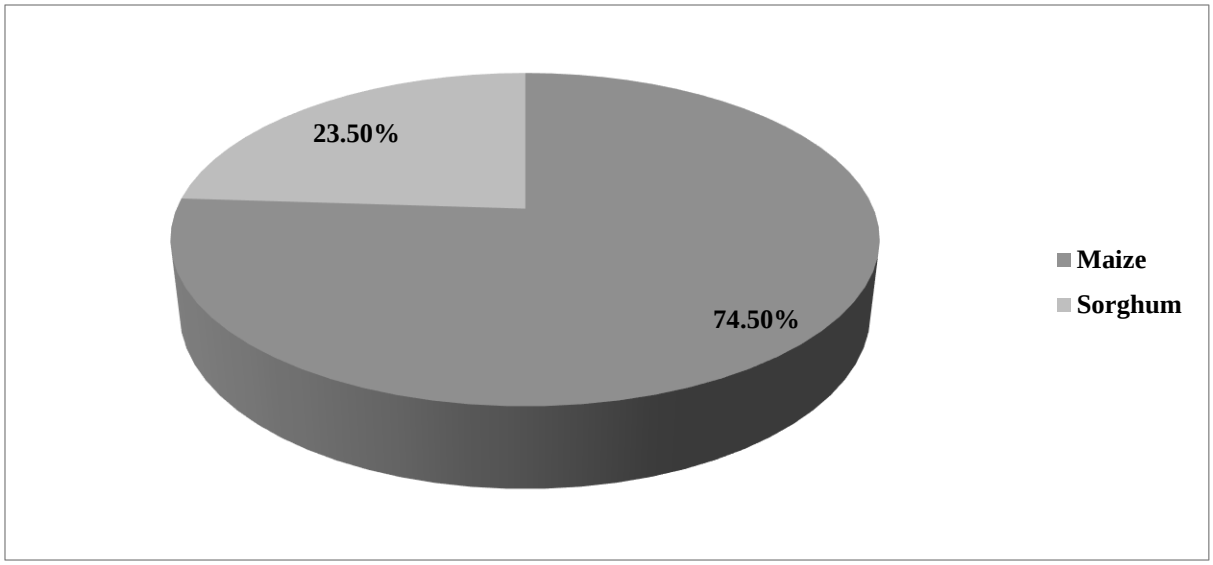


Figure 8: Respondents' category based on their involvement in cereals farming.

4.1.3. Respondents' category based on their involvement in legumes farming

Figure 9 illustrated the distribution of legumes that farmers were involved in, highlighting that the majority (83.3%) were engaged in cowpea production, while the remaining portion (16.7%) focuses on soya bean cultivation. Field investigations point to the farmers' involvement in cowpea production, driven by its demand and the readily available market for the produce. Additionally, the friendly agronomic practices associated with cowpea cultivation make it a cost-effective option, considering the beneficial input-demand ratio compared to production costs.

The farmers' commitment to these legumes is further attributed to the significant nutritional benefits they offer. As a result, the production serves dual purposes: meeting subsistence demands at the family level and catering to commercial production needs.

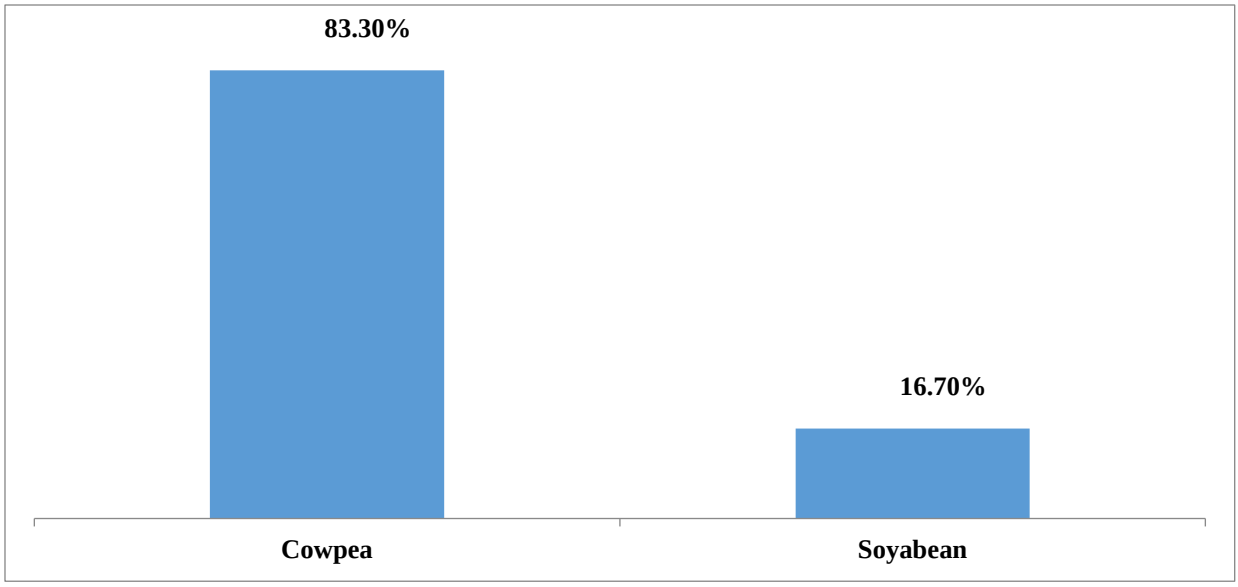


Figure 9: Respondents' category based on their involvement in legume farming

4.1.4. Respondents' category based on their involvement in poultry production

Figure 10 described farmers' involvement in poultry production, with the predominant focus (86.3%) on egg production. The farmers were driven by the demand for a substantial source of animal protein, considering eggs as a valuable contributor. The high demand for eggs is underscored by their lucrative pricing relative to other animal protein sources. Farmers engaged in egg production at both subsistence and commercial levels to meet the robust demand for this nutritious commodity.

"We participate in poultry production, partly to provide for our family's needs. Additionally, we utilize a portion of our farm produce to formulate feed for the birds. Raising birds is made more accessible for us as we construct their housing using locally available materials such as bamboo, palm trees, and palm fronds, which incur no additional costs. Furthermore, we engaged in processing some of our farm produce to create compound feed for the birds, enhancing the efficiency of our poultry farming practices".

Female respondents during KII at College Road , Igbokoda, Ondo state.

The information in Figure 5 additionally indicated that farmers were involved in the production of fowls destined for live processing, constituting 9.8% of their activities. This facet of production serves as a direct source of animal protein for their households. The utilization of locally sourced materials in constructing shelters and

preparing feed acts as an encouraging factor for their participation in this aspect of the poultry venture. Additionally, the presence of indigenous practices catering to the health requirements of the fowls was considered a motivating factor for their engagement in the production of live fowls.

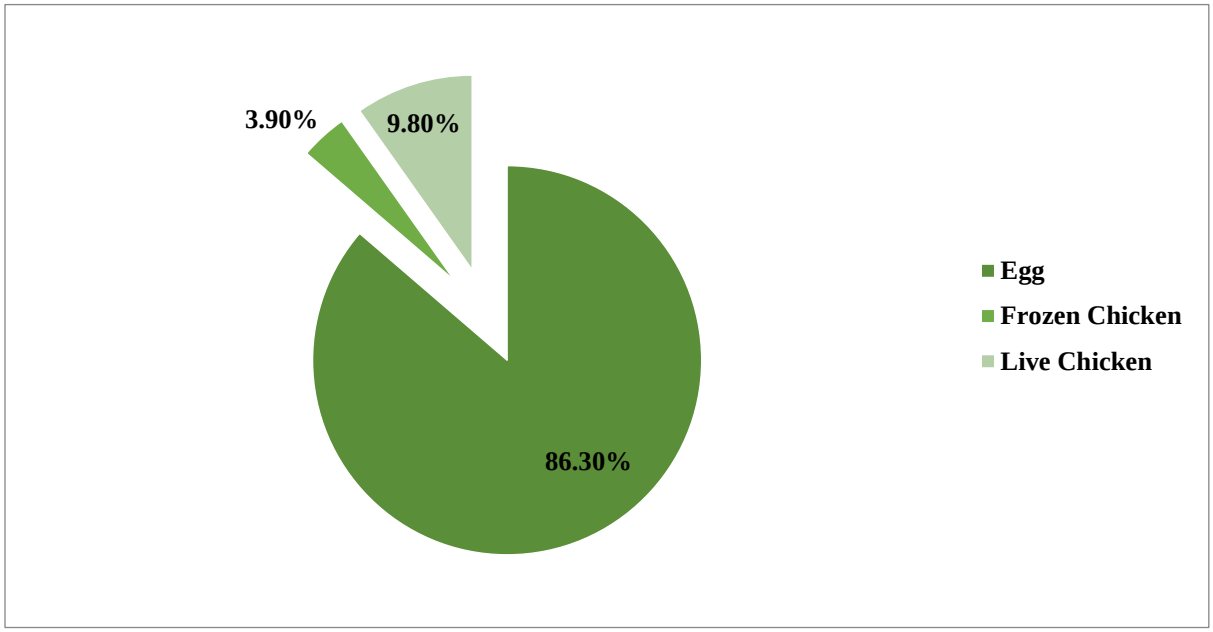


Figure 10: Respondents' category based on their involvement in poultry production

4.1.5. Respondents' category based on their involvement in fish production

The data illustrated in Figure 11 highlights a notable proportion (83.4%) of respondents actively involved in the production of dried fish. Their commitment to this production is driven by the existing demand for dried fish, coupled with the financial benefits associated with the value addition process compared to other product forms. Furthermore, the processed dried fish has the advantage of being able to travel long distances, enhancing market reach.

The sustained availability of the primary raw materials is acknowledged as another factor supporting dried fish production, with these materials being sourced both from the wild and raised in controlled environments. A smaller fraction of respondents (12.7%) engaged in freshwater fish production, while a few (3.9%) were involved in frozen fish production. The limited engagement in frozen fish production can be attributed to the requirement for infrastructure, specifically electricity, to maintain the shelf life of these products. It's important to note that many production zones face

infrastructural deficits, contributing to the relatively lower participation in frozen fish production.

