



The United Republic of Tanzania,
Ministry of Agriculture

National Postharvest Management Strategy

2019 -2029







THE UNITED REPUBLIC OF TANZANIA
Ministry of Agriculture

**NATIONAL POST-HARVEST
MANAGEMENT STRATEGY-NPHMS
2019-2029**

Dodoma, Tanzania
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LIST OF ACRONYMS

| | |
|----------|---|
| ADB | African Development Bank |
| AEZ | Agro-Ecological Zone |
| AFB1 | Aflatoxin B1 (Sumu Kuvu B1) |
| AGRA | Alliance for a Green Revolution in Africa |
| ANSAF | Agricultural Non State Actors Forum |
| APA | Agricultural Produce Act |
| ARI | Agriculture Research Institutes |
| ASDP | Agricultural Sector Development Programme |
| ASDS | Agricultural Sector Development Strategy |
| ASLMS | Agriculture Sector Lead Ministries |
| AU | African Union |
| AZISE | Asasi Zisizo za Serikali |
| BMI | Body Mass Index |
| BRN | Big Results Now |
| CAADP | Comprehensive African Agricultural Development Program CAMARTECCentre for Agricultural Mechanisation and Rural Technology |
| CBOs | Community-Based Organizations |
| CFS | Committee on World Food Security |
| CMEW | Crop Monitoring and Early Warning |
| CMT | Coordination and Management Team |
| COSTECH | Tanzania Commission for Science and Technology |
| COWABAMA | Collective Warehouse Based Marketing schemes |
| CVC | Commodity Value Chain |
| DADPs | District Agriculture Development Plans |
| DAICO | District Agricultural, Irrigation and Cooperative Officer |
| DASIP | District Agriculture Sector Investment Plan |
| DCP | District CVC Platform |
| DEDs | District Executive Directors |
| DNFS | Division of National Food Security |
| DPs | Development Partners (DPs) |

| | |
|--------|---|
| EAC | East African Community |
| FAO | Food and Agriculture Organization of the United Nations |
| FFS | Farmers Field School |
| FPs | Focal Persons |
| FSAS | Food Security Assistance Scheme. |
| FSC | Food Supply Chain |
| FSD | Food Security Department |
| GDP | Gross Domestic Product |
| GMP | Good Manufacturing Practice |
| GPLP | Grain Postharvest Loss Prevention Project |
| HACCP | Hazard Analysis Critical Control Points |
| HSI | HELVETAS Swiss Interco-operation. |
| ICT | Information and Communication Technologies |
| JSR | Joint Sector Review |
| LGAs | Local Government Authorities |
| LGB | Larger Grain Borer |
| LTPP | Long-Term Perspective Plan |
| M & E | Monitoring and Evaluation |
| MOA | Ministry of Agriculture |
| MATIs | Ministry of Agriculture Training Institutes |
| MDAs | Ministries, Departments, and Agencies |
| MIS | Market Information Systems |
| MITI | Ministry of Industries Trade and Investment |
| MIVARF | Marketing Infrastructure Value Addition and Rural Finance Programme |
| MoFP | Ministry of Finance and Planning |
| MT | Metric Tonnes |
| NASSM | National Agricultural Sector Stakeholders Meeting |
| NEPAD | New Partnership for Africa's Development |
| NFS | National Food Security |
| NGOs | Non-Governmental Organizations |
| NMC | National Milling Corporation |

| | |
|-------------|--|
| NPHMS | National Post-Harvest Management Strategy |
| NSAs | Non-State Actors |
| PH | Post-Harvest |
| PHL | Pots-Harvest Losses |
| PHM | Post-Harvest Management |
| PHM-TWG | Post-Harvest Management Services-Technical Working Group |
| PHTs | Post-Harvest Technologies |
| PMO | Prime Minister's Office |
| PO-RALG | President 's Office - Regional Administration and Local Government |
| PPP | Public Private Partnership |
| PS MOA | Permanent Secretary Ministry of Agriculture |
| RAS | Regional Administrative Secretariat |
| REA | Rural Energy Agency |
| REPOA | Research on Poverty Alleviation |
| RS | Regional Secretariat |
| SACCOS | Savings and Credit Cooperative Society |
| SADC | Southern Africa Development Community |
| SAGCOT | Southern Agriculture Growth Corridor of Tanzania |
| SC | Steering Committee |
| SDC | Swiss Agency for Development and Cooperation. |
| SDG | Sustainable Development Goals. |
| SGR | Strategic Grain Reserve |
| SIDO | Small Industries Development Organisation |
| SMEs | Small and Medium Enterprises |
| SO | Strategic Objective |
| SSA | Sub-Saharan Africa |
| TAFSIP Plan | Tanzania Agriculture and Food Security Investment Plan |
| TBS | Tanzania Bureau of Standards |
| TCD | Technical Committee of Directors |
| TDV | Tanzania Development Vision |

| | |
|--------|--|
| TEMDO | Tanzania Engineering and Manufacturing Design Organisation |
| TF | Task Force. |
| TFDA | Tanzania Food and Drug Authority |
| TIRDO | Tanzania Industrial Research and Development Organisation |
| TMA | Tanzania Meteorological Agency |
| TPMP | Tanzania Post-harvest Management Platform. |
| TV | Television |
| TWG | Thematic/Technical Working Groups (TWG) |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| UNGA | United Nations General Assembly |
| USD | US Dollars |
| VICOBA | Village Community Banks |
| WRC | Ward Resource Centre |
| WRRB | Warehouse Receipts Regulatory Board |

Foreword

In Tanzania, domestic food production is sufficient to meet national food needs. However, some of the regions suffer perennial food shortages due to inherent weaknesses, especially post-harvest systems, which contribute to higher food prices, as a result of decreased food supply to the market. Due to increasing magnitude of post-harvest losses, which is estimated to be 30 - 40% for cereals and even higher for perishable crops. As a response to this situation, the government in collaboration with other stakeholders developed the National Post-harvest Management Strategy (NPHMS). NPHMS will be implemented over ten years period focusing on food crops particularly cereals, legumes, fruits and vegetables, roots and tubers and edible oil crops. The strategy intends to provide significant interventions that will reduce post-harvest losses and potentially offset this food deficit.

Furthermore, there is now global consensus that mitigating food losses that occur between harvest and consumption offers the single most enormous opportunity to reduce hunger. Therefore, attention needs to be given to the efforts that focus on demand-driven approaches that explore value addition and appropriate uses of post-harvest products and by-products.

Moreover, the NPHMS aims at facilitating and building capacity of postharvest actors to reduce postharvest losses in order to increase their income, food and nutrition security. The strategy will also contribute in the implementation of the National Agriculture Policy (2013) through a second phase of a comprehensive Agricultural Sector Development Programme (ASDP II), which aims to achieve effective and efficient food and nutrition security. This strategy intends to facilitate the achieving of the African Union Malabo Commitment of halving post-harvest losses by 2025 and the United Nations General Assembly Sustainable Development Goal 12.3 which aims to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains by 2030.

The Strategy has been prepared in a participatory approach involving various post-harvest management actors at different levels. Therefore, this strategy is the joint product of input from different stakeholders. I hope that the implementation of this strategy will minimize post-harvest losses along the commodity value chain and sufficiently contribute to national food and nutrition security overall economic development of the country at large.



Eng. Mathew J. Mtigumwe

Permanent Secretary

Acknowledgement

The Ministry of Agriculture wishes to extend the appreciation to various stakeholders along the postharvest value chain comprising of public, private, non-governmental organizations and academic and research institutions, who actively participated in and contributed to the development of this National Post-Harvest Management Strategy (NPHMS).

In particular, the Ministry would like to thank the Task Force (TF), which comprises of members from the Ministry of Agriculture (MOA), Ministry of Industries Trade and Investment (MITI), Prime Minister's Office (PMO), Agricultural Non State Actors Forum (ANSAF), and HELVETAS Swiss Inter-cooperation (HSI) for their technical expertise in developing this strategy. (List Attached)

Acknowledgement is also due the Swiss Agency for Development and Cooperation (SDC), the Alliance for Green Revolution in Africa (AGRA), and the Food and Agriculture Organization of the United Nations (FAO) for their technical and financial support towards the development of this strategy.

Lastly but not least, great appreciation is directed to all who contributed and supported the formulation exercise in various ways.

INTRODUCTION



1. Introduction

1.1 Background

The global food security challenge is straight forward: by 2050 the world must feed 9 billion people (Parfitt, Barthel, & Macnaughton, 2010). The demand for food will be 60 percent greater than it is today. The United Nations has set ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture as the second of its 17 Sustainable Development Goals (SDGs) for the year 2030. While considerable attention is directed towards increasing food production by 50–70 percent to meet this target, one important and complementary factor that is often forgotten is reducing food loss and food waste.

The third target under this goal (Target 12.3) calls for halving per capita global food waste at the retail and consumer levels and reducing food losses along production and supply chains (including post-harvest losses) by 2030.

However, both approaches are necessary in any strategy to address food security and avoid hunger. Since the start of the surging food and market prices in 2006, the risk of intermittent food shortage is becoming ever so more a reality. For low-income food deficit countries such as Tanzania, factors such as persistent low agriculture production, difficulties of addressing the effect of climate change and inability to handle the financial burden of high food prices in the context of limited access to credit are all escalating the concerns for food insecurity. However, one underlying factor that seems to be often forgotten is the effect of post-harvest losses on exacerbating food insecurity and income loss especially among small-scale farmers.

Post-harvest losses feature prominently in recent global initiatives such as the Comprehensive Framework for Action issued in 2009 by UN High – Level Task Force for Food Security and Nutrition after the global food crisis, Global Agricultural and Food security Programme endorsed by World Bank (2010) and the

Committee on World Food Security (CFS). PHL reduction is also prioritized in the Africa Union's Comprehensive Africa Agricultural Development Program (CAADP) as well as in agricultural and food security investment plans of national governments. The Africa Union Summit in Malabo in 2014 committed to ending hunger by, among other things, halving the current levels of post-harvest losses by 2025.

Reducing Post-Harvest Losses (PHL) is a key pathway to food and nutrition security in the world. FAO and World Bank suggested that about one third of the food produced globally is lost or wasted, representing a loss of 1.3 billion tons of food per year in a world where over 870 million people go hungry. A recent report by the World Bank (World Bank, 2011) revealed that, each year, significant volumes of food are lost after harvest in Sub-Saharan Africa (SSA), the value of which is estimated at USD 4 billion for grains alone. The report demonstrates that this magnitude of food loss exceeds the value of total food aid received in SSA over the last decade, and further equates to the annual value of cereal imports to SSA. In addition, such losses are estimated to be equivalent to the annual caloric requirement of 48 million people.