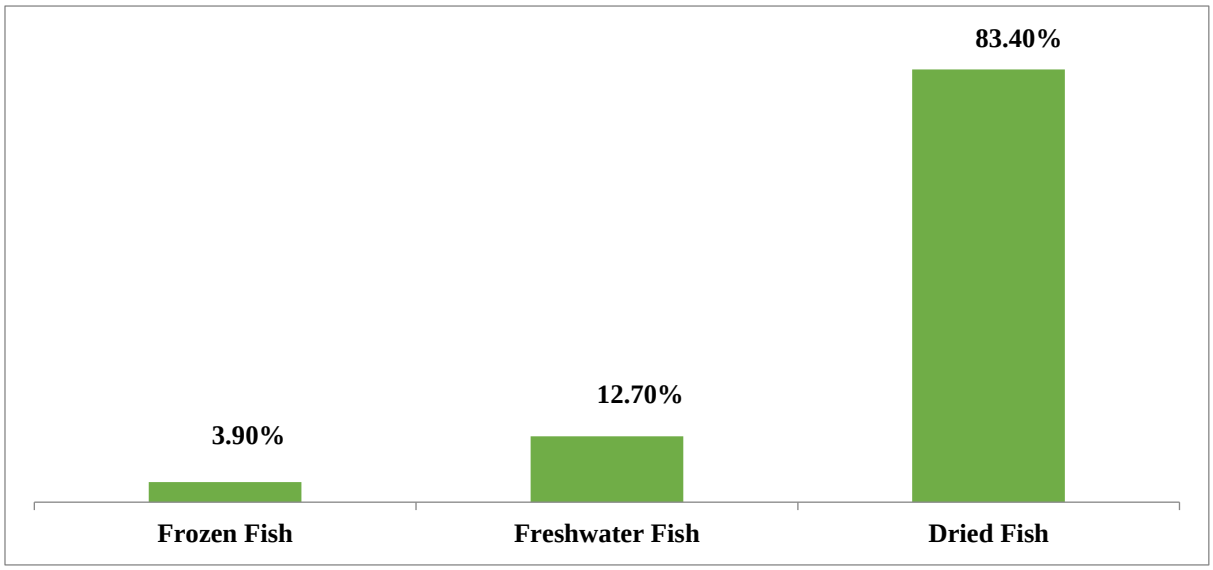


Figure 11: Respondents' category based on their involvement in fish production

4.2. Respondents' category based on their involvement in fruits and vegetables processing

Figure 12 provided insights into respondents involved in the processing of both fruits and vegetables, with a substantial portion (81.8%) engaged in plantain processing. Their participation in plantain processing aims to minimize waste and extend the shelf life of the produce. During production periods, some produce may not reach consumers in a timely manner, and a significant portion may spoil. Hence, processing is undertaken to add value, utilizing minimal to no input, which encourages its processing. The high fibre and low-fat content of plantain contribute to its considerable demand in the market. Additionally, the short processing timeframe is attributed to the low moisture content of plantains compared to other crops, giving plantains a comparative and competitive advantage for processing.

Pepper (18.2%), as depicted in Figure 1, is also valued by processors who engage in its processing. The processing of pepper aims to reduce moisture content, thereby increasing shelf life and maintaining its usability and value. Acknowledged as a high-demand food condiment, pepper retains its popularity both during its peak and off-peak production periods.

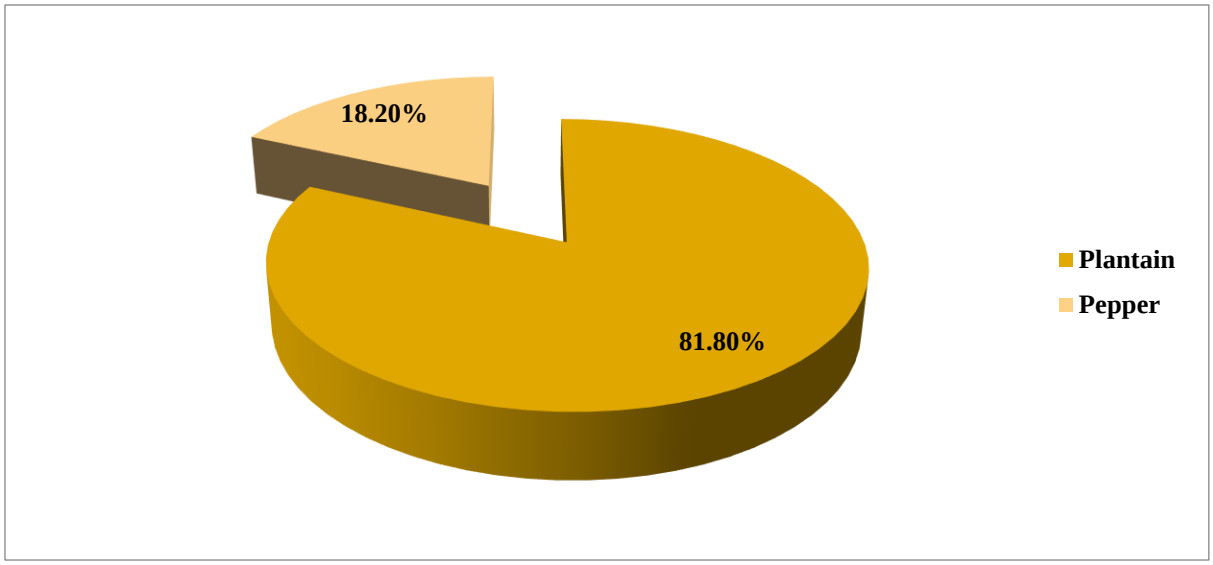


Figure 12: Respondents' category based on their involvement in fruits and vegetables processing.

4.3 Respondents' category based on their involvement in roots and tubers processing

Figure 13 presents data on the roots and tubers processed by the respondents. The majority (72.7%) of processors are involved in the processing of cassava. This prevalent engagement is attributed to the versatility of products that can be derived from cassava. Additionally, cassava serves as an affordable staple, crucial for many households as a primary source of carbohydrates. The good organoleptic properties of cassava after storage make it a preferred choice for processors when compared to other roots and tubers.

The data also reveals that processors are active in the processing of potatoes (27.3%). Indigenous knowledge has spurred the recent processing of potatoes, aiming to minimize losses associated with waste. Consequently, the conversion of potatoes into another staple food, particularly for household use, becomes a compelling reason for their processing of this food item.

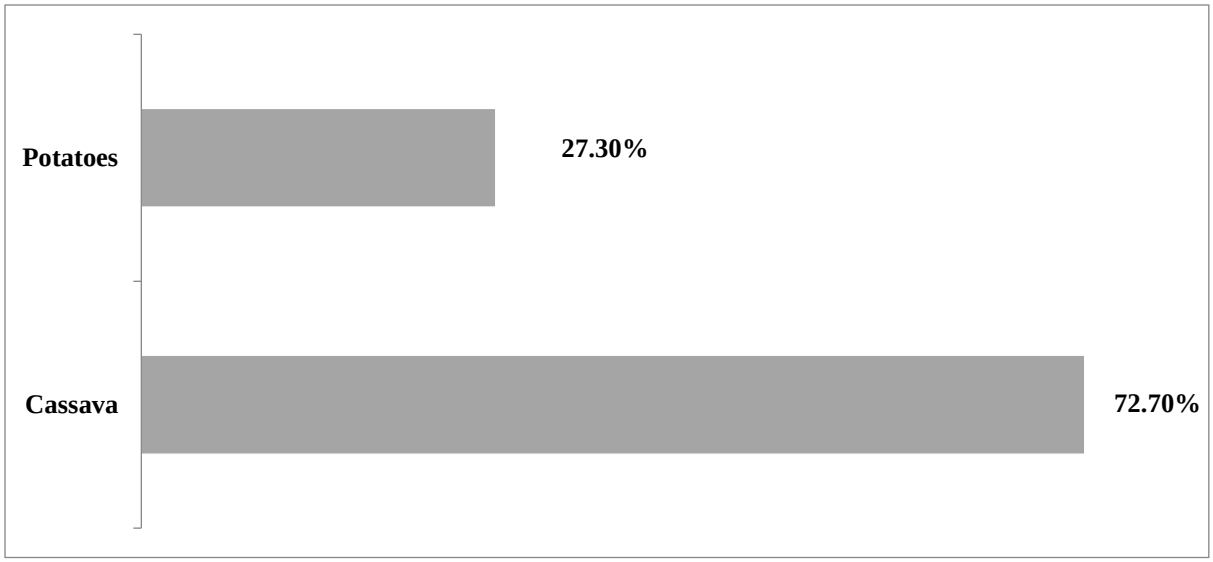


Figure 13: Distribution of respondents according to roots and tubers processed

4.3. POST HARVEST HANDLING

4.3.1 Post harvest Handling Methods Deployed

As evident in Figure 14, the predominant method of harvesting, at 96.1%, is manual, with a smaller proportion (4.9%) employing mechanical methods. The chosen harvesting method significantly influences subsequent value chain activities for the produce. While the manual approach is cost-effective, the use of mechanical methods requires entrepreneurs to possess the necessary knowledge and skills for effective deployment.

The adoption of mechanical harvesting methods necessitates not only technical expertise but also an attitudinal shift among entrepreneurs. This shift is crucial for embracing modern practices and capitalizing on the associated benefits of mechanical harvesting. These advantages encompass, but are not limited to, cost-effectiveness, improved health for the entrepreneur, reduced damage to the produce, time efficiency, and a decrease in labour-intensive processes.

Figure 14: Post harvest Handling Methods Deployed

4.3.2. Type of Containers Used During Harvesting

The data presented in Figure 15 illustrates the types of containers utilized during the harvesting of produce. Half (50.0%) of the respondents opt for sacks to convey their farm produce during harvesting, possibly due to their lightweight nature compared to other mediums. Sacks are favoured for their ease of transportation, as they can be stacked and arranged efficiently on the means of transport used to convey the produce from the farms to the collection point. Additionally, the use of sacks minimizes damage to the produce during transit.

Traditional baskets (39.2%) are also widely employed, with their local availability being a contributing factor. These baskets are favoured for their ability to transport produce with minimal damage and conserve space during transportation through various media.

Other materials used during harvesting include plastic crates (4.9%), trays (2.9%), wheelbarrows (2.0%), and bowls (1.0%). When selecting materials for harvesting, considerations are typically given to factors such as ease of haulage, ensuring the safety of farm produce to prevent damage, and the cost-effectiveness of the chosen medium.

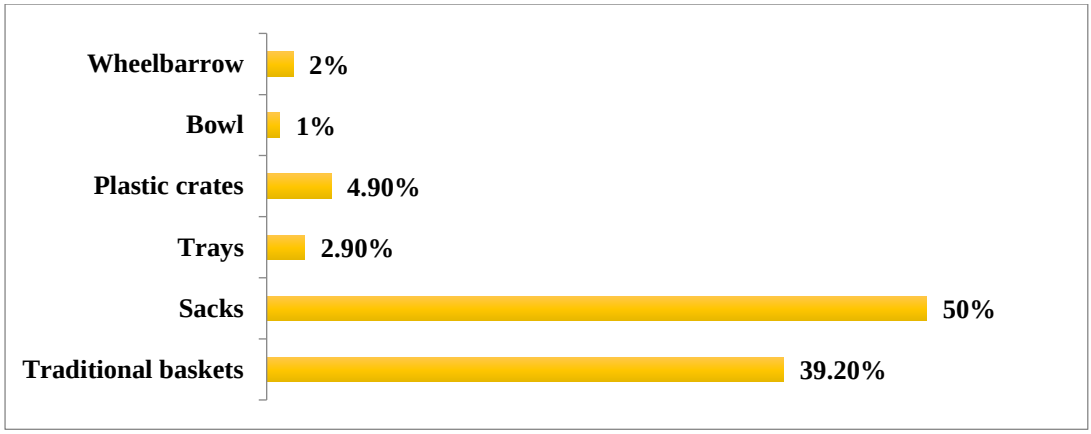


Figure 15: Type of Containers Used During Harvesting

4.3.3. Quantity Of Waste on the farm During Harvesting

Figure 16 provides detailed information on the quantity of waste associated with harvesting. A substantial majority (66.7%) of the respondents report that between 20% - 40% of their produce is wasted on the farm during harvesting. The occurrence of waste during harvesting is linked to factors such as the timing of harvesting concerning the crop's physiological maturity. Crops that are harvested beyond their physiological maturity are more prone to damage.

The method and skills employed during harvesting also contributed to potential damage and waste. It is acknowledged that careful and skilful handling is crucial during the harvesting of farm produce, regardless of the nature of the crops.

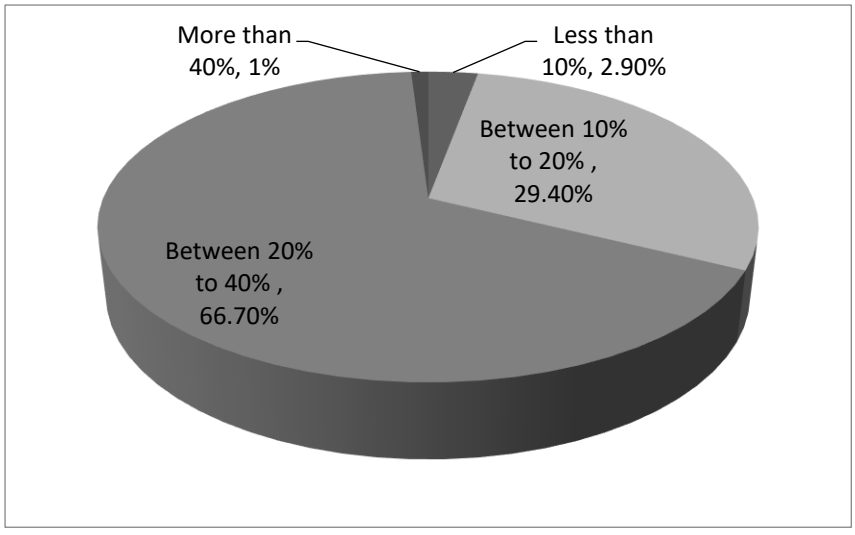


Figure 16: Quantity Of Waste on the farm During Harvesting

plate 1: Sample of Wastage on the farm in Oyo farm, Oyo State – Pineapple

Plate 2:: Sample of Wastage on the farm in Okitipupa, Ondo State – Cucumber

4.3.4. Sorting of Harvested Produce on the farm

Figure 17 delineates the percentage of respondents involved in sorting their farm produce after harvesting. A vast majority (94.1%) of the respondents actively engage in sorting. The sorting process is specifically undertaken to grade the produce and assign financial value. Various criteria, including quality and size, are employed during sorting to ensure effective standardization and quality assurance.

A small fraction (5.9%) of respondents, however, reported that they do not conduct sorting. Reasons for non-sorting include dissatisfaction with the pricing of the sorted produce, a perception that sorting is time-consuming, especially when middlemen will eventually handle it, and the belief that the marginal price variance, considering the small quantity left after grading, justifies leaving the sorting responsibility to middlemen.

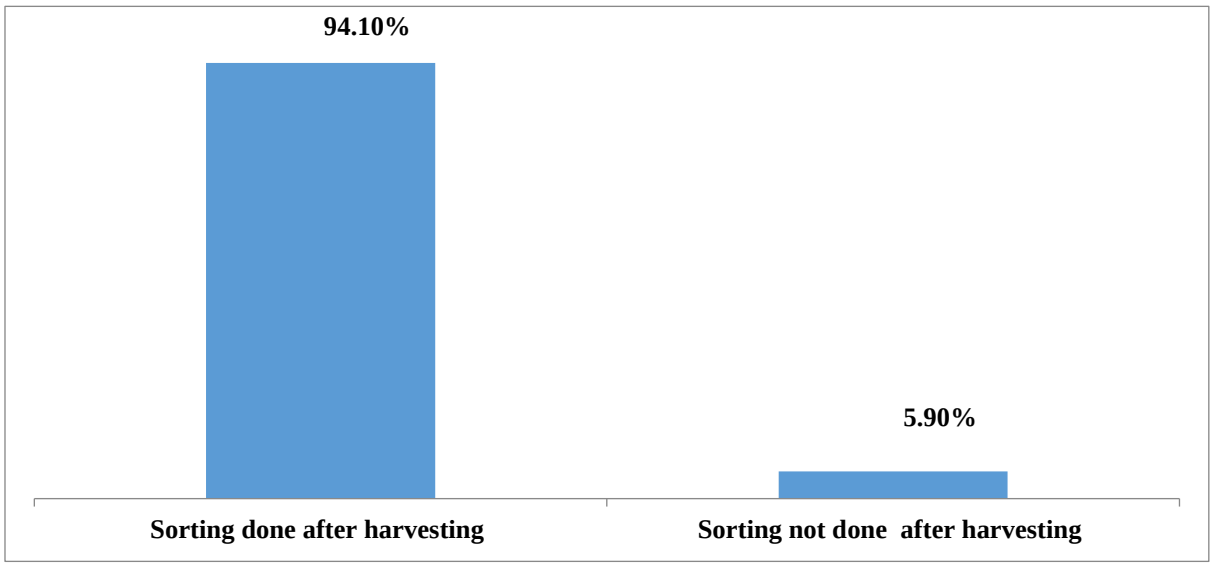


Figure 17: Distribution of respondents according to sorting of harvested produce

4.3.5. Quantity of wastage during sorting of harvested Produce on the farm

Figure 18 provides information on the proportion of waste associated with sorting. A significant majority (67.0%) of respondents report that lbetween 20% - 40% of their produce becomes waste after sorting right on the farm. The pattern of waste after sorting, as depicted in Figure 12, mirrors the proportions ascribed to waste during harvesting. In some instances, sorting occurs concurrently with harvesting, while in others, it is conducted shortly after harvesting, often a day or two later. This delay

allows for the assembly of produce at a collection point before sorting and transportation.

During sorting, some farmers also perform counting and weighing, emphasizing quality assurance and standardization. The data suggests a consistent correlation between wastage during harvesting and sorting. It is reasonable to attribute the waste at this stage to those originating from the harvesting of produce.

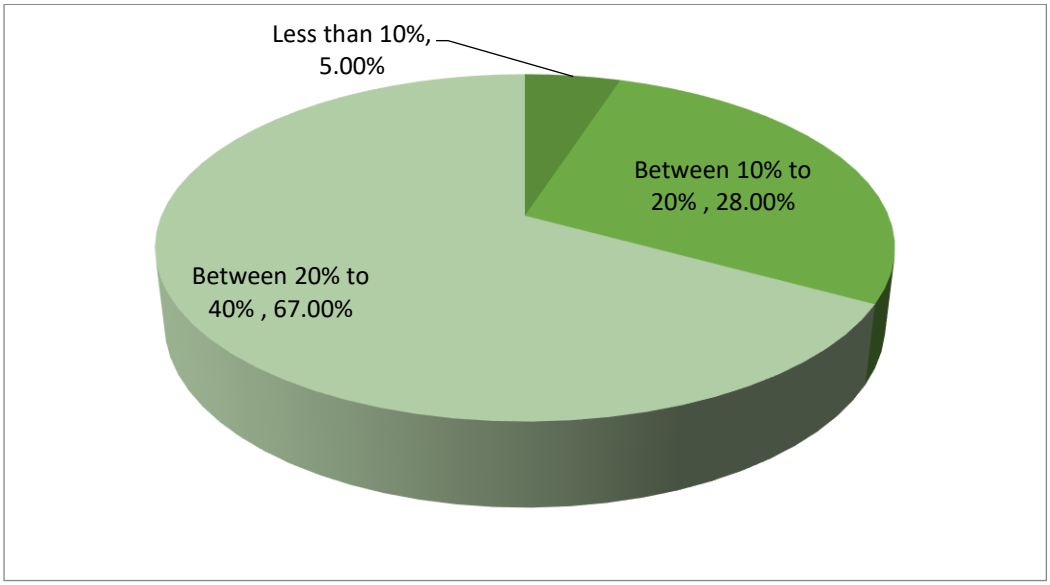


Figure 18: Distribution of respondents according to waste generated during sorting on the farm

4.3.6. Method of Transportation of Produce from The Farm to The Selling Point.

Figure 19 illustrates the various transportation methods employed to convey produce from the farm to the selling point. Common modes of transportation include open pick-up (32.4%), motorcycles (22.5%), and closed pick-up (20.6%). The preference for motorcycles stems from their widespread use as the primary mode of transportation for farmers, allowing them to reach distant farms efficiently. This mode proves practical for accessing farms situated far from the farmers' homes and spread across various locations.

In instances where vehicles are used, they typically reach an assembling point where the produce is consolidated before being transported to various locations. This approach helps save time and costs, particularly in areas with poor access roads that

make direct farm access challenging. Additional transportation methods include bicycles (9.8%), human transportation (9.8%), and buses (4.9%). Bicycles and human transportation are commonly employed for smaller quantities of farm produce, often for household use or transportation to the farmstead. These methods are also utilized to transport produce to the assembling point, from where it is further conveyed by open pick-up, closed pick-up, or buses.

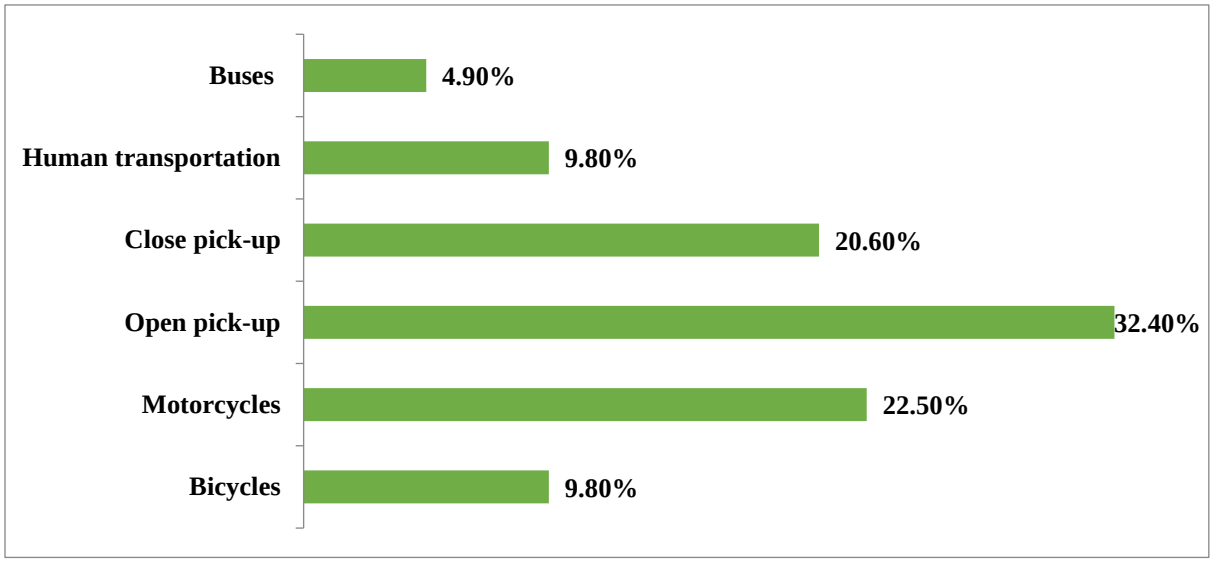


Figure 19: Method of Transportation of Produce from The Farm to The Selling Point

plate 3: Local transportation with wheel barrow within the market

plate 4: Intra and Intercity transport of farm produce

4.3.6. Types of Packaging Used During Transportation to The Market

The data presented in Figure 20 details the types of packaging used for transporting produce to the market. Half (48.0%) of the respondents utilize sacks for this purpose. Sacks are favoured for their lightweight and flexible nature, accommodating a sizeable portion of farm produce. The availability of varying sizes, ranging from 50kg to 100kg, contributes to their popularity. Additionally, sacks are cost-effective compared to other packaging options. Their design includes airy spaces that prevent heat buildup, reducing the risk of spoilage. The fine texture of sacks minimizes the potential for injury to the packaged farm produce.