Furthermore, FAO and World Bank approximated that up to 47 percent of USD 940 billion needed to eradicate hunger in SSA by 2050 will be required to support the post-harvest sector (FAO–World Bank, 2010). Reducing food losses therefore offers an important pathway of availing food, alleviating poverty, and improving nutrition. Moreover, reducing PHL has positive impacts on the environment and climate as it enhances farm-level productivity and reduces the utilization of production resources or expansion into fragile ecosystems to produce food that will be lost and not consumed. Deploying limited land, water, energy, inputs and other resources to produce products which are not consumed, unnecessarily enlarges agriculture's environmental footprint and is not sustainable.

1.2 National Policies, Strategies And Programmes

There have been major changes in the National Policy Frameworks resulting from the implementation of the Tanzania Development Vision (TDV – 2025), Long-term Perspective Plan and Five Year Development Plan (2016/2026). The macro policy frameworks provide high priority on achieving food security in the country. In this regard, the Government has formulated relevant policies, strategies and programmes. The most applicable public policies to crop post-harvest losses are National Agriculture Policy (2013) and Agriculture Marketing Policy (2008), which all acknowledge post-harvest losses as a challenge in achieving food security. In order to implement such policies, a number of reforms such as KILIMO KWANZA, Resolve, the Tanzania Agricultural and Food Security Investment Plan (TAFSIP) and Southern Agriculture Growth Corridor of Tanzania (SAGCOT) have been initiated to complement speedy implementation of the ASDP. The initiatives are linked to the Comprehensive African Agriculture Development Programme (CAADP), the African Union initiative for revamping agricultural development in Africa through the New Partnership for Africa’s Development (NEPAD).

Although the Government through various policies, strategies, and programmes has done much, challenges still remain in addressing post-harvest losses issues in the country. Inadequacy of post-harvest services, limited agricultural marketing infrastructure and shortage of relevant technologies are some of the causative factors of the problem. Therefore, the strategy will guide public and private sector efforts in addressing post-harvest losses matters. Furthermore, the strategy takes into account the ongoing institutional and policy reforms, the country’s new political system and structure of government.

1.3 Rationale For National PHM Strategy

The National Agriculture Policy (2013) acknowledges that, among the key challenges in the agriculture sector, is the high pre- and post-harvest losses, which make up 30-40 percent of the total annual crop production. The largest magnitudes of losses occur in fruits, vegetables, root and tuber crops, because of the perishability of these commodities, and the poor post-production infrastructure for handling perishable produce across the country. Post-harvest loss disadvantages value chain actors by reducing saleable volumes for farmers with correspondingly higher prices for consumers. The yield gain which farmers work hard to achieve from productivity investments, has low returns if consequences of PHL remain unabated. The advantages of agricultural intensification, in the absence of the capacity to preserve and market the excess production cannot be achieved. Mitigating PHL represents an opportunity to deliver increased incomes, better health and a sustainable environment.

Additionally, the Agricultural Marketing Policy (2008) recognizes that agricultural marketing is adversely affected by lack of marketing structures, poor linkages within the marketing, processing and production chains, poor market-orientation and inadequate processing facilities. These lead to high levels of produce wastage. The key objective in the policy is to ensure that the agricultural marketing infrastructure is improved and developed in order to, among others, reduce post-harvest losses for agricultural products. Loss prevention, therefore, offers an important opportunity to advance food security now and a sustainable food future for Tanzania.

Although the current policy environment is more receptive to the importance of PHL, the agriculture strategies have not paid adequate attention to PHL issues in efforts to increase food and income security. Additionally, there is inadequate awareness on PHL and the costs it poses to the economy and environment. It is within this context that PHLs still remains a persistent problem

and presents an enormous threat to food security. It is, therefore, imperative to have a strategy for mitigating post-harvest losses. The strategy will build on the other on-going global and regional initiatives including Malabo Declaration commitments to combat PHL so as to create synergies for moving forward.

1.4 Methodology

The development of this National Post-harvest Management Strategy involved a process of wide consultation with various stakeholders in an effort to come up with concrete issues and constraints facing post-harvest losses in the country. In preparing the strategy, a Task Force (TF) comprising of 11 members from the Ministry of Agriculture (MoA), Ministry of Industries Trade and Investment (MITI), Prime Minister's Office (PMO) and Agricultural Non State Actors Forum (ANSAF), and HELVETAS Swiss Intercooperation (HSI) were formed. The TF team worked closely with technical expertise from Sokoine University of Agriculture and the University of Dar es Salaam to come up with NPHMS. List of Task Force Members is attached in annex 5.

Different stakeholders' workshops were held in different zones. The TF gathered different literature and expert views to prepare a draft strategy report, which was widely circulated, to various stakeholders for comments. The reviewed draft report was then shared with Tanzania Post-harvest Management Platform (TPMP) stakeholders' workshop where comments and suggestions for the strategy were provided.

1.5 Scope

NPHMS will be implemented over a ten year (2018-2027) period focusing on food crops particularly cereals, legumes, fruits and vegetables, roots and tubers and edible oil crops. The strategy does not include traditional cash crops, livestock and livestock products. Furthermore, it covers post-harvest losses and actors along the value chain from harvesting to consumption.

2. Situation analysis

2.1 State of Post Harvest Loss in Tanzania

The term “Post-Harvest Loss” (PHL) refers to measurable quantitative and qualitative food loss in the post-harvest system (de Lucia and Assennato, 1994). This system comprises interconnected activities from the time of harvesting through crop processing, marketing and food preparation, to the final decision by the consumer to eat or discard the food.

Post-harvest losses are classified into three main categories, namely, quantitative loss, qualitative loss and economic or commercial loss (Suleiman and Rosentrater, 2015). Others classify these as direct and indirect losses. Quantitative loss indicates the reduction in physical weight, and can be readily quantified and valued. For example, a portion of grain damaged by pests or lost during transportation can be weighed and valued.

Qualitative losses cover a wide range and are concerned both with external features, shape and size and with odour and taste, which affect consumer acceptability and loss of nutritional value of products. These losses include cultural factors that can influence diets and food habits, contamination by bad grains, scraps of straw or other plant residues, soil, pebbles and bits of glass. Other contaminants are hard to remove and represent a greater risk of contamination than others, for example, soluble excreta of pests, oils, pesticides, pathogenic organisms spread by rodents and toxins from fungi (mycotoxins). The presence of foreign bodies, which can distort the weight of a batch being sold, also affects the quality and thus the market value of a product.

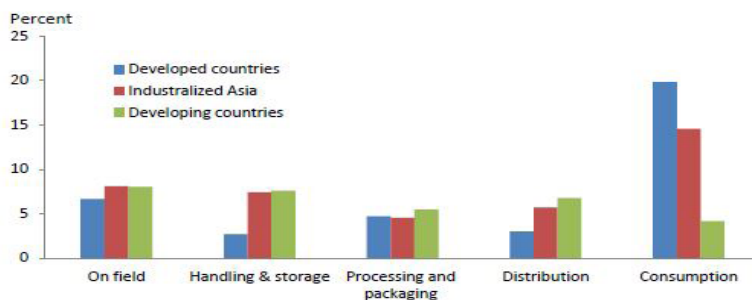
According to Tefera (2012) economic losses occur when a reduction in monetary value of the product due to a reduction in quality and or/ quantity of food. Although these loss categories are often measured individually, the incidences of these losses are linked. A significant weight loss often signifies nutritional as well as commercial loss of value.

Direct losses occur when the disappearance of a foodstuff is caused by leakage (for example, spillage from bags) or consumption by pests (insects, rodents, birds), whereas indirect losses occur when a reduction in quality leads to the consumer’s refusal to purchase.

While weight loss is easy to observe and measure, it does not necessarily mean food loss, since it can result simply from a reduction in moisture content. Moisture loss during drying is therefore not a food loss. On the other hand, an abnormal increase in weight through moisture absorption following rainfall on stocks left in the open can cause serious damage resulting in loss.

2.1.1 Magnitude of physical weight losses

The magnitude and pattern of post-harvest losses (PHLs) vary across countries, based on their stage of economic development. In high- and middle-income countries, significant losses occur in the early stages of the food supply chains and at the consumer level (United Nations, 2011). While, food losses in the low-income countries mainly occur in the early and middle stages of the food supply chains with proportionally less amounts wasted at the consumer level. Food losses in low-income countries are the result of “inadvertent losses” due to the ‘poor’ state of their supply chains (Figure 1).



Source: Author calculations using loss parameters from Gustavsson et al. (2011) and 2009 production data from the FAO.

Note: Bars denote percent of supply at each stage which is lost.

Figure 1. Food losses vary by the stage of the supply chain across countries

There are multiple dimensions of post-harvest challenges. Premature harvesting, poor storage facilities, lack of infrastructure, lack of processing facilities and knowledge are the main technical reasons for high food losses along the entire Food Supply Chain (FSC). Socio-economic conditions such as inadequate capital expenditures, handling skills, markets and policies drive the manifestation of technical challenges. Strategies to solve the PHL problem require a systematic diagnosis and analysis of technical deficiencies and socio-economic challenges.

FAO results from different research studies demonstrate that farmers in Tanzania lose up to 40 percent of the harvest through PHLs (depending on the crop and geographical area). This has a negative impact on their income, livelihood and production incentives. However, there is inadequate data on PHLs in food crops for Tanzania; most of data are out-dated and coverage is for few crops and small area that cannot be a representative, given the big size of the country and various agro-ecological zones.

The estimates of loss for developing countries indicate a wide range of losses for specific crops such as: Tomatoes vary from 20 to 50 percent, yams from 10 to 60 percent; bananas from 20 to 80 percent and papaya from 40 to 100 percent. FAO also estimated losses of roots and tubers to be 12 to 27 percent and for other fruits and vegetables range between 18 and 32 percent.

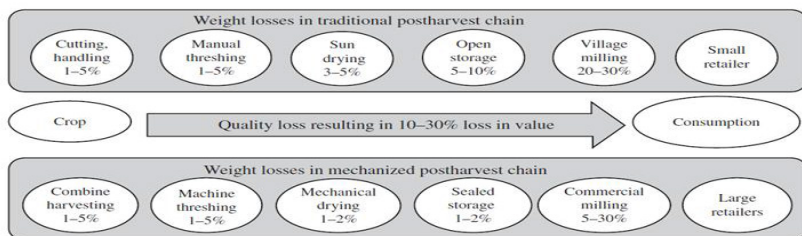
In case of grains, a study conducted by FAO in 2011 estimate 13.5 percent losses in East and Southern Africa. These results are comparable to the study conducted in Tanzania by Sokoine University of Agriculture (2012), which indicates the post-harvest loss for three major cereals as follows; maize 15.5 percent, paddy 10.7 percent and sorghum 12.5 percent. Abass *et al.* (2014) referred to estimates of post-harvest loss of grains in Tanzania at 22 percent (excluding field loss), based on work by Hodges (2012).