Traditional baskets (39.2%) were also prominently used by respondents, benefiting from their local sourcing and practicality like sacks.

Other packaging materials include trays (8.8%), plastic crates (2.0%), and polythene (1.0%). Plastic crates, while recently adopted for transporting perishables like tomatoes and peppers over long distances, incur a significant initial cost. Despite this constraint, the benefits, such as intact and well-stacked farm produce during haulage, make the investment worthwhile over time as the enterprise is sustained.

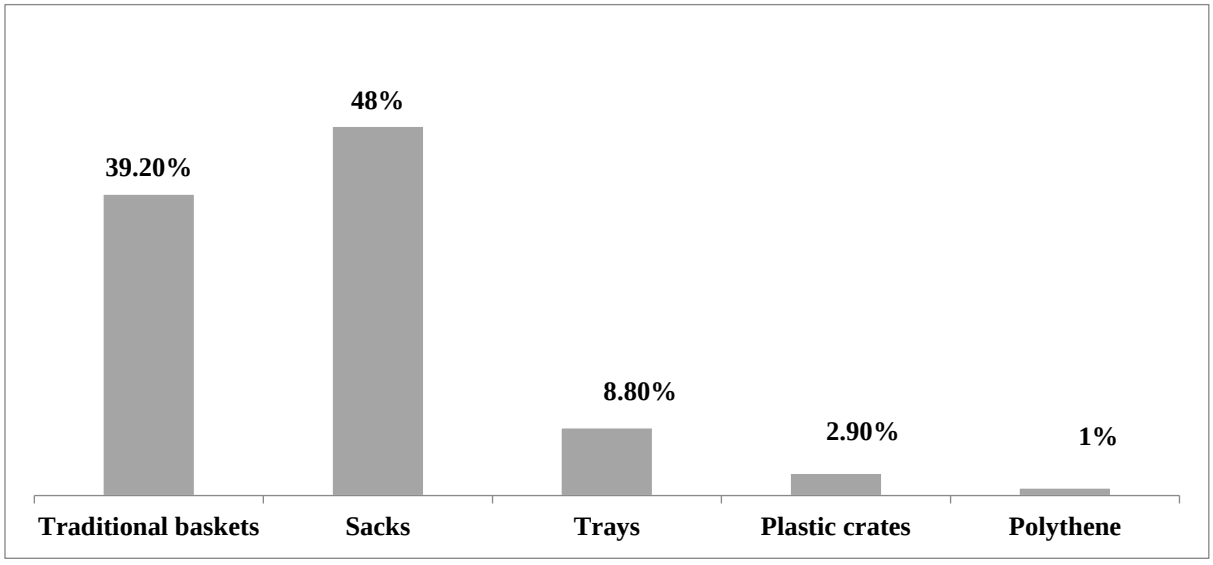


Figure 20: Types of Packaging Used During Transportation to The Market

4.3.7. Quantity of Wastage During Transportation to The Market

Figure 21 outlines the distribution of waste during transportation. A substantial majority (72.0%) of respondents assert that between 200% - 40% of their entire quantity of transported produce was wasted. The recorded waste can be linked to inadequate packaging during haulage, poor road conditions, and extended hours spent transporting farm produce. The mode of transportation and the duration of transportation emerge as pivotal factors responsible for the losses incurred during the conveyance of farm produce from the farm to the market or collection point.

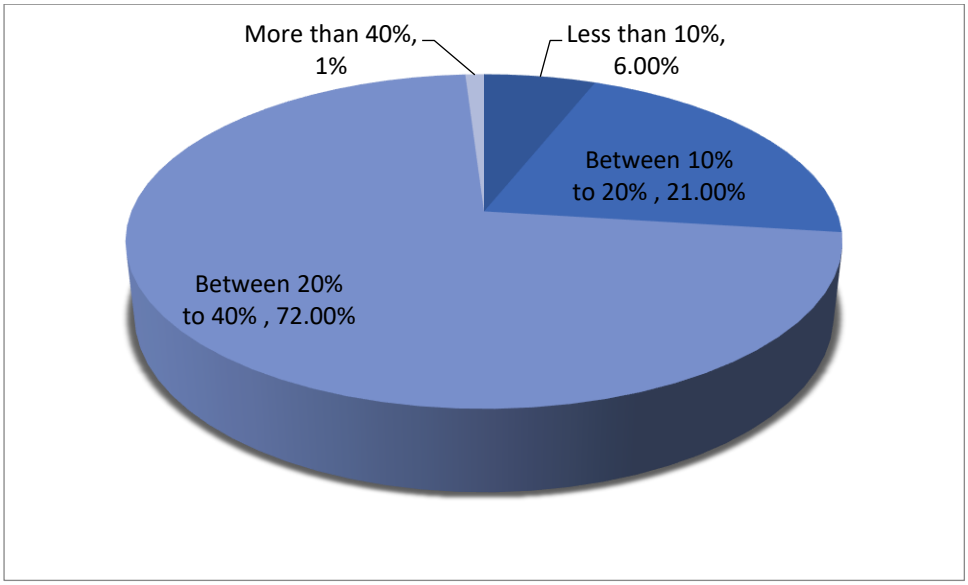


Figure 21: Quantity of Wastage During Transportation to The Market

4.3.8 Methods of Farm Produce Storage After Harvest

Figure 22 provides a detailed overview of the methods employed by respondents in storing their farm produce after harvest. The majority (70.6%) indicated that they store their farm produce under shade. Other storage methods include storing produce in open-air sacs (16.7%), utilizing cold rooms (8.8%), and storing in cool, dry places (3.9%). The choice of storage location is influenced by factors such as available space, the duration of storage needed, and the quantity of harvest awaiting transportation. However, a crucial consideration is the necessity to shield stored farm produce from the unpredictable effects of weather. It is recognized that extreme weather conditions can adversely impact the condition of crops, leading to potential spoilage.

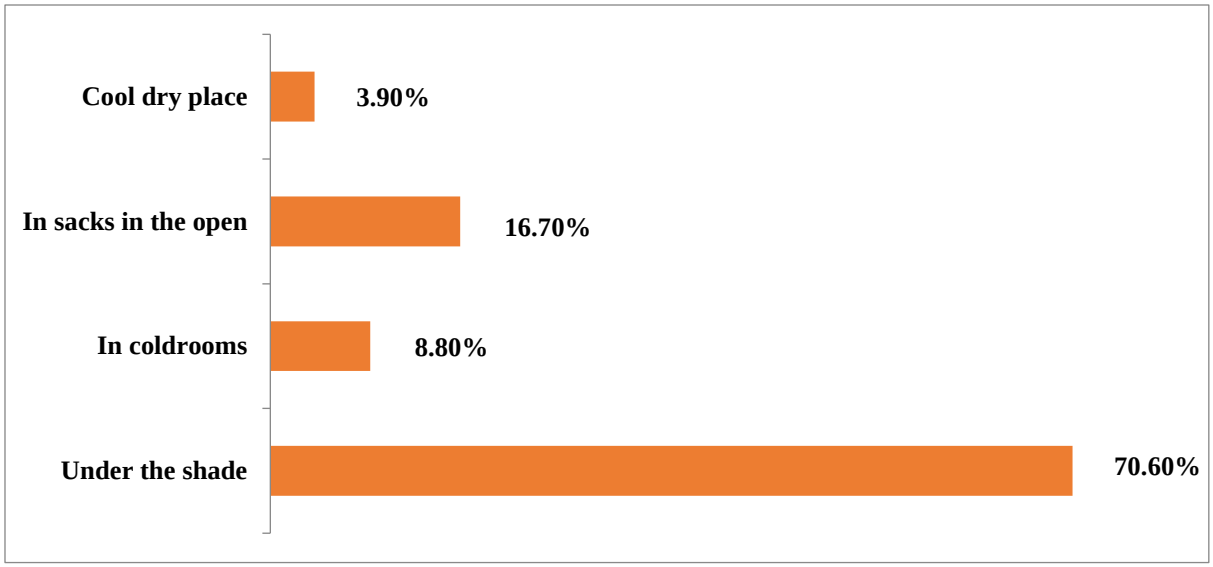


Figure 22: Methods Farm Produce Storage After Harvest

4.3.9: Duration of storage before produce sales

Figure 23 provides insights into the varying durations farm produce is stored on the farm before being sold. Approximately half (40.2%) of the respondents store their produce on the farm for more than 6 hours before it is hauled out. Another 23.5% store the produce in the market for a duration between 3 to less than 6 hours before it is transported from the farm. Additionally, 19.6% and 16.7% store their produce for less than 1 hour and between 1 to less than 3 hours, respectively.

The duration of storage is often contingent on logistical arrangements, with farmers generally inclined to transport their produce to the market promptly after harvesting. It is advised to minimize storage time, as agents of deterioration become active immediately after harvest, potentially compromising the quality of the produce.

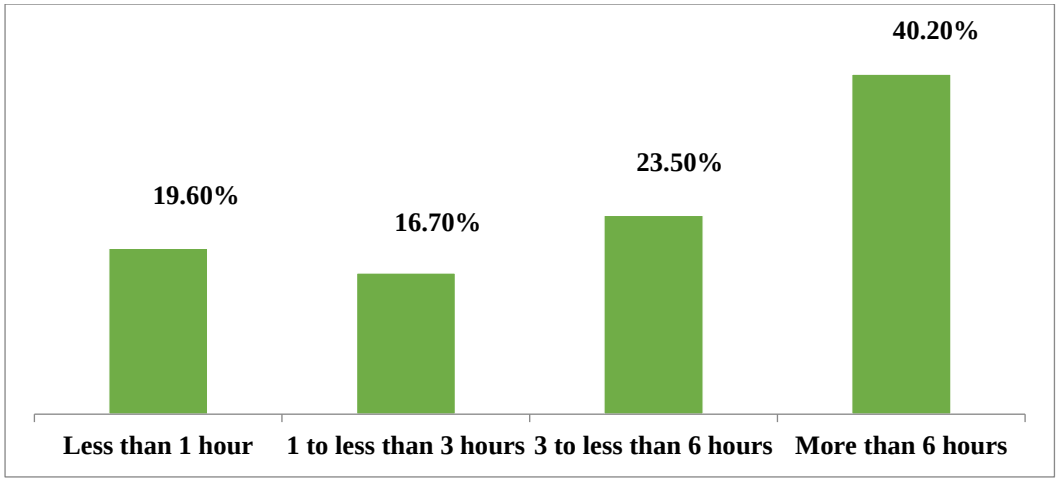


Figure 23: Duration of storage before produce sales

4.3.10: Wastage adduced to poor handling in the market.

The data presented in Figure 24 highlights that a substantial majority (72.0%) of respondents report that between 20%- 40% of their produce goes to waste due to poor handling at the market. Poor handling of produce is ascribed to inadequate infrastructure at the market and suboptimal storage conditions before the goods are sold.

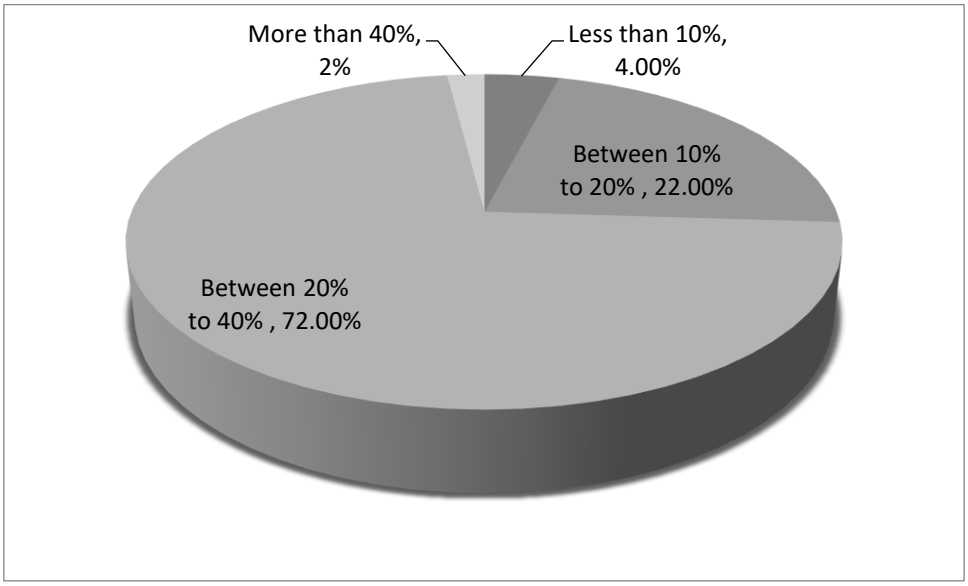


Figure 24: Wastage adduced to poor handling in the market.

4.3.11. Cumulative post-harvest loses/ wastage along the value chain

Figure 25 displays responses revealing that substantial losses primarily occurred during transportation (72.0%) and poor handling at the market (72.0%), as well as at harvest and during the harvesting process (66.7%). These findings indicate losses ranging from 20% to 40% across the domains from harvest to the market.

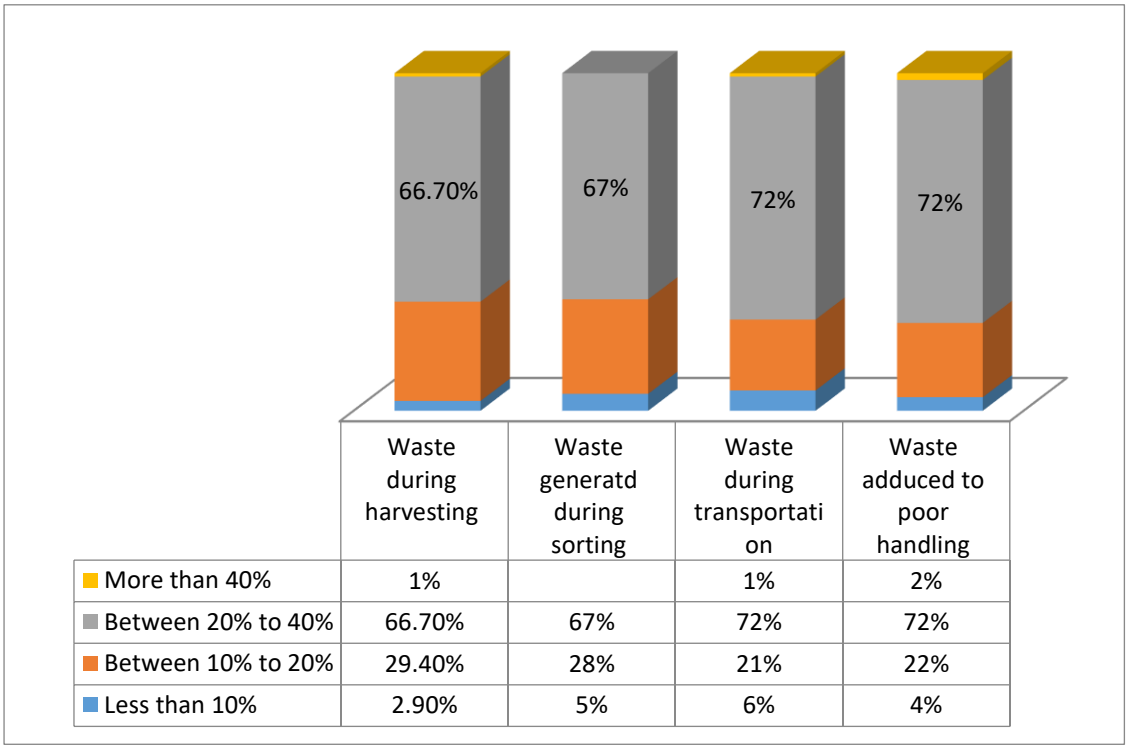


Figure 25: Cumulative post-harvest loses/ wastage along the value chain

4.3.12. Wastage on the Farm during harvest and sorting

Table 4: Wastage on the Farm during harvest and sorting

	WASTE AT THE FARM		
CROPS	LESS THAN 10%	BETWEEN 10% & 20%	BETWEEN 20% & 40%
Spinach	-	5.90%	7.65%
Tomatoes	28.35%	20.85%	33.10%
Cabbage	1.10%	1.00%	7.40%
Garden egg	-	5.20%	12.20%
Carrot	-	1.70%	9.40%
Cucumber	12.10%	11.50%	14.60%
Cassava	-	4.40%	26.20%
Yam	13.90%	10.90%	23.95%
Potatoes	16.15%	20.85%	39.90%
Maize	14.40%	14.60%	31.65%
Sorghum	1.00%	2.30%	9.45%
Cowpea	13.60%	14.60%	29.65%

Soyabeans	5.45%	7.40%	24.25%
Egg	6.45%	13.25%	23.95%
Frozen chicken	-	2.20%	4.80%
Live chicken	-	4.50%	10.45%
Frozen fish	-	-	17.60%
Fresh water fish	10.70%	9.75%	22.90%
Dried fish	-	2.15%	5.55%

Data presented in Table 3 and Figure 26, illustrating waste occurrence on the farm indicated that most wastage between 20%-40% occurred in perishable items like Tomatoes (33.10%), cassava (26.20%), Potatoes (39.90%), Maize (31.65%), Cowpea (29.69%) and eggs (23.95%). It's noteworthy that the method of harvesting, the crop's state at harvest (physiological maturity), and weather conditions are plausible factors contributing to waste during harvest. It is recognized that the sorting phase of the value chain involves grading and quality assurance of products before their transportation to their respective destinations. This phase holds prime importance as it signifies the products leaving the farmer's farm or collection point and determines the appropriate destination for each sorted product based on preferences, demand, and market dynamics.

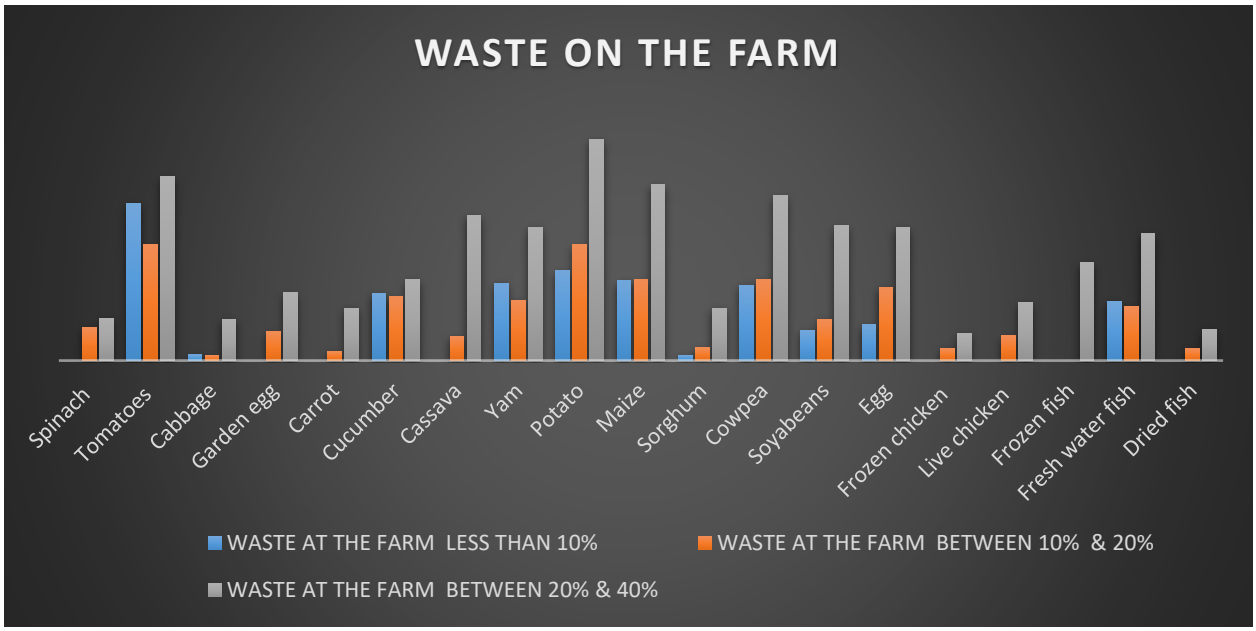


Figure 26: Wastage on the farm during harvest and sorting

4.3.13. Wastage during transportation

Table 5: Wastage during transportation

	WASTE DURING TRANSPORTATION		
CROPS	LESS THAN 10%	BETWEEN 10% & 20%	BETWEEN 20% & 40%
Spinach	0	2.60%	6.30%
Tomatoes	30.80%	20.00%	33.10%
Cabbage	-	-	1.60%
Garden egg	3.10%	5.10%	10.00%
Carrot	-	-	2.60%
Cucumber	7.90%	2.60%	10.00%
Cassava	11.00%	10.00%	12.80%
Yam	14.20%	15.40%	20.00%
Potato	12.60%	20.00%	41.00%
Maize	17.30%	10.00%	30.80%
Sorghum	1.60%	2.60%	10.00%
Cowpea	-	15.70%	23.10%
Soyabeans	11.80%	10.00%	23.10%
Egg	-	6.30%	12.80%
Frozen chicken	-	2.40%	5.10%
Live chicken	-	6.30%	12.80%
Frozen fish	1.60%	5.10%	10.00%
Fresh water fish	7.10%	10.00%	12.80%
Dried fish	-	3.10%	5.10%

As depicted in Figure Table 4 and 27 below, the waste trend during transportation is evident across all crops between 20% and 40%. Expectedly, perishable items like tomatoes (33.1%), Yam (20.00%) potatoes (41.00%), and maize (30.80%) were the worst hit. The transportation of food items plays a pivotal role in the farm produce value chain activities. Factors such as the state of infrastructure, materials used for conveying the farm produce, and the duration spent in transporting the farm produce from the point of production to its destinations of demand contribute to the recorded waste. However, handling food produce with high moisture content requires caution and expertise due to its fragile and perishable nature.