Variations in the estimated losses among different country groups can be attributed to the changing food demand patterns at

different income levels. Increases in per capita income levels of households across the world are contributing to major changes in food demand patterns (Regmi, et al., 2001). Consumers with higher incomes tend to demand special 'quality attributes' in the food they consume. In response to these demands, food suppliers have implemented stringent quality standard and certification programs. Products unable to satisfy these standards, even if nutritious and safe for human consumption, become discarded thus contributing to food losses.

Furthermore, as food comprises a small share of the budget, consumers in developed countries do not have a strong incentive to avoid wasting food. In contrast, as food is a large share of the household budget for consumers in low- income countries, consumption behaviours tend to be more frugal, therefore contributing less to waste.

Modern PHTs, e.g., mechanization, have however proven to be more effective than traditional measures (Figure 2).



Source: Hodges, Buzby and Bennett, 2011.

Figure 2. Effectiveness of Traditional versus Mechanized postharvest chain

2.1.2 Economic Value Loss

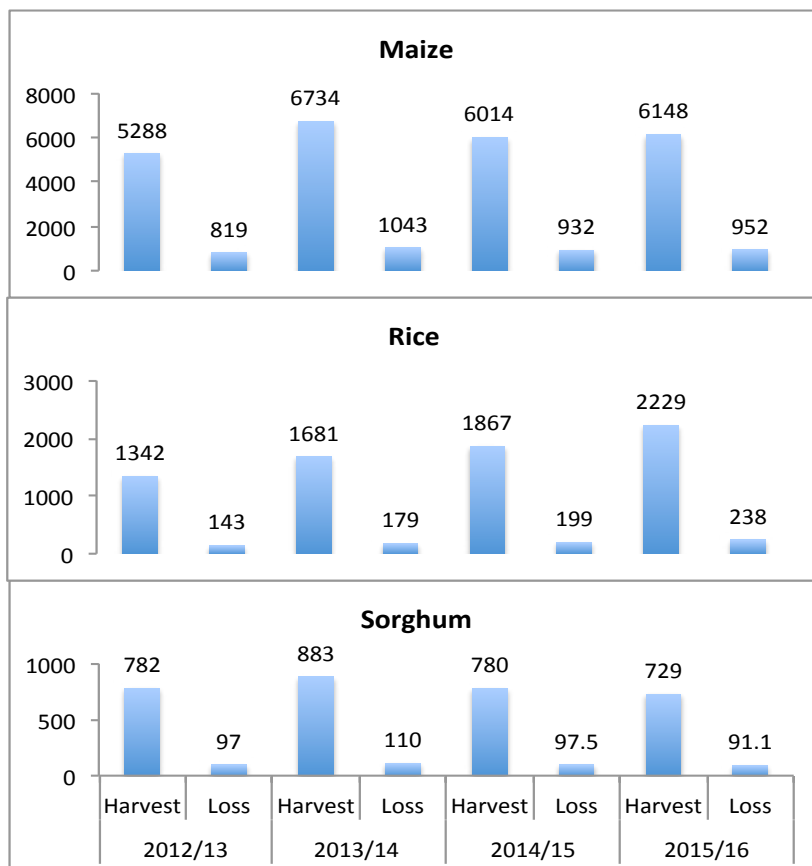
Huge post-harvest (PH) losses are a threat to food security, incomes and livelihoods of many households in sub-Saharan Africa (SSA). Annual value of PH losses for grains alone exceeds USD 4 billion. In Tanzania, domestic food production is barely sufficient to meet national food needs but many households experience protracted periods of food shortage. As a result, over USD 200 million is spent annually to import food (Mutungi and Affogon 2013).

The value loss of cereals takes place during agricultural production, post-harvest, and processing stages in the food supply chain. In developing countries, smallholder farmers dominate production, with limited or none existent access to financial resources (Mittal 2007). Production, harvesting and post-harvest techniques and technology are often out-dated, technical, regulatory, and financial capacities are often inadequate. In addition, natural disasters, weather and climatic conditions, negative economic trends might play a role too.

In Tanzania, despite the increase of cereal crops production at national level, estimated at 9,455,000 tonnes on average per year, technologies used for harvesting and processing are poor and this has made the PHLs to be 3, 782,000 tonnes on average per year. This means that a total of 40 percent of the annual national production of cereals is lost due to PHLs (Figure 2).

In Eastern Africa, post-harvest losses (PHLs) are estimated to destroy between 20 and 60 percent of the food produced, thus contributing heavily to the devastating food and nutrition situation. A reduction in the quantities or qualities of grain means a corresponding commercial loss that is evidenced as a loss of money.

Along cereals value chain, smallholder farmers suffer infrastructure constraints and limited access to buyers. Middlemen experience product losses due to inadequacy of handling and storage capacity, which leads to consumers to suffer higher prices because of decreased food supply in the market.



Source: REPOA, 2014 and MOA, 2015

Figure 3. Trend of post-harvest loss of selected crops (Metric tonnes)

The monetary value of cereal grains decline due to a reduction in quality and quantity of grains produced. In Tanzania, the monetary value for maize is estimated to be TZS 3.92 billion (equivalent to 1.8 million USD) (where approximately TZS 600 million (273,000 USD) is lost along the maize value chain, sorghum 767 million (349,000 USD) with estimated loss of 95 million (43,200 USD), Rice 2.58 billion (1.2 billion USD) with estimated loss of 276 million (125,500 USD) (Table 1).

Table 1. Average annual economic value loss for major food crops due to PHL in 2012-2016 period

| Crop | Average (000' tonnes) | | Average monetary value TZS million (000') | |
|---------|-----------------------|------|---|------------|
| | Production | Loss | Value retained | Value lost |
| Maize | 6,046 | 937 | 3,920 | 601 |
| Sorghum | 793 | 99 | 767 | 95 |
| Rice | 1,780 | 190 | 2,580 | 276 |

Source: REPOA, 2014; MOA, 2015

Smallholders are often forced to sell their produce cheaply to local traders who can set prices below market-clearing levels. The consequences of such situations often go beyond individual losses of money. This affects production and the entire national economy. PHL aggravates rural poverty by eroding income generation along the food value chain. Physical losses lead to loss in produce quality along commodity value chains leading to considerable price discounts in markets and later, consumers will suffer higher prices because of decreased food supply in the market economy. The trend of post-harvest loss dampens expectation to invest in agriculture sector because it heavily affects income and welfare of farmers and nation at large.

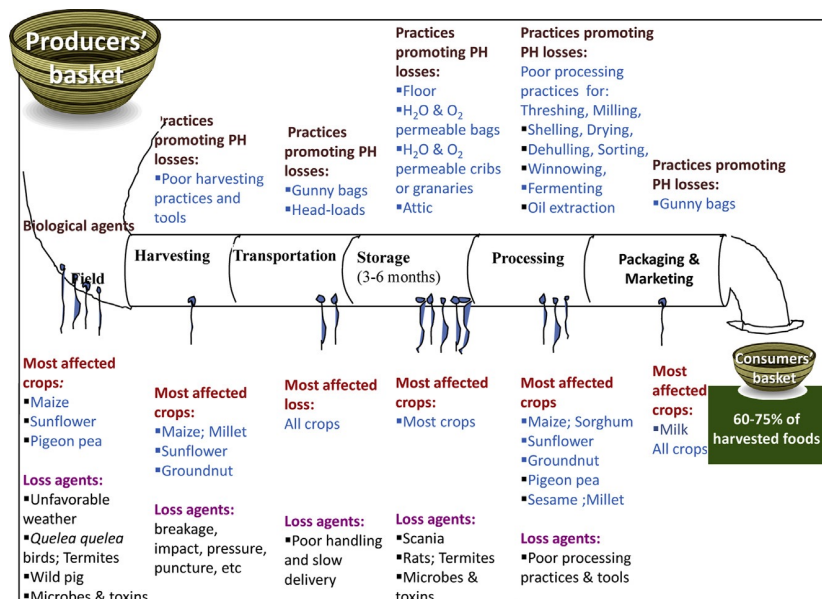
2.2 Food safety risk due to poor PHM

Poor PHM is one of the factors for alarming levels of mycotoxin contaminations in Tanzania, particularly for key staple crops – maize and cassava. Mycotoxin contamination of foods is a public health concern and as hurdle to trade. Kimanya *et al.* (2008; 2010) found 12 % of all samples of maize collected exceeded the maximum limit for total aflatoxin (10 ppb). The recent economic assessment conducted by Abt Associates in collaboration with Tanzania Food and Drug authority (TFDA) observed significantly higher prevalence of aflatoxin B1 (AFB1) in multiple regions around the country (TFDA, 2012). AFB1 is the most toxic of all mycotoxins and exposure to this toxin can lead to liver cancer.

Given the pervasiveness of mycotoxins, [TFDA \(2012\)](#) concludes that mycotoxins contamination is one of the greatest public health threats due to their detrimental effects to human health. Moreover, from an economic viewpoint, contaminated food crops are an important reason for economic losses and they further hamper trade, both at international and domestic levels.

2.3 Causes of Post-Harvest Losses in Tanzania

Factors that contribute to food loss range from mechanization of practices such as harvesting to handling, processing and others, to weather conditions, production practices, management decisions, transportation facilities, grading issues, infrastructure, consumer preferences/attitudes, and availability of financial markets. Of recent, the effects of climate change have been noted to amplify the losses as they affect the effectiveness of most of the commonly used Post-Harvest Technologies (PHT) in harvesting and drying, pest & disease management, and storage. Figure 3 summarizes the nature of PHLs along a crop value chain.



Source: Abasset al., 2014

Figure 3: Characterizing post-harvest loss along a value chain

As Figure 3 shows, a typical post-harvest chain comprises of a number of stages for the movement of harvested output from the field to the final retail market. The losses incurred at each step vary depending upon the organization and processes applied in the food supply chain. For example, in less developed countries where the supply chain is less mechanized, larger losses are incurred during drying, storage, processing and in transportation.

In Tanzania, post-harvest losses are caused by many factors, which are varied in nature, and the degree of causing damage is different (Figure 3). These factors include pests infestation, poor transportation infrastructures, improper storage practices, improper harvesting and drying, improper weighing and packaging, unpredictable markets, improper processing and farmers little knowledge on post-harvest handling practices along post-harvest chain. Results from different studies in Tanzania demonstrate that farmers are aware on causes of PHL but have limited capacities, including finances, to mitigate the losses (Table 2).