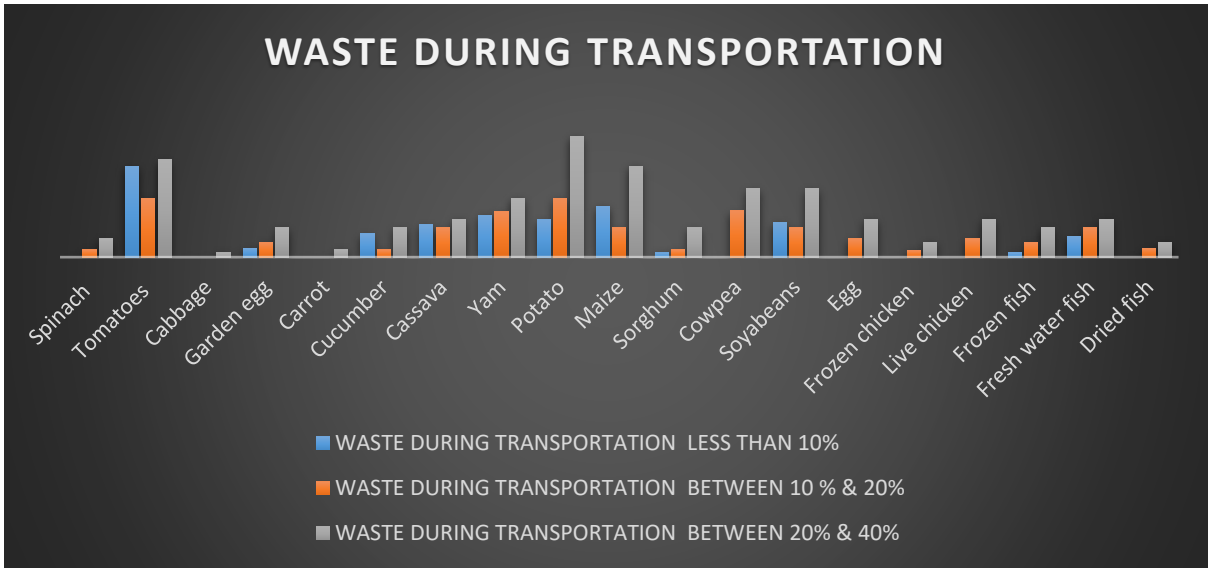


Figure 27:Wastage during Transportation

4.3.14. Wastage at the market

Table 6: Wastage at the market

	WASTE AT THE MARKET		
CROPS	LESS THAN 10%	BETWEEN 10% & 20%	BETWEEN 20% & 40%
Spinach	-	-	6.90%
Tomatoes	31.00%	21.70%	60.00%
Cabbage	0.90%	-	20.00%
Garden egg	-	3.40%	6.50%
Carrot	0	0	1.70%
Cucumber	-	2.20%	9.50%
Cassava	-	8.70%	13.80%
Yam	16.40%	13.00%	20.00%
Potato	13.80%	20.00%	32.60%
Maize	20.70%	19.60%	20.00%
Sorghum	1.70%	2.20%	20.00%
Cowpea	-	12.90%	30.40%
Soyabeans	0	12.90%	15.20%
Egg	6.90%	5.50%	20.00%
Frozen chicken	-	1.70%	8.70%
Live chicken	-	2.20%	8.60%
Frozen fish	-	-	1.70%
Fresh water fish	-	-	20.00%
Dried fish	0	3.40%	4.30%

The data presented in Table 5 and Figure 28, illustrating wastage at the market, which indicates a prevalence of waste between 20% and 40%. However, tomatoes(60.00%), cabbage (20.00%), potatoes (32.60%), cowpea (30.40%), eggs and fresh fish (20.00%) recorded dominant waste within 20%-40% wastage threshold. It is noteworthy that factors such as delays in the sales of farm produce to consumers, inadequate knowledge, and a lack of infrastructure in produce markets, among other reasons, are probable explanations for the experienced waste.

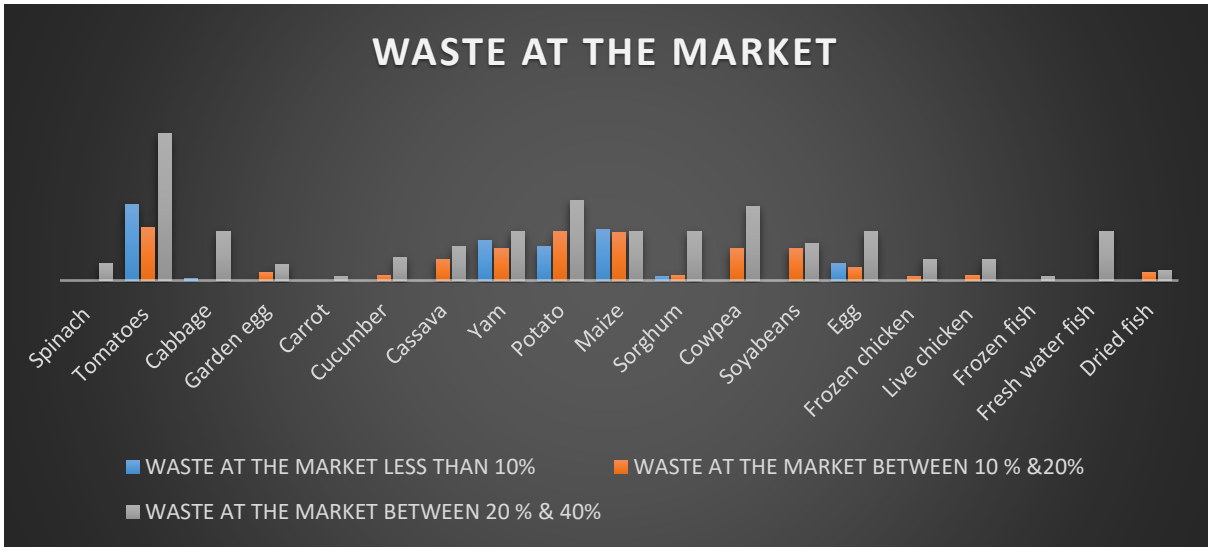


Figure 28: Wastage at the market

4.4 Culturally Adopted Agricultural Recovery System /Post-Harvest Handling

Exploring culturally adopted agricultural recovery systems and post-harvest handling methods reveals that respondents often employ the use of chemicals for preservation, drying, and immediate sale of produce. While the use of chemicals can be effective, there are concerns about the lack of knowledge among users regarding the conditions for proper application. In cases where conditions are known, compliance may be lacking. Critical factors include the initial moisture content of the food produce, the appropriate quantity of chemicals, the temperature of the storage facility, and the duration for which the active ingredients remain potent, among others. Additionally, there is apprehension about the potential residual effects of these chemicals on the stored food produce. Given these considerations, the use of chemicals for preservation

is often discouraged, especially when understanding and control of its use and regulation are lacking.

Drying is recognized as a potent and culturally accepted means of preserving food produce after harvesting. This method aims to reduce the moisture content of the food items, thereby inhibiting the activities of deteriorating organisms in and around the produce. By decreasing moisture content, the shelf life of the food produce is extended without compromising its quality.

Immediate sale of food produce after harvest is another culturally significant preservation method. This practice ensures prompt removal of produce from the farm, primarily due to a lack of infrastructure for on-farm preservation. Additionally, there are associated costs with post-harvest preservation that may increase overall production costs. Immediate sale also allows for another cycle of production, enabling entrepreneurs to reinvest the proceeds from the last cycle. Many producers focus primarily on this aspect of the value chain, opting for specialization to enhance efficiency.

4.5 Constraints to Agricultural Recovery System/Post-Harvest Handling

Information derived from qualitative data highlights several constraints affecting agricultural recovery systems and post-harvest handling. These challenges include poor sales, weather and climatic conditions, pest and disease attacks, high transportation costs, poor road infrastructure, and insecurity.

Poor sales, often attributed to inadequate harvests and unfavourable pricing, contribute to non-remunerative outcomes for farmers, discouraging them from engaging in post-harvest handling or value addition processes. Weather and climate conditions play a crucial role, as post-harvest activities are heavily dependent on prevailing weather conditions. Optimal post-harvest handling is achievable only when weather conditions are favourable.

The incidence of pests and diseases poses a significant constraint to successful post-harvest handling. Attacks on farm produce decrease their value, making it challenging to conduct further post-harvest operations. These attacks can occur during harvest or shortly afterward, affecting the overall quality of the produce.

Bad roads and the associated high transportation costs are additional hindrances to agricultural recovery systems and post-harvest handling. Poor road conditions impede timely access to farms for hauling produce to collection points or direct market destinations. Bad roads lead to increased transportation costs, vehicle breakdowns, and damage to produce during offloading and reloading.

Insecurity emerges as a critical factor contributing to post-harvest losses. Farm attacks by assailants' force farmers to abandon some produce in the fields, leading to spoilage. Insecure conditions during transportation result in transporters abandoning farm produce for safety. Insecurity poses a consistent challenge throughout the entire farm produce value chain, impacting various phases and activities.

CHAPTER 5: CONCLUSION

5.1 Preference of technology to keep your produce longer for the market.

Data from Figure 30 reveals that a significant majority (76.5%) of respondents express a willingness to embrace technology for storing their produce and ensuring prolonged market viability. Recognizing that waste occurs during harvest, sorting, transportation, and market handling, respondents believe that the integration of technology can mitigate waste, leading to reduced associated costs across these phases or value chain nodes. The adoption of technology by entrepreneurs is seen as a key to generating remunerative income, thereby enhancing their passion for the job and their commitment to sustaining the enterprise.

Conversely, a fraction (23.5%) of entrepreneurs is less inclined toward the use of technology to extend the shelf life of their produce. Contributing factors to this negative stance include concerns about the initial investment cost, skepticism regarding the technology's operations, and uncertainties about its lifespan. It is noteworthy that, during the technology adoption process, a portion of respondents may initially display indifference, but over time, they are likely to embrace the technology. Essentially, the data reflecting the preference for technology to enhance produce longevity aligns with the typical adoption curve, illustrating a gradual acceptance of technology.

Importantly, the deployment of technology will be influenced by factors such as economic feasibility, ease of use, accessibility, among others, which will play a pivotal role in encouraging its sustained use.