Table 2: Perception of the surveyed farmers on causes of PHL

| Causes of PHLs | Perception by farmers |
|--|-----------------------------------|
| Damage caused by insects and rats | Recognised by 35 percent |
| Losses during transport from field to storage | Recognised by 16 percent |
| Improper weighing and packaging as reason for PHL | Recognised by 12 percent |
| Improper drying | Recognised by 9 percent |
| Unpredictable markets (delay in selling the produce) | Recognised by less than 5 percent |
| Loss during processing | Recognised by less than 5 percent |
| Grain breaking into pieces (especially for rice) | Recognised by less than 5 percent |

Source: REPOA, 2014.

Generally, the causes of food losses and waste in low-income countries are mainly connected to financial, coordination and technical limitations in harvesting techniques, storage and cooling facilities in difficult climatic conditions, infrastructure, packaging and marketing systems. Furthermore, studies also revealed that post-harvest losses occur differently with commodities and specific stages.

Since a post-harvest system is comprised of many processes, interventions to eliminate this all-inclusive problem will have to be done through an all-inclusive solution that looks across the food system to detect where the biggest loss reduction can be achieved and provide motivations for solving the problem through behavioural change at different levels.

Table 3: Variation in PHL by crop and stage in the value chain

| Commodity | Value chain stage | Loss (%) |
|--------------|---|-----------|
| Maize | Harvesting | 1-4.5 |
| | Storage | 2.8-17 |
| Beans | Storage | 14.7-17.5 |
| Sweet potato | Harvesting | 4 |
| | Transportation | 16 |
| | Market value loss due to damage | 11-37 |
| Cassava | Storage of dried chips | 4.5 |
| | Market value loss due to bad quality of chips | 15-45 |
| Tomato | Harvesting | 2.6 |
| | Transportation | 2 |
| Mango | Harvesting | 2.6 |
| | Transportation to market | 10.6 |
| | wholesaling | 30.6 |

Source: REPOA, 2014.

In general, farmers have a relatively good understanding of the problems causing PHLs. It would hence be inappropriate to approach PHL as an issue of storage alone. Simply providing technology solutions for storage is insufficient to obtain sustainable loss reduction. PHLs are occurring from the field to the fork and even pre-harvest decisions and practices are affecting the degree of PHL at a later stage. More emphasis should be given to this holistic approach of dealing with PHLs. Such an integrated approach to attain an efficient, productive food system with minimal loss is not demonstrated in most strategies.

2.4 Impact of PHL in food and Nutrition Security

Post-harvest losses pose negative impact on food and nutrition security

2.4.1 Impact of PHL in Food Security

More than 70 percent of the sub-Saharan African population is directly involved in agriculture as the primary source of income and food security. Therefore, growth in agriculture production and productivity are critical for eradicating extreme poverty and hunger in the continent. However, sub-Saharan African agriculture productivity and the per capita value of agriculture output is the lowest in the world (FARA, 2006). Despite the low total agricultural productivity, post-harvest losses of the food being produced are significant (World Bank *et al.*, 2011).

Tanzania suffers perennial food shortages, especially some parts of the coastal regions, the semi-arid central regions and some parts of north-west regions. The reasons for the shortage among others is inherent weaknesses in PH systems, which contribute to high food prices, as a result of decreased food supply to the market, since part of the food produced is lost at post-harvest period.

Although the volume and impact of PHL are well-known, up to now little success has been achieved in reducing them. This failure is mainly due to the multitude of reasons for losses at all stages of complex food systems, with multiple actors involved. Moreover, these actors operate within social, political, economic and

environmental contexts that are often insufficiently understood. Reducing PHLs may effectively and sustainably increase the volume and quality of available food. Furthermore, adding value to existing agricultural and food value chains has a strong potential to create jobs and income opportunities and thus counteract poverty and hunger in rural areas.

2.4.2 Impact of PHL in Nutrition

Malnutrition is one of the most serious constraints to human and economic development and growth. Human productivity is impacted by nutritional deficiency diseases and contributes to 2 to 3 percent reduction in GDP. According to Tanzania Demographic Health Survey (2010), stunting affects 35 percent of children; wasting affects 4 percent of children and 15 percent are underweight. The most notable **micronutrient deficiencies** are iron, vitamin A and iodine deficiencies. Child malnutrition is much worse in rural areas than in urban areas and much higher in the poorest quintiles, resulting from poor nutrition of reproductive-age women, inadequate dietary intake and infectious diseases. About 11 percent of women of reproductive age have chronic energy deficiency, defined as a body mass index (BMI) $< 18.5\text{kg}/\text{m}^2$, and 53 percent of pregnant women are anaemic, both risk factors for low birth weight.

Post-harvest losses are also nutrient losses, which negatively impact nutrition status. The foods we eat provide our body with the raw materials it needs for growth, development and function. There are two basic groups of nutrients that must be obtained through the diet: macro-nutrients and micro-nutrients. Fruits and vegetables are nutrient powerhouses; they are packed full of vital micronutrients and can improve nutrient absorption in a diet high in phytate (from whole grains, seeds, and pulses). But, fruits and vegetables are extremely perishable and meta data analysis shows that 50 percent of the produce cultivated in sub-Saharan Africa is lost or wasted. Reducing PHL along all segments of fruit and vegetable value chains and other food crops, could improve nutrition security by capturing otherwise lost nutrients and create profitable, accessible and affordable diversified diets.

Post-harvest quality loss has an impact on nutrition if mycotoxin or other substances, which can interfere with the health status of the body, contaminate the food. A growing body of research is highlighting an association between aflatoxin exposure cancer and child growth (Suleiman, 2015). Furthermore, Aflatoxin consumption may increase infection by suppressing the immune system or reduce nutrient absorption by changing metabolism.

2.5 PHM Initiatives

In Tanzania, the issues of PHL became of considerable importance in 1980s, following the appearance of the Larger Grain Borer (LGB) that resulted in high PHL of cereals, which endangered food security in the country. During that time policy reforms in the agricultural sector, especially in relation to the reduction of post-harvest losses were implemented and the government began to support farmers to reduce PHL.

2.5.1 Establishment of National Food Security Department

Before this establishment, many efforts were directed towards ensuring food security with more emphasis on increasing production and productivity. During the time, many programs and initiatives were implemented in the country and also policies and Acts to support food security were formulated. These included the 1962 Agricultural Produce Act and Food Security Assistance Scheme (1976) aimed at reducing food imports experienced since 1971/72, which led to the establishment of SGR under NMC and the Food Security Unit under the Ministry of Agriculture. The Food Security Act of 1991 transferred several functions related to food crops from NMC to the Food Security Department (FSD) of the Ministry of Agriculture and Cooperatives. The Department became operational in 2001 whereby the two sections under it named Crop Monitoring and Early Warning (CMEW) and Post-harvest Management Services (PHM) were formulated and given their mandates. It is through this structure that the post-harvest Management Section was given the mandate to oversee all the post-harvest issues of the agriculture sub-sector in the country.

2.5.2 Tanzania Post-harvest Management Platform (TPMP)

The idea to initiate the Tanzania Post-harvest Management Platform emanated from stakeholders as a move against high level of post-harvest losses in the country. Apart from experiencing a high level of post-harvest losses in the country, there are few policy statements and laws, which address the problem. The TPMP, which was launched in 2014, therefore aimed at putting together efforts from different stakeholders dealing with issues on PHM, particularly policy framework. The platform consists of diverse actors along the PHM continuum and all have been involved during the strategy formulation process.

Among the objectives of the TPMP is advocating various strategies to enhance capacity of stakeholders to address various issues on PHM. The platform has continued to advocate for supportive post-harvest policies and frameworks in the country, leading to an improved regulation, policies and business environment.

2.5.3 Establishment of Post-harvest Management Technology Developers

There are a number of institutions with responsibility of undertaking applied research and development, design, promotion, adaptation, adoption and dissemination of appropriate technologies in the fields of agricultural mechanization and rural technology. Also, these institutions have been developing, training and transferring various post-harvest machineries, which quite simplify post-harvest processes focused to smallholder farmer. These technologies, which include hermetic storage technologies and use of high-density polyethylene, have been helping much in reduction of PHL and increase household food security and cash income. A list of these institutions includes among others, SIDO and CAMARTEC Sokoine University of Agriculture (SUA) and the University of Dar es Salaam (UDSM). Additionally, there have been indigenous techniques used by farmers to store their produce. These include use of cow dung as a plaster of storage containers, specific plant leaves, plant ash and ash from rice husks and solarisation.

2.5.4 Post-Harvest Losses Initiatives

The Government in collaboration with Food and Agriculture Organization (FAO), United Nation Development Programme (UNDP) supported farmers to build storage facilities due to the presence of Larger Grain Borer (LGB) and high cereal/grain post-harvest losses in 1980s. The appearance of LGB, endanger food security situation in the country. The support entailed the construction and/or rehabilitation of household and village storage facilities with capacities ranging from 200 to 400 tonnes. These storage facilities were constructed under the auspicious of primary cooperative societies on the assumption that farmers would continue selling their produce via the cooperatives.

In addition, the Sasakawa Global 2000 in collaboration with the Ministry of Agriculture, Food Security and Marketing implemented post-harvest systems projects, taking an integrated approach to reducing PHLs by addressing all post-harvest processes. Under Sasakawa projects, 1,260 storage facilities were constructed. However, these storages were very few compared to the demand of the warehouses in the entire country comprising of about 11,000 villages.

Moreover, from early 2000, there have been a number of initiatives to improve post-harvest management supported through various Government interventions. These initiatives were mainly focusing on the construction/rehabilitation of storage facilities as well as training of farmers on post-harvest management. According to a survey done by Ministry of Industry Trade and Investment (by then Ministry of Industry and Trade) (2013, Tanzania has 2,081 storage facilities with different storage capacities. These storage facilities may either be warehouses or micro storage facilities (cribs) known as *Vihenge*. The most important role played by the warehouses is the minimization of crop losses after harvest. This intervention helped to reduce losses due to risks related to poor storage, shrinkage and rodents damage.

There have been interventions from other non-state stakeholders. For instance, HELVETAS with support from Swiss Agency for Development and Cooperation (SDC) is implementing the Grain Postharvest Loss Prevention Project (GPLP) aimed at reducing postharvest losses in food grains by improving food security and incomes for targeted smallholder farming households as well as creating rural employment through appropriate technology, capacity building and informed policy. With support from the Rockefeller Foundation, the Alliance for a Green Revolution in Africa (AGRA) is implementing the YieldWise Maize project (2015 – 2019) to scale an integrated approach for reducing post-harvest losses in Tanzania. The project seeks to increase smallholder farmer incomes by 25 percent by cutting down maize post-harvest losses by half.