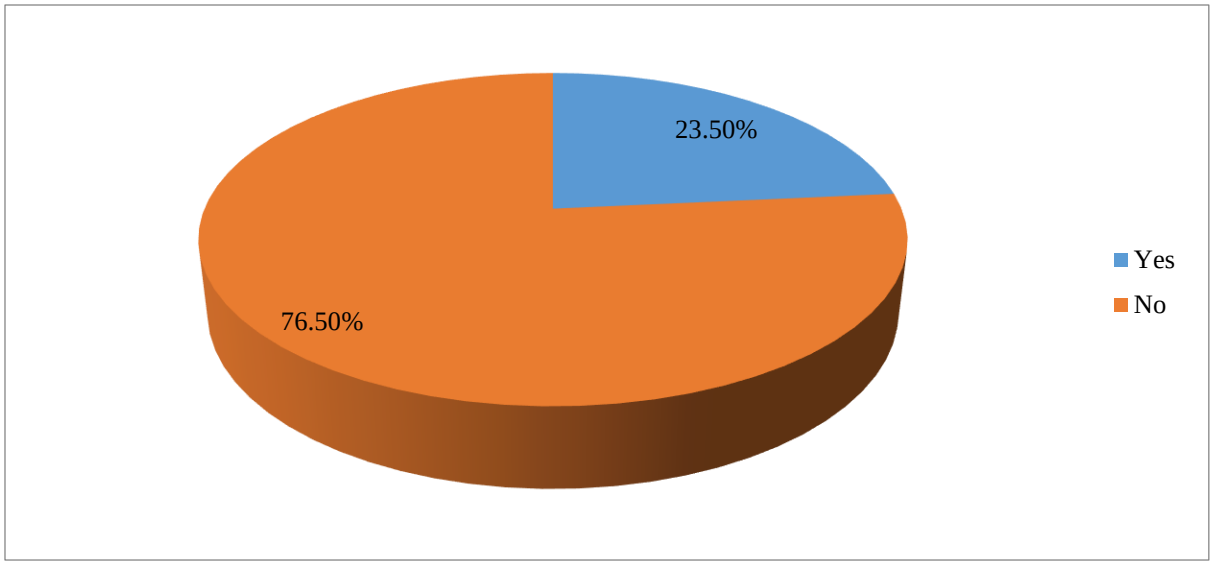


Figure 29: Preference of technology to keep your produce longer for the market

5.2 Type of preservation method preferred

Figure 31 provides data on the preferred preservation methods chosen by respondents. Notably, cold storage (37.3%) and solar drying systems (35.2%) emerged as the most favoured preservation methods for their farm produce. The preference for cold storage is driven by the need to cater for perishable items susceptible to waste due to storage and post-harvest handling activities. Respondents also acknowledge the significant infrastructural investment required for cold storage, which could potentially encourage small-scale infrastructure investments by producers.

The demand for solar drying systems stems from the desire for sustained drying of food produce. Despite being a small-scale technology, its successful use among some producers has generated interest and proposed demand. Additionally, respondents express a willingness to adopt open sun drying (19.6%), a traditional method for processing farm produce. However, this method has drawbacks, including dependence on weather conditions, limited scale of production, and exposure of the produce to dust, rodents, and other environmental factors.

A smaller fraction of respondents indicated a preference for electrical dryers (6.9%). The limited enthusiasm and low subscription to electrical dryers are attributed to challenges related to the current state of electricity infrastructure, especially considering that most production occurs in rural and suburban areas.

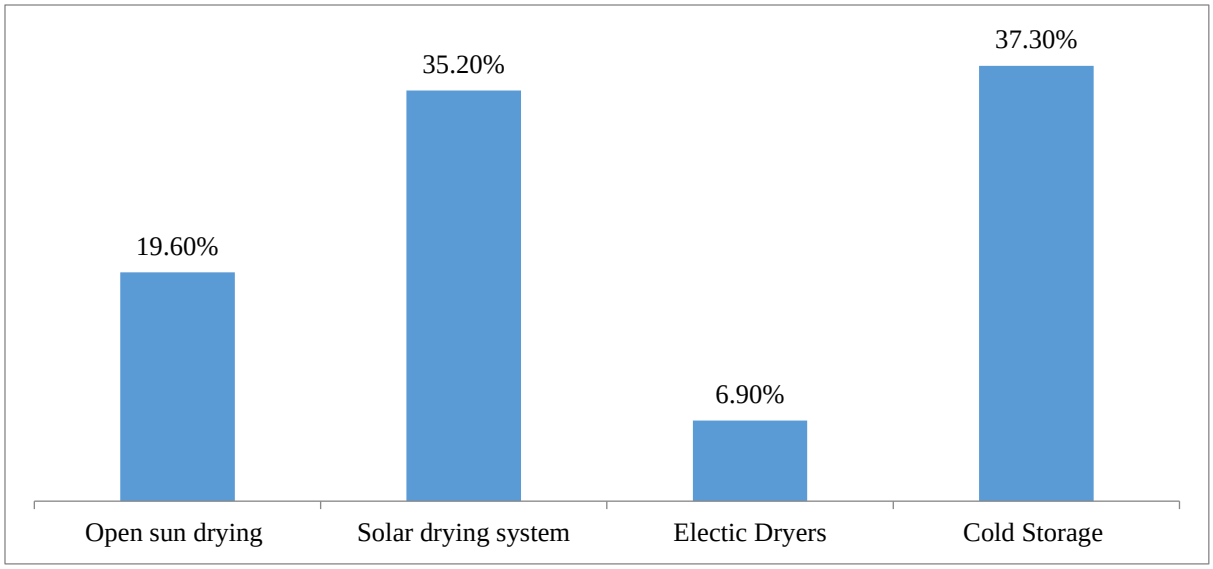


Figure 30: Type of preservation method preferred

5.3 Respondents' Desirable Value addition options

Statistics presented in Figure 32 reveal the preferred types of value addition as desired by the respondents. A significant majority (68.7%) indicates a preference for drying as the most desirable form of value addition. Drying is seen as a method to enhance the shelf life of produce and reduce wastage throughout the value chain. Respondents also recognize that drying allows for the creation of a variety of food products in demand in the market. The appeal of dried products is further augmented by their packaging, standardization, and acceptance in supermarkets.

Other types of value addition acknowledged by respondents include paste (23.5%) and jam (7.8%). The interest in venturing into these forms of value addition is motivated by the opportunity to process various fruits into pastes and jams, which have a readily available local market. It is recognized that with knowledge acquisition and investment in infrastructure, entrepreneurs can leverage these methods to minimize waste and maximize income from their production.

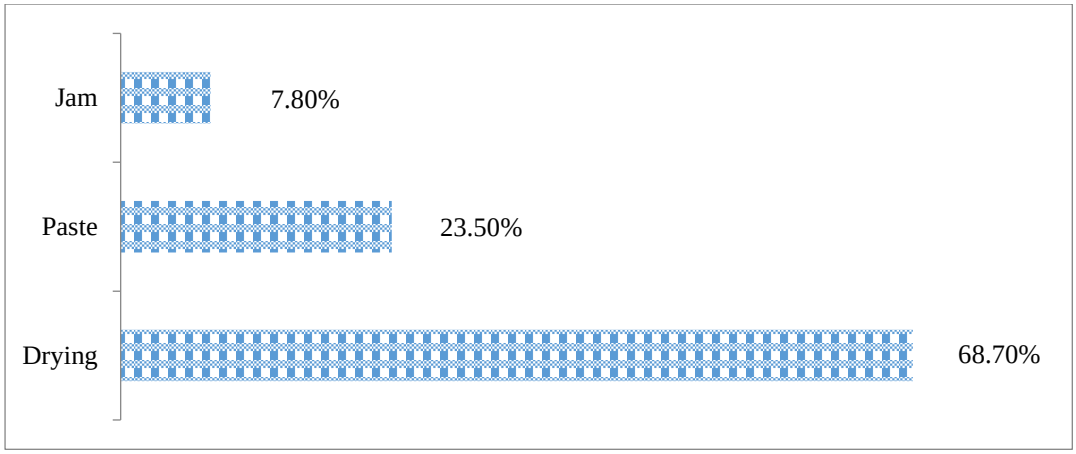


Figure 31: Respondents' Desirable Value addition options

5.4 Subscription to membership of group to rescuing surplus agricultural produce

Data presented in Figure 33 indicates that almost all respondents (95.1%) express their willingness to be part of a group focused on rescuing surplus agricultural produce to prevent wastage. Their inclination to join such a group is rooted in the distress they experience when calculating the losses attributed to post-harvest issues. Consequently, they are eager to subscribe to and support any initiative or platform that empowers them to minimize post-harvest losses to the lowest possible threshold. It is recognized that the reduction of waste will not only reignite their interest but also sustain their passion for their agricultural pursuits. Moreover, their willingness to belong to a group will enable them to share experiences and pool resources, facilitating collaborative efforts to address areas of post-harvest loss in crop produce where they possess comparative and competitive advantages.

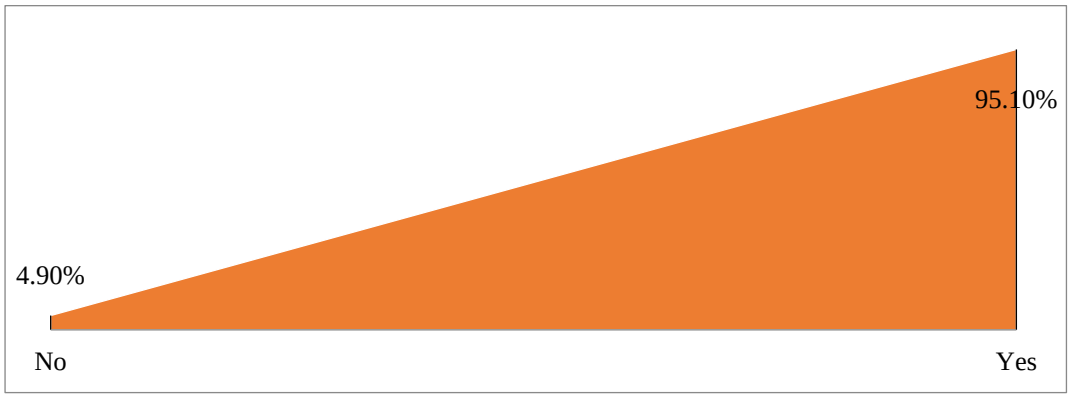


Figure 32: Subscription to membership of group to rescuing surplus agricultural produce

5.5 Key Recommendations

Baseline information on the disposition to the feasibility of agricultural recovery program for rescuing agricultural produce surplus was favourable. However, cold storage and solar drying systems preservation methods to prolong shelf life and market viability were the technology needed to establish food bank and negotiate cost and distribute excess produce to the vulnerable communities.

Implementing an efficient agricultural recovery system in Nigeria holds significant viability and potential impact. The country's economy is largely dependent on agriculture, and a well-designed recovery system can enhance food security, boost the income of farmers, and contribute to overall economic growth. By addressing challenges such as inadequate infrastructure, limited access to credit, and inconsistent policies, Nigeria can unlock its agricultural potential. This would not only lead to increased productivity but also create employment opportunities, alleviate poverty, and reduce reliance on food imports. Therefore, investing in and implementing an efficient agricultural recovery system in Nigeria is crucial for sustainable development and long-term prosperity.

The following recommendations would essentially reduce post-harvest loses and wastages.