2.5.5 Agricultural Sector Development Programme (ASDP)

Basing on the measures to improve agriculture and livelihood of smallholder farmers, the Government is implementing the Agricultural Sector Development Program Phase I which started in 2006 as an instrument for implementation of TDV 2025 and the ASDS. The ASDP provides the government with a sector-wide framework for overseeing the institutional, expenditure and investment development of the agricultural sector. The agricultural marketing systems and infrastructure interventions by ASDP have been improved through rehabilitation and/or construction of 450 warehouses nationwide. The storage capacity of these warehouses varied from 200 to 500 tonnes. The investment in warehouses made through District Agriculture Development Plans (DADPs) is expected to have a positive externality effect on the planned commodity exchange system and current emphasis for the farmers' collective bargain through the provision of collection and storage facilities of agriculture produce. It would also contribute to the reduction of post-harvest losses. The program also supported the capacity building of farmers on good crop husbandry practices and technologies including post-harvest management. In addition, District Agriculture Sector Investment Plan (DASIP) complemented

the implementation of ASDP whereby 73 storage facilities were constructed.

Together with these efforts, the sector potential is still unrealized and its growth targets are not being met. Opportunities to add value to agricultural produce are largely unexploited. This is coupled with high PHL due to few storage facilities, especially in the isolated rural areas. Due to this problem, there have been a number of initiatives to build warehouse to improve post-harvest management implemented by Government in collaboration with some projects and programmes as shown in Table 4.

Table 4: Number of warehouses and storage capacity

| Program/Project | Number of warehouses built | Capacity (in metric tons) |
|----------------------------|----------------------------|---------------------------|
| ASDP basket fund | 429 | 250 to 500 tons |
| Sasakawa Global 2000 | 1260 | |
| DADPS | 450 | |
| DASIP | 73 | 200 to 500 tons |
| Others (LCGD, FAO and NMC) | 1652 | 100 to 21,000 tons |

Source: Ministry of Industry and Trade survey 2013.

However, these storages are very few compared to the demand of the warehouses in the country and partly explain the relatively high PHL of 30 – 40 percent of the harvest. The shortage of storage capacity is associated with high risks related to poor storage, shrinkage and rodents damage. Moreover, there are 6,995 small-scale agro-processing machines according to survey done by Ministry of Industry and Trade in 2013. These small-scale machines were installed using ASDP fund. Table 5 shows the number in each category.

Table 5: Number of agro-processing units in 2013

| S/No | Sector category | Number of agro-processing facilities |
|------|--------------------------|--------------------------------------|
| 1 | Oil processing machine | 622 |
| 2 | Cassava grating machine | 313 |
| 3 | Milling machine | 6,043 |
| 4 | Fruit processing machine | 17 |
| | TOTAL | 6,995 |

Source: Ministry of Industry and Trade survey 2013.

As a country, we need to ‘scale-up’ activities such as agro-processing, particularly in rural areas as well as farm level quality improvements that will reduce PHL and increase market value of primary products.

2.5.6 Marketing Infrastructure, Value Addition and Rural Finance Support Programme (MIVARF)

In addressing the limited access to storage facilities and farm to feeder roads as well as market structures, the Government has taken a number of measures including implementation of Marketing Infrastructure, Value Addition and Rural Finance Support Programme (MIVARF) with an objective of enhancing incomes and food security. The programme supported the establishment and sustainable maintenance of improved marketing infrastructure. The Programme also supported the rehabilitation and equipping of regional Post-Harvest Management Training Centres, provided support to institutions and service providers of on-the-training to farmers and processor groups, which are all geared towards reducing post-harvest losses. In addition, MIVARF supported the rehabilitation and construction of farm to feeder roads aimed at reducing the post-harvest losses caused by the poor roads.

2.5.7 Collective Warehouse Based Marketing Schemes (COWABAMA)

The goal of reducing post-harvest losses and increasing storage capacity and efficiency is a demand to ensure food security and sustainable development. As pointed out earlier, the Government is strongly concerned with national food and nutrition security. However, smallholder farmers in the country face a number of constraints that limit their ability to engage in the market profitably and increase their crop value additions. In recognizing this as a setback, the Government through Big Results Now (BRN) Initiatives in 2013 embarked on rehabilitation and equipping the warehouses through Collective Warehouse Based Marketing Schemes (COWABAMA) for maize and paddy. COWABAMA is aimed at addressing smallholders' lack of access to warehousing facilities to reduce their post-harvest losses. The warehouses created a more robust buying and selling platform to enhance supply and pricing for smallholder crops as well as reducing post-harvest losses. Through COWABAMA 123 warehouses have been rehabilitated and equipped.

2.6 KEy PHM issues

Based on the above analysis of the current situation, there are nine strategic PHM issues, which should be addressed. These are summarized as follows:

- i. Inadequate awareness on post harvest losses including causes, impacts and solutions by actors along the value chain
- ii. Limited access to appropriate and cost effective PHM technologies
- iii. Insufficient and poor marketing systems, including infrastructure
- iv. Inadequate research and innovation efforts on PHM
- v. Inadequate and poor enforcement of existing post-harvest management regulations and guidelines

- vi. Limited institutional capacity, inadequate coordination, and little involvement of other stakeholders in post-harvest management
- vii. Limited capacity to adapt and mitigate the effect of climate changes on PHM.
- viii. Inadequate financing of PHLM
- ix. Lack of accurate data on post-harvest losses that allows for monitoring progress in PHL reduction and PHM decisions

The next chapter sets strategies to address these issues.

3. POST-HARVEST MANAGEMENT STRATEGY

The Post-Harvest Management Strategy (PHMS) identifies and analyses the bottlenecks that stand as the cause of food losses of food crops to result into household and national food insecurity and income losses to players along the value chain. It proposes concrete Strategic Objectives and Management Interventions that will enable the nation to fight against the problem. The NPHMS is composite and is made up of the Vision (where Tanzania desires to be in ten years to come); the Mission (grand strategy to attain the aspiration); Strategic Objectives (guide of purpose/direction); Management Interventions (specific strategy undertakings to achieve the intended mission). The management interventions thus carry the targets, activities to be implemented, division of responsibilities and measurable indicators.

3.1 Vision and Mission

3.1.1 Vision

Reduced post-harvest losses along the commodity value chains, which adequately reward the actors and sufficiently contributes to national food and nutrition security and the economy.

3.1.2 Mission

To improve PHM by ensuring availability of appropriate post-harvest and value-addition practices and technologies, providing incentives for investment in marketing systems, as well as improving capacities and coordination of strategic interventions

3.2 Strategic objectives

From the eight strategic issues, which should be addressed in order to improve the PHM in Tanzania, this section presents the strategic objectives, summary of the respective rationale, management interventions and targets to be reached between 2017 and 2027. By 2027, other national level development frameworks, e.g., the TDV 2025, LTPP 2026, ASDP II, 2026, etc., would have come to an end and new ones adopted. This then provides for an opportunity to revise the NPHMS.

In order to allow smooth flow of the text, details of the specific management interventions, targets, strategic activities, performance indicators, and responsible actors are relegated to Annex 1.

Strategic Objective A:

Facilitate Awareness on Post-Harvest Management to Improve Efficiency and Reduce Crop Losses along the Value Chain

Rationale: The highest post-harvest losses occur in fruits, vegetables and root and tuber crops. This is expected due to the perishable nature of these commodities. The poor mechanisms for primary handling and transporting perishables along the post-harvest value chain also contribute to highest post-harvest losses. Likewise, many post-harvest losses for other crops such as cereals, legumes, oilseeds and spices, occur due to improper primary handling technologies (threshing, shelling, winnowing, and drying), aggregation and transport, storage and speculation, marketing and processing. The actors lack awareness on the causes, impact and appropriate solutions. Also awareness triggers action to address the causes of losses and awareness could be

the least expensive way to reduce losses. Therefore, this strategic objective aims at increasing actors' awareness on post-harvest management, to reduce post-harvest losses.

Management intervention 1: Implement communication strategies to raise awareness of food losses, causes and impact

Target .1: At least 3 awareness communication packages on causes, impacts and solutions on post-harvest losses prepared and delivered to actors, along the value chain and consumers of the products by 2022

Target 2: At least 5 multi-media means of communication are used to deliver post-harvest management information by 2022

Management intervention 2: Capacity building for all actors on PHL and supporting the communication platforms.

Target: At least 80 percent of actors capacitated on PHM by 2027.

Management intervention 3: Promote actor-specific best handling practices along the value chain.

Target: At least 50 percent of actors adopt specific best handling practices by 2022.

Management intervention 4: Increase awareness of PHM actors and consumers of practices and management systems that prevent and control aflatoxin contaminations along the value chain.

Target: 30% of consumers appreciate the importance of addressing post-harvest losses and food waste and the dangers of consuming aflatoxin contaminated food.

Strategic Objective B:

Promote availability, accessibility, affordability and adoption of tested technologies and processes to reduce post-harvest losses

Rationale: Various studies have shown that among the factors contributing to crop post-harvest losses include technological limitations by smallholder farmers. Some post-harvest technologies are available in the country but are not accessible, or are unaffordable and their adoption by farmers is very low.

Few post-harvest technologies are accessible and adopted from other countries and are used by farmers but some are not efficient or suitable to our environment. Also, there is need to promote practices and process that support the reduction of PHL. Therefore, there is a need to promote accessibility and adoption of tested technologies and practices to reduce post-harvest losses.

Management intervention 1: Enhance actors' awareness and utilization of PHTs.

Target: At least 80 percent of actors are aware and utilize PHTs by 2027.

Management intervention 2: Promote agro-processing along the value chain.

Target: Agro-processing investments increased by 30 percent by 2027.

Strategic Objective C: Facilitate agricultural marketing systems to improve market access and minimize post-harvest losses

Rationale: Tanzania's markets for food crops are characterized by inadequate rural infrastructure to support actors to operate effectively and efficiently in agricultural marketing, inadequate infrastructures such as cold chain facilities and storage facilities. Also, there is lack of marketing structures, poor linkages due to informal marketing arrangements and inadequacy communication that constrain access to marketing information and hence leading to high level of post-harvest losses. Meanwhile, studies reports on Tanzania indicate that majority of the small holder farmers (95 percent) have no appropriate storage facilities, store produce in their houses and mostly dispose their grain through unscrupulous middlemen. Only 5 percent of the farmers store produces in improved storage facilities and more than 80% of the grain is traded through informal systems. Furthermore, MOA Report, 2016 shows that the current national storage capacity for food crops is about 2,042,559 MT while production for 2015/2016 is 16,172,841 MT. It is therefore apparent that in order to keep pace

with increasing production there is a need to improve marketing infrastructures.

Management intervention 1: Improve and formalise market access to reduce post-harvest losses.

Target: 80% of agricultural commodities are traded through formalised and traceable channels by year 2022

Management intervention 2: Ensure availability of specialized human resources to manage marketing infrastructure.

Target: Sufficient number of specialized human resource obtained by 2027.

Strategic Objective D:

Promote research and innovations of new and appropriate technologies and methods to reduce crop losses

Rationale: Tanzania has a multitude of technologies and methods used in reducing post-harvest losses. However, some are inefficient/ineffective in curbing the losses. In some cases, technologies, which used to be effective, are constrained by high prices of spare parts and limited knowledge in adapting the technology. Furthermore, information on the said technologies and methods is scattered and/or unknown outside the group/cohort of users. It is therefore important that such information is mobilized into a single database to enable users to access with ease in their quest to promote food security and development issues. It is also imperative that efforts are made to take stock of available/existing technologies as well as new ones coming into the market, test their efficacy and disseminate the successful ones to producers, processors, relevant actors along the respective value chain. This will require establishment of database management system on PHM in the country, conduct research to introduce new and innovative technologies, as well as undertaking verification exercise of existing technologies on PHL.

Management intervention 1: Ensure inclusion of PHM issues in agriculture research themes

Target: PHM issues are included in agriculture research themes

Management intervention 2: Establish database management system on PHM.

Target: PHM database for food crops established by 2020.

Management intervention 3: Introduce innovative PHT and undertake verification of existing and emerging technologies to reduce post-harvest losses.

Target: 80 percent of existing PHTs verified and adopted by 2025.

Strategic Objective E:

Review and put in place new legislations to ensure compliance with standards and adoption of practices to minimize PHL.

Rationale: Since the 1980s the Government has been supporting farmers to reduce post-harvest losses (PHL). However, there are inadequate guidelines and regulations on post-harvest management of some crops and in some cases there are no guidelines and regulations for actors to adhere. Furthermore, there are weaknesses in enforcing existing regulations and guidelines, including those enacted by the LGAs. As a result, little has been achieved in terms of attaining the required standards for food crops and reduction of crop losses. For the effective implementation of the PHMS, it is imperative that regulations and guidelines are in place and effectively enforced.

Management intervention 1: Ensure incorporation of PH issues in existing legislation.

Target: Existing legislations reviewed by 2022.

Strategic Objective F:

Strengthen institutional capacity, coordination, partnerships and stakeholders' participation of PHM actors to enhance implementation of strategic interventions

Rationale: The PHM initiatives suffer from weak coordination amongst state and non-state institutions. Duplication of efforts in the same location has become a common phenomenon in many places of the country, while other areas, which require attention, have been marginalized. This has resulted into ineffective planning and distribution of resources and weak results in tackling the PHL. This strategy is therefore developed to align and coordinate the multiple efforts of various actors along the post-harvest value chain. Strategies are required to strengthen coordination and partnerships among all sectors responsible for post-harvest management in order to ensure efficiency and effective implementation of the agreed actions towards reducing crop post-harvest losses.

Apparently, there are several actors along the post-harvest value chain; and it is important that the PHM champions are identified and capacitated accordingly in order to effectively coordinate and oversee implementation of the PHMS. The lead institution, which according to the current structure is the Directorate of National Food Security (DNFS) under MOA, will need to be strengthened for it to carry out its functions effectively. Other institutions/organizations will also need to be strengthened in order to complement and augment the effort of the DNFS under MOA. The efforts to strengthen them should include improving available human resource base, retooling as well as accessing adequate resources for implementation of the stated management and coordination activities.

This strategic objective will only be achieved through implementation of the under mentioned management interventions with their respective targets.

Management intervention 1: Enhance coordination at all levels to improve involvement of key actors in various PHM issues.

Target: Coordination mechanism at National, Regional & LGAs levels enhanced by 2020.

Management intervention 2: Propose investment incentive packages to increase private sector participation.

Target: Investment incentive packages developed and implemented by 2022.

Target: Value of private sector investment in PHM increased by at least 50% by 2027

Management intervention 3: Strengthen human resource base to address PHL in the country.

Target: 80 percent of the human resource base to address PHL strengthened by 2025.

Management intervention 4: Support the provision and access of PH extension services along the value chain

Strategic Objective G:

Adapt post-harvest management systems to mitigate the effects of climate change.

Rationale: PHM of most crops in Tanzania are highly affected by climate change due to increased frequency and intensity of extreme weather events and their influence on moisture and outbreak of crop pests and diseases as well as bio-deterioration. Climate change affects the effectiveness of PHT for harvesting and drying, pest & disease management, and storage. For instance, with climate change, mycotoxin contamination is expected to increase with rising temperatures and crop stress unless preventative actions are taken. Also, under drought stress conditions, the fungal commensals of crop produce higher amounts of their respective mycotoxins. Likewise, storing grain at too high a moisture content can also lead to increased mycotoxin production. The resultant

effect is exposing the households and nation to food insecurity and increased occurrence of disaster associated with food contaminations, e.g., aflatoxin.

Addressing the adverse impacts of climate variability and change requires undertaking effective and strategic interventions to build a climate sensitive society, including integration of climate services in development agenda; thus climate-informed decision-making at all levels in order to minimise risks and costs. The success in addressing Climate Change (CC) effects on PHL depends on well-functioning agricultural innovation systems, and in particular, systems for growing and/or storing crops and varieties which are less susceptible to post-harvest pest attack; timely harvesting and adequate and protected drying; maintenance of the storage structures; cleaning and hygiene; increasing farmer access to market information and transport options; usage of early warning seasonal forecasts to project how the climatic conditions might impact on food storage or marketing strategies. The systems go back before the PHM to also include capacity of the plant breeders to evaluate post-harvest as well as pre-harvest crop characteristics and helping farmers to learn from others' and their own experiments.

Management intervention 1: Ensure provision of CCC – PHM relevant information and early warning systems.

Target: All key early warning messages appropriate to identified CC risk along the PH value chain are prepared and disseminated by 2027.

Management intervention 2: Introduce innovative Post-Harvest Climate Resilience technologies, and infrastructure.

Target: 80 percent adoption of CC compliant and resilience PHT mainstreamed by 2027

Target: 80 percent capacity building to suppliers and beneficiaries in establishing and operating climate smart harvest and post-harvest technologies conducted by 2027.

Strategic Objective H: Addressing inadequacy in PHM financing

Rationale: Currently, PHM suffers from inadequate financing relatively more than other nodes of the agriculture value chain. This section of the chain faces limited access to credit and financing. It is estimated that, only 10 per cent of the lending goes to agriculture sector despite the fact that its contribution to GDP is around 25 – 30 per cent. Of the 10 per cent, only a small fraction goes to PHM.

This phenomenon will continue as long as the financial sector finds agriculture lending risky. Therefore, the current strategy should strive to strengthen existing and introduce new, innovative and friendly financial mechanisms, products and instruments to finance agriculture. There should also be strategies to reduce risk along post-harvest value chain, including strengthening insurance products/policies suited to the sector. In delivering these products, supporting the usage of ICT to extend the financial inclusion is vital noting that the traditional banking approach will not give the level of financial inclusion required. Therefore, the current strategy directs interventions to address the financial needs of the actors along the value chain – financing support at the stage of manufacturing, supplying and utilizing PHT. This will have to go hand in hand with intervention to improve the capacity of financial institutions to support PHM.

Management intervention 1: Introduce innovative financial mechanisms to support investments, promotion, distribution and utilization of PHTs.

Target: Share of lending to investors, SMEs and farmers to invest in PHTs increased by 50 percent by 2022.

Management intervention 2: Establish mechanisms to do risk and introduce blended finance.

Target: Traditional donor funding mechanisms supporting PHT complimented by 2022.

Target: Mechanisms to reduce financial risks associated with Post harvest Management established by 2022.

Management intervention 3: Ensure timely availability of adequate financial resources to support PH activities.

Target: Sufficient financial resources to support PH services obtained by 2025.

Strategic Objective I:

Develop a standard methodology for collecting data and estimating Post-Harvest Losses in a country

Rationale: There are various researches conducted on PHLs in Tanzania. The available data shows to vary depending to the nature of the crop commodity along the value chain. However, the available data are inadequate to capture PHLs for both crops and even the available ones are mostly out-dated and coverage is for few crops and small area that cannot be a representative. Researchers used different methods to assess levels of PHLs and there is no common agreed methodology of post-harvest loss assessment and hence there is no agreed single figure for the percentage of post-harvest losses on a national basis.

Interventions: Review and harmonize existing PHLs assessment methodologies

Target: common methodologies including the FAO Loss assessment Methodology (FLAM) broadly agreed and adopted for PHLs assessment

4. IMPLEMENTATION ARRANGEMENTS

This chapter identifies the key stakeholders in the implementation of the NPHMS and points out their roles. The chapter also posts the potential means of mobilizing resources for implementation of the identified interventions. Potential financiers of the strategic interventions are also listed. The need for effective coordination and partnerships is underscored in this chapter to reiterate and emphasize the Strategic Objective F, which calls for measures to strengthen coordination, partnerships and stakeholders' participation.

4.1 Key Implementing Actors

The National Post-Harvest Management Strategy is holistic and requires the participation of different stakeholders including the Private Sector, Civil Society Organizations, CBOs, Non State Actors and Development Partners, to achieve the overall vision. NPHMS will be implemented over a ten year period focusing on food crops particularly cereals, legumes, fruits, vegetables, roots and tubers and edible oils. The roles and expected interface among these actors are outlined subsequently.

4.1.1 Ministry Responsible For Agriculture (MoA)

NPHMS is, by the nature of the issues addressed, a crosscutting strategy and there are various actors to be coordinated for effective implementation. The overall coordination of this strategy will be vested in the Ministry responsible for Agriculture, which is currently known as Ministry of Agriculture (MOA). MOA will play the role of the lead sector ministry in similar ways as it does in crosscutting frameworks, e.g., ASDPs. However, unlike in other initiatives, which required having a National Steering Committee of the strategy, NPHMS will be implemented without its own steering committee. Since NPHMS is a component of the ASDP II, the ASDP II Steering Committee will be used for such matters, which require such level of coordination¹.

¹ By and large, the implementation of the strategy will go in tandem with implementation of ASDP including utilization of existing ASDP frameworks at the National, Regional and District levels. ASDP is jointly implemented by Agricultural Sector Lead Ministries, which include MoA, MITI, PO-LARG, and Ministry of Water.

Other ASDP II implementation structures which the implementation of NPHMS could be aligned to are (i) National Agricultural Sector Stakeholders Meeting (NASSM); (ii) Joint Sector Review (JSR); (iii) Technical Committee of Directors (TCD); (iv) Thematic Working Groups (TWGs); and (v) Coordination and Management Team (CMT). As will be noted, PHM will have its Thematic Working Groups (PHM -TWGs) as well as Coordination and Management Team (CMT).