1. Infrastructural development: Invest in rural infrastructure, including roads, irrigation systems, and storage facilities, to facilitate the efficient movement of agricultural products and reduce post-harvest losses.
2. Access to finance: Enhance access to credit for smallholder farmers by collaborating with financial institutions and implementing farmer-friendly loan programs. This can enable farmers to invest in modern farming practices, machinery, and inputs.
3. Technology adoption: Promote the adoption of modern agricultural technologies, such as precision farming, crop monitoring, and efficient irrigation methods, to increase productivity and sustainability.
4. Research and Extension Services: Strengthen agricultural research and extension services to provide farmers with up-to-date knowledge, improved techniques, and pest/disease management strategies for better crop yields.

5. Market Linkages: Facilitate the creation of direct market linkages for farmers to connect with buyers, processors, and exporters. This can help farmers secure better prices and increase their income.
6. Policy consistency: Ensure consistency and coherence in agricultural policies to provide a stable and predictable environment for farmers, investors, and other stakeholders.
7. Capacity Building: Implement training programs to build the capacity of farmers, especially in areas such as sustainable farming practices, agribusiness management, and value addition.
8. Climate Resilience: Integrate climate-smart agricultural practices to build resilience against the impacts of climate change, ensuring sustainable production in the face of evolving environmental challenges.
9. Diversification: Encourage crop diversification to reduce dependency on a few staple crops, promoting a more resilient and varied agricultural sector.
10. Community Engagement: Involve local communities in decision-making processes, ensuring that recovery programs are tailored to the specific needs and realities of different regions within Nigeria.

By addressing these key areas, Nigeria can develop a robust agricultural recovery program that enhances productivity, improves livelihoods, and contributes to the overall economic development of the country.

To further strengthen the feasibility of agricultural recovery program for rescuing agricultural produce surplus, we recommend for study on the following thematic areas:

1. **Pilot Programme and Evaluation**
   - Start with a pilot program to test the feasibility and identify potential challenges.
   - Regularly evaluate the program's effectiveness, gather feedback, and make necessary adjustments.
2. **Expand and scale up.**
   - Once the pilot is successful, expand the program to reach more donors, recipients, and communities.

- Explore opportunities to collaborate with additional businesses, organizations, and government agencies.

3. **Advocacy and Policy influence**
    - Advocate for policies that support food recovery, reduce barriers for donors, and promote incentives for businesses to participate.
    - Collaborate with local authorities and policymakers to create an environment conducive to food redistribution programs.
4. **Measure Impact**
    - Establish metrics to measure the impact of the program on reducing food waste and addressing food insecurity.
    - Use data to communicate the success of the program to donors, volunteers, and the community.

CHAPTER 6 : APPENDIX

6.0 Seasonal calendar of fruits, vegetables, cereals, roots and tubers crops in Nigeria

Nigeria has a diverse climate, and the agricultural calendar varies across different regions. The country generally experiences two main seasons: the rainy season (March to October) and the dry season (November to February).

Marketing of food produce

Months	Food produce
January	Kolanut, cherry and Plantain
February	Tomatoes and Okro
March	Maize, Tomatoes, Cassava and plantain
April	Maize, Water melon, Ground nut, Cocoa and Plantain
May	Pepper and Tomatoes
June	Maize, Tomatoes and Yam
July	Potatoes, tam and maize
August	Cowpea, Oil palm and pineapple
September	Cocoa and Kolanut
October	Orange, Banana and Plantain
November	Cocoa, Banana, Orange , Pineapple and Plantain
December	Cocoa, Orange, Pineapple, Cherry and Plantain

Source: Field Survey 2023

The following outlines a broad seasonal calendar applicable to various crops across different agricultural zones in Nigeria.

1. Fruits
    - Mangoes: May to August
    - Pineapples: June to September
    - Bananas: Year-round, but peak season may vary
2. Vegetables
    - Okra: May to September
    - Tomatoes: June to October

- Pepper: June to October
- Watermelon: June to September
- Spinach: November to April
- Cucumber: November to April

3. Cereals
    - Maize (Corn): May to August
    - Rice: June to October
4. Roots and Tubers
    - Cassava: Year-round
    - Sweet potatoes: Year-round
    - Yams: Year-round

It's important to note that these timelines are general and can vary based on specific local conditions, agro-ecological zones, and farming practices. Additionally, advancements in agricultural practices and technology may enable some crops to be grown out of their traditional seasons through irrigation and other techniques. Local farmers and agricultural extension services can provide more specific and regionally accurate information.

6.1Baseline Survey Questionnaire

This is instrument is meant to elicit baseline information on post-harvest handling of agricultural produce across the value chain (farmers, processors, marketers and transporters) to generate appropriate data on agricultural recovery system needed to drive food security in Nigeria. Information obtained would be treated with absolute confidentiality. Please note that your participation is voluntary, and you are free to withdraw at any stage of the interview.

Name of interviewer	Date of interview	Community/Location	GPS Location

Please tick accordingly [X]

A. **Respondents' Category**: Farmer [ ], Processor [ ], Marketer [ ], Transporter [ ].

B. **Agricultural enterprise(s)**

i. **Fruits** – Pineapple [ ], Oranges [ ], Papaya [ ], Banana/Plantain [ ]
ii. **Vegetables**- Spinach [ ], tomatoes [ ], cabbage [ ], garden egg [ ], carrot [ ], cucumber [ ]
iii. **Roots and Tubers** – Cassava [ ], Yam [ ], Potatoes [ ]
iv. **Cereals** – Maize [ ], Sorghum [ ]
v. **Legumes** – Cowpea [ ], Soya bean [ ].
vi. **Poultry & Poultry Products**: Egg [ ], Frozen chicken [ ], Live chicken [ ]
vii. **Fish & Fish Products**: Frozen fish [ ], Fresh water fish [ ], Frozen Fish [ ], Dried Fish [ ]

C. **Socioeconomic information**

i. Age---------- (In years)
ii. Highest level of education--------- (In years)
iii. Marital status: Single [ ], Married [ ], Widow/widower [ ],
iv. Years of experience in agricultural enterprise selected in B---------

D. **Post-Harvest Handling – Record as applicable to the selected agricultural enterprise**

i. How do you harvest your produce? Manually [ ], Mechanically [ ], Others (Specify)----
ii. What types of containers do you use when harvesting? Traditional baskets [ ], Sacks [ ], Trays [ ], Plastic crates[ ], Other (specify)----------
iii. How much waste occurs in the farm during harvesting? Less than 10 % [ ], Between 10 to 20 % [ ], 20 to 40 %[ ], More than 50 % [ ].
iv. Do you sort your harvested produce? Yes [ ], No [ ].
v. If yes in iv above, what percent of your harvested produce is thrown away during sorting? Less than 10 % [ ], Between 10 to 20 % [ ], 20 to 40 %[ ], More than 50 % [ ].
vi. How do you transport your produce from the farm to collection or selling point? Human transportation [ ], Bicycle [ ],Motorcycles [ ], Animal [ ], Open pick-up [ ], Close pick-up [ ].
vii. What type of packaging do you use for transporting to the market? Traditional baskets [ ], Sacks [ ], Trays [ ], Plastic crates[ ], Other (specify)----------
viii. What percentage gets wasted during transport to the market or collection point? Less than 10 % [ ], Between 10 to 20 % [ ], 20 to 40 %[ ], More than 50 % [ ].

ix. How do you store your produce on the farm after harvest? Under the shade [ ], In cold rooms [ ], In sacks in the open [ ], Others(specify)_____

x. How long do you store your produce on the farm before selling? Less than 1 hour [ ], 1 to less than 3 hours [ ], 3 to less than 6 hours [ ], More than 6 hours [ ].

xi. What percentage of your produce do you think go to waste due to poor handling at the market? Less than 10 % [ ], Between 10 to 20 % [ ], 20 to 40 %[ ], More than 50 % [ ].

E. Feasibility of establishing a mechanism for rescuing surplus agricultural produce.

i. Would you like technology to keep your produce longer for the market? Yes [ ], No [ ].

ii. If yes, specify_____

iii. What types of preservation method(s) would you prefer for your agricultural produce? Open sun drying [ ], Solar drying systems [ ], Using electric dryers [ ], Cold storage [ ].

iv. What type of value addition would you like to adopt for your produce? Drying [ ], Paste [ ], Jam [ ], Others(specify)_____

v. Would you like to be a member of a group dedicated to rescuing surplus agricultural produce in your locality? Yes [ ], No [ ].

vi. If No to v. why?----------

F. Effects of economic, environmental, and social features on agricultural recovery system/post-harvest handling.

S/N		Agreed	Disagreed	I am not sure
1.	Poor economic returns on agricultural produce is the reason for post-harvest loses.			
2.	Associated cost for agricultural recovery systems/post-harvest handing is somewhat expensive.			
3.	Infrastructural support needed for agricultural recovery systems/post-harvest handing is deficient in most cases.			
4.	Actors in agricultural value chain somewhat abuse chemical application methods during production and marketing.			
5.	Fake/ unregulated agro-chemicals seems to be a major factor for post-harvest losses.			
6.	Sharp practices among the agricultural value chain actors somehow affect agricultural recovery systems.			
7.	Climate change appears to be responsible for post-harvest losses due to extreme weather condition.			

8.	Absence of organised market seems to limit agricultural recovery systems in Nigeria.			
9.	Poor ambience in most farming community is likely to elicit post-harvest losses.			
10.	Sociocultural agronomic practice somewhat negatively affects post-harvest handling.			

Agricultural Recovery System in Nigeria

Key Informants' Interview (KII)

Key Informants' Interview (KII) for Agricultural Recovery System/ Post-Harvest-Handling in Nigeria for market, farming group, agricultural processing group and transport leaders.

Name of interviewer	Date of interview	Community/Location	GPS Location

Please tick accordingly [X]

G. **Respondents' Category**: Farming group leader [ ], Processing group leader [ ], Market leader [ ], Transport leader [ ].

H. Key Informant's Personal Information

   i. Name of the interviewee----------
   ii. Age---------- (In years)
   iii. Sex--------- Male [ ], Female [ ].
   iv. Ethnic background----------
   v. Educational qualification- No formal education [ ], Functional literacy [ ], Primary [ ], Secondary [ ], Tertiary [ ].
   vi. How long have you been in this Value Chain node? ____ (in years).

I. Determine the seasonal calendar of fruits, vegetables, cereals, roots and tubers crops in Nigeria. (At this point conduct seasonal calendar to ascertain periods to target recovery intervention for selected agricultural produce).

J. Examine the culturally adopted agricultural recovery systems/post-harvest handing in Nigeria (Probe into culturally adopted agricultural recovery systems/ post-harvest).

K. Examine the constraints to agricultural recovery system/post-harvest handling in Nigeria. Assess the economic, environmental, and social implications of reducing food loss and waste throughout the supply chain causes (Conduct problem tree analysis to understand the limiting features of agricultural recovery system/post-harvest handling in Nigeria).

Seasonal Calendar Template

Months	Crops	Productive/economic Activities	Remarks
January			
February			

March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

Problem Tree Analysis for constraints to agricultural Recovery systems

Effect of post-harvest loses. List	1. 10
Main Problem – Post-harvest loses.	
Root caused of post-harvest loses. List	1. 10

6.2 References

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