In order for MoA to coordinate implementation of the NPHMS, the PHM decision forums will be chaired by PS MoA and with selected members drawn from MDAs, Development Partners, Private Sector, Non State Actors engaged in post-harvest matters. In similar spirit, the secretariat for NPHMS will be the DNFS under MoA. The meetings of PHMS stakeholders will be delineated in the workplan and they will be planned so as to feed into and benefit from other related sectors and national processes (e.g., ASDP II Calendar).

Other responsibilities of MoA include resource mobilization, budgets and expenditure plans, and procurement. MoA will also be responsible for the operations of the thematic working groups.

The section responsible for coordinating the strategy under MoA will be the Post-harvest Management Section, which is under the DNFS. In performing this function, MoA will be assisted by Regional Secretariats and Local Government Authorities as stipulated in the ASDP II.

In fulfilling these functions, MoA will rely on forged partnerships and collaboration with key stakeholders including; Private Sector, Civil Society Organizations, CBOs, Non State Actors and Development Partners.

4.1.2 Ministry Responsible for Industry Trade and Investment (MITI)

MITI facilitates regional and international trade, and develops the marketing of agricultural commodities. This Ministry aims to promote the investment opportunities in industrial development and other key sectors by facilitating and maintaining trade relations with foreign countries and formulating a relevant policy framework.

4.1.3. President's Office- Regional Administration and Local Government (PO-RALG)

PO-RALG will coordinate implementation of the intervention activities implemented at Regional and District levels and liaise with MoA. At the Regional level, the RS through focal person will facilitate coordination of key players (including private sector, Non state actors and others) implementing post-harvest initiatives within that region while at district level such activities will be coordinated by DED through focal person at that level.

4.1.4 Technology Developers

TIRDO is a multidisciplinary R&D organization established in 1979. Its mandate is to assist the Tanzanian industrial sector by providing technical expertise and support services to upgrade their technology base. Specific R&D is being conducted in postharvest technologies, along with research and the development of technical expertise to improve agro-processing through the application of Hazard Analysis and Critical Control Points (HACCP) and Good Manufacturing Practices (GMP).

TEMDO is responsible to design, adapt and develop machinery and equipment, and to promote their commercial manufacture and use. Also, TEMDO is responsible for transferring the technology to manufacturing small and medium-sized enterprises (SMEs), and also offers consulting services and training to industries.

SIDO specifically focuses on the development of the small industry sector, working on a wide range of tasks from policy formulation to establishing SMEs in rural and urban areas.

CAMARTEC is responsible to develop and disseminate improved technologies for agricultural and rural development. CAMARTEC produces and disseminates agricultural implements such as harrow planters, nut shells, oil press machines, wheelbarrows, pulling and oxen carts, water harvesting tanks and brick making tools.

4.1.5 Regulatory authorities

4.1.5.1 The Weights and Measures Agency is responsible for consumer protection through ensuring that measuring systems result in fair trade transactions. Certification is done by way of inspection, calibration and verification, with regular inspection of the scales at factories in order to ensure that farmers and consumers obtain unbiased pricing on inputs. The Agency also advises manufacturers and other clients on the proper use, care and custody of weights and measures.

4.1.5.2 Warehouse Receipts Regulatory Board (WRRB) has the roles of regulating and promoting the Warehouse Receipts System that ensures a fair and sustainable accessibility to formal credit; and commodity marketing systems is expected to be met by performing its functions of licensing the warehouse business, warehouse operators and inspectors and by administering the system in general. WRRB is also responsible in linking commodity producers to formal credit marketing using an effective and efficient way of Warehouse Receipts System.

4.1.5.3 TBS has roles to formulate and publish standards and undertakes quality control, testing, calibration and training. TBS main duties involve enacting, formulating and implementing the national standards that various sectors of the economy should abide.

4.1.5.4 REA is responsible for ensuring availability of reliable and affordable energy supplies, and to promote efficient energy use in order to support agro- processing industries.

4.1.6 Academic and Research Institutions

Several academic and research institutions play important research and training roles in the post-harvest management. These institutions include ARIs, MATIs, TIRDO, CAMARTECT, COSTECH, TEMDO, Universities like SUA and others. Their main roles include conducting long and short-term training to meet professional needs including specific tailor-made training programmes. They also conduct research, disseminate research results and provide advisory services to the Government and the private sector through consultancies and other means.

4.1.7 Development Partners (DPs)

DPs are vital in the provision of technical support and financial resources for successful implementation of the strategy. DPs will also be part and parcel of the PS-MoA meetings and the thematic working groups. By supporting this strategy, the DPs will be contributing to the overall objective of reducing poverty and contributing to the economic growth and food and nutrition security of the nation.

4.1.8 Private Sector

Private sector such as PHT manufactures distributors, processors, transporters, aggregators, farmers, agro-dealers, traders and service providers are important in implementation of this strategy at different levels.

There are those who will be called upon to make specific investments in the marketing and storage infrastructure. Other private actors will facilitate capacity building and dissemination of appropriate post-harvest technologies. Yet, others can participate in the thematic groups and high-level meetings.

4.1.9 Non State Actors

Non-state actors (NSAs) and other stakeholders are also critically important in the successful implementation of this strategy and mobilisation of required resources. Consequently, they will also be co-opted in the thematic working groups as well as monitoring and evaluation and technical support. There will be a need to enhance collaboration, which has already been established between MoA on one side, and key and active, existing and new PHM NSA on the other, in the implementation of this strategy.

4.1.10 Cooperatives

Currently, the cooperative institutions are relatively weak but they are historically known to play a very significant role in PHM by contributing to aggregation, sorting and grading, storage, transport, distribution and marketing. With the envisaged commencement of the operation of the Tanzania Commodity Exchange, cooperative institutions can be used to augment the role of the private sector. Support to cooperative institutions could prioritize weaker sections of PH value chain and remote locations as well as to enhance storage capacity.

4.1.11 Financial Service Providers

The NPHMS implementation needs to involve various types of financial institutions - banks, non-bank, insurance, micro-finance institutions (e.g., SACCOS, VICOBA) to address the financing (credit) and insurance challenges facing the PH value chain, including financing the cooperatives, and other risk management. These institutions will be required to design PH financial products to support PHT manufactures, distributors, processors, transporters, aggregators, farmers, agro-dealers, traders and service providers, e.g., cooperatives, etc.

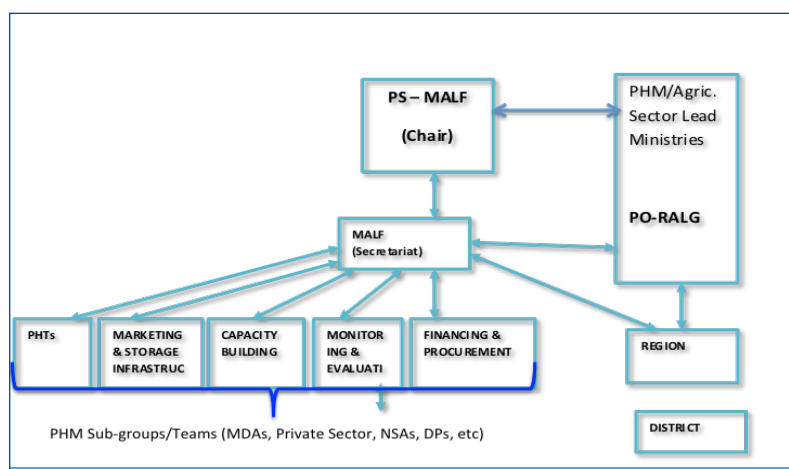
4.1.12 Thematic Working Groups (TWG).

There will be a PHM technical working group, which will also serve as ASDP II TWG. There is also a necessity of having key thematic groups to work on specific matters and advice the MoA accordingly.

The role of PHM -TWG in the implementation of strategy will be to provide technical and expert advice on specific issues. The group will be composed of technical experts drawn from various stakeholders of the strategy (under PHM-sub groups/ teams).

The envisaged teams/subgroups to be formed will be based on the stage in the PH value chain and the sub-sector importance. With this consideration, the following are initial PHM-subgroups: PHTs group, Marketing and Storage Infrastructures group, Capacity Building group, Financing and procurement group and M&E group. These teams will perform their activities under specific directives of MoA and the respective Terms of Reference will be firmed up at the stage of preparing NPHMS Work-plan. The implementation arrangement is shown in Fig. 4.

Figure 4: Implementation Arrangement



Each key actor, both at national and sub-national level will be required to appoint PHM focal persons, who will be tasked to manage all PHM matters in their respective institutions. The focal person will also be vital in the coordination and monitoring of intervention activities implemented under this strategy in the respective areas of jurisdiction. At the sub-national level, the Focal Persons (FPs) will be assigned their duties by RAS and DEDs respectively after consultation with MoA and PO-RALG.

4.2. Operation plan - Work Plan and Budget

NPHMS will be implemented in a span of ten years. Its terminal year is aligned with other national and sector policy frameworks such as TDV 2025, LTPP 2026, and ASDP II, 2026. This alignment will allow the successor PHM strategy to draw on the policy directions of the successors to the TDV 2025, LTPP, and ASDP II.

To operationalize the NPHMS over this period, NPHMS has identified one of the first activities after formally adopting the NPHMS is to prepare a detailed work plan, with costing of key activities, specific assignment of roles and responsibilities, as well as short-, medium- and long-term milestones.

The NFS Department, in collaboration with relevant actors will prepare the operation plan, which will detail activities, timeframe, and budget.

4.3 Financing the PHMS

Post-harvest management in Tanzania will largely depend on financial support from government budget, private sector, international community as well as individual contributions. However, an integrated approach and coordinated working system is highly required to ensure that funds to address post-harvest issues are used to achieve the objectives presented in this strategy.

The funds mobilization for financing NPHMS from several development partners supporting post-harvest interventions will be managed through special arrangement (equivalent to those of ASDP) in order to remain focused. Where necessary, the funding arrangement will require signing a common Memorandum of Understanding between the Government of Tanzania and Development Partners agreeing to the operational modalities of the Basket Fund (using the Government system for disbursement and procurement).

Direct project funds from other Development Partners are to be included separately in the budget submissions and Treasury will advise accordingly. The proposed annual expenditures will form the basis for planning for NPHMS Basket expenditures to be included in the budget submissions. The PHM funds activities will be coordinated through MOA in collaboration with other sector lead ministries and other stakeholders.

Based on experience, the following are envisaged sources of funding mechanism:

- i. National funds:** The main national funds are revenue collected by the Government through taxes. These funds are allocated to various MDAs and Local Government Authorities through their Medium Term Expenditure Framework that will be reflected in their both recurrent and development budgets. Post-harvest interventions in such MDAs and LGAs can be supported under this arrangement. Other sources of domestic funds include funds obtained through Public Private Partnership and funds from local NGOs. These funds can be drawn for implementation of various planned activities by following the arrangements established under such funds.
- ii. International funds:** International Funds financing NPHM include the World Bank Funds, Africa Development Bank (ADB) Funds and Bilateral Funds, which are provided in the arrangement between one of the donor countries and a developing country, institution, or NGO. Bilateral funds are mainly channelled through special assistance agencies in donor countries. Additional official assistance is channelled from donor to recipient countries through multilateral organisations and through international NGOs. Some bilateral donors have a regional focus whilst others prefer regional networks, for example SADC, EAC, AU, etc. Interest of some donors is also confined to specific aspects of post-harvest losses.

- iii. **Multilateral Agreement Funds:** These include funds, which were established under United Nations Frameworks and multilateral agreements to facilitate implementation of post-harvest activities.

4.4 Monitoring and Evaluation (M&E)

The Monitoring and Evaluation system of the PHM strategy will have the function of tracking the implementation of the planned activities and subsequently to make corrective measures on the implementation strategy when the need arises. Although the M&E hub for PHM needs to be situated in MOA, the M&E activities need to be implemented collaboratively with other key stakeholders to upscale the M&E results credibility and acceptability across the value chain. Both internal and external M&E will be undertaken accordingly. There will be both mid-term and end of period M&E that will be participatory in nature.

The monitoring activity involves systematic and regular data collection, processing, analysis and reporting of the findings to PHM Steering Committee and relevant Forums and Stakeholders. It is primarily used to compare planned targets against achievements. It is an important tool that will enable stakeholders to detect deviation from the target plan in time and hence make the necessary corrections.

The overall objective of the evaluation is to draw lessons from experiences gained during the implementation of the management intervention measures and convey them to MOA and other stakeholders to gauge the pace and impact of reducing the food crop post-harvest losses envisaged in the implementation period.

Specifically, the M&E exercise will involve: -

- i) Assessment as to whether the targets set in the PHMS are realistic
- ii) Assessment as to whether the implementation of the PHMS is achieving the intended results

- iii) Assessment as to whether adequate resources (manpower and finance) are being mobilized to implement the PHMS
- iv) Assessment of the efficiency and effectiveness of utilizing the available resources
- v) Assessment of the reasons for failures in implementing some of the agreed activities
- vi) Assessment of the performance of MoA in spearheading the implementation of the PHMS.

Also, the M&E system will be reviewed annually to determine elements of the system that need to be reviewed or dropped.

Since the NPHMS is planned to be a strategy of 10 years, there will be an evaluation of the strategy implementation once in every three years using an impartial external evaluator to diagnose potential changes that might affect the performance of NPHMS during the remaining period of strategy implementation.

In implementing this strategy, monitoring and evaluation will accommodate the Malabo Declaration targets and indicators.

4.5 Reporting arrangement

Reporting system will follow the normal Government channels whereby at the district/LGA level the report will be compiled and sent to the RS. Different district reports will also be compiled by the Region and sent to the National level.

Since the PHM issues fall under Agriculture sector and ASDP II is the framework for implementing agriculture initiatives in the country, PHM activities will also be reported under the ASDP II. Reports will be submitted on quarterly and annual bases and will include:

- i) Summary of progress in work plan implementation, including a review of any challenges encountered;
- ii) Summary of expenditures relative to project disbursement targets; and

- iii) A summary of results being achieved, including a copy of the Results Framework listing performance targets and accomplishment. The performance targets are not expected to change in every quarterly report. However, the implementation team is expected to summarize the progress of performance monitoring, and highlight any challenges that may affect the achievement of project targets.

At the District level, the District PHM Focal person under the supervision of DAICO will be responsible for compiling the reports from different PHM Government and non-Government actors at that level. While at the Regional level, the PHM focal person will analyze and compile all the District reports and submit to the responsible Ministry, which is PO-RALG and a copy to be sent to the Ministry responsible for Agriculture, currently MOA.

At national level, the PHM Section under MOA will be responsible for compiling and analyzing all regional reports. The issues identified will be forwarded to the respective thematic working group for action. Only the issues, which need High-level decision, will be taken to the High Level Steering Committee for action.

The reports will pay particular attention to the availability of resources required to implement the PHMS, achievements of the planned targets, constraints impeding implementation of planned activities and way forward.

The MOA responsible Section will be charged with preparation of detailed strategy reports, which focus on targets and specific achievements, constraints experienced during the implementation, actions taken to address constraints and milestones.

Forms to be used to prepare the progress and financial reports are attached in Annex 2, 3 and 4.

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ANNEXES

Annex 1: Strategic Objective Implementation Matrix

SO A: Facilitate awareness of good handling practices to improve efficiency and reduce crop losses along the value chain.

| S/n | Management intervention | Targets | Activities | Responsibility | Performance indicators | Expected outcomes |
|-----|---|--|---|--|--|---|
| 1 | Implement communication strategies to raise awareness of food losses, causes and impact | At least 3 awareness communication packages causes, impacts and solutions on post-harvest losses prepared and delivered to actors along the value chain by 2022 At least 5 multi-media means of communication are used to deliver post-harvest management information by 2022 | Compile and consolidate relevant information Translate compiled information into user friendly form Prepare and disseminate various programs through mass media (Radio, TV, Publications, Internet, and social media) and dedicated agricultural shows. Strengthen and capacitate WRC and FFS as channels and outlets for PHLM information | MOA in collaboration with other relevant stakeholders | Proportion of actors accessing relevant information on PHM | Reduction of post-harvest losses. Informed decisions making on PHL and PHT at all levels Improved planning for addressing PHL and PHT at all levels |
| 2 | Capacity building for all actors on PHL | At least 80 percent of actors capacitated on PHM by 2027 | Prepare and harmonize training manuals for PHM Conduct training on PHM to all actors along the value chain. Provide working tools packages to extension officers. | MOA in collaboration with other relevant stakeholders. | Percentage of actors capacitated on PHM | Significant reduction of post-harvest losses Improved planning for addressing PHM issues |

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|---|---|---|---|---|---|---|
| 3 | Promote actor specific best handling practices along the value chain | At least 50 percent of actors adopt specific best handling practices by 2022 | Conduct training on best handling practices to all actors along the value chain Create public awareness on proper handling to ensure quality and safety along the crop value chain | MOA in collaboration with other key institutions. | Proportion of actors adopted specific best handling practices | Percentage Reduction of PHLs. Improve in quality of locally value added products Improved quality and safety of produce |
| 4 | Improve capacity of PHM actors to prevent and control contaminations along the value, e.g. mycotoxins, pesticide/ other chemicals residuals | Aflatoxin contamination reduced to 5 ppb and 10 ppb for AFB1 and total aflatoxin respectively | Conduct comprehensive survey to establish causes, magnitude and spread of mycotoxins, pesticide/ other chemicals residuals contamination Promote appropriate intervention measures in reducing aflatoxin contamination | | Value of Aflatoxin contamination reduced | Reduced Aflatoxin contaminations |

SO B: Promote availability, accessibility and adoption of tested technologies to reduce post-harvest losses

| S/n | Management intervention | Targets | Activities | Responsibility | Performance indicators | Expected outcomes |
|-----|---|--|--|--|---|--|
| 1 | Enhance actors awareness and utilization of proven PHTs | At least 80 percent of actors are aware and utilize PHTs by 2027 | Mobilize and sensitize actors on appropriate use of PHTs Disseminate information on available technologies Support and facilitate usage of proven technologies | MOA in collaboration with other key institutions. | Percent of actors aware and utilize improved PHTs | Post-harvest losses significantly reduced. |
| 2 | Promote agro-processing along the value chain | Agro-processing investments increased by 30 percent by 2027. | Sensitization of adoption of efficient processing units Improve enabling environment to attract investors Attract more investments in affordable packaging materials | MOA and MITI in collaboration with other relevant stakeholders | Percentage increase of agro-processing investment units | Reduced post-harvest losses Increased agro-processing value added |

SO C: Facilitate marketing systems, including infrastructures and storage facilities to enhance crop shelf life and minimize post-harvest losses.

| S/n | Management intervention | Targets | Activities | Responsibilities | Performance indicators | Expected outcomes |
|-----|--|--|---|--|---|---|
| 1 | Improve market access to reduce post-harvest losses | Market access improved by 2022 Streamlined regulatory and administrative procedures to improve to market access by 2022 | Establish and strengthen existing produce handling systems (e.g. transport and storage) at all levels pack houses, cold chain/rooms, warehouses, silos etc.) Establish market information system Support the development marketing mechanism, e.g. WRS and linkage to commodity exchange system | MOA and LGAs in collaboration with other relevant stakeholders | Number of regulations and administrative procedures on market access improved | Market access and premium prices obtained |
| 2 | Ensure availability of specialized human resources to manage marketing systems, including its infrastructure | Sufficient number of specialized human resource obtained by 2027 | Train or recruit specialist personnel with relevant skills | MOA and LGAs in collaboration with other key institutions | Number of people specialized in PHM in place | Improve in quality of products in local value chain |
| | Enhance Marketing Information Systems | All key crops/commodities are included in approved Crop MIS | Establish and strengthen market information systems Link key crop MIC to the Commodity Exchange | MOA and LGAs in collaboration with other key institutions | marketing information systems established | Market access and premium prices obtained |

SO D: Promote research and innovations of new and appropriate technologies and methods to reduce crop losses

| S/n | Management intervention | Targets | Activities | Responsibility | Performance indicators | Expected outcomes |
|-----|---|--|---|--|--|----------------------------------|
| 1 | Ensure inclusion of PHM issues in agriculture research themes | PHM issues are included in agriculture research themes | Review and incorporate PHM issues in agriculture research institutions | MOA in collaboration training and research institution | Number of research conducted on PHM issues | |
| | Establish data base management system on PHM | PHM data base for food crops established by 2020 | Develop a comprehensive data base management system Conduct comprehensive baseline survey to establish status of the PHL in the country, including research on the magnitude of the PHL. Collect routine data for updating PHL database and monitor the extent of PHL. Conduct action/market oriented research on PHM issues | MOA in collaboration with relevant stakeholders | PHM data base in place | Improved post-harvest management |

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|---|---|--|--|--|---|----------------------------------|
| 2 | Verification of existing, emerging, innovative and certified technologies to reduce post-harvest losses | 80 percent of existing PHTs verified and adopted by 2025 | Carry out a survey of existing and emerging PHTs Conduct adaptive research to test and perfect PHTs before dissemination Support PH tech innovations Disseminate results of PH research (both technologies and social research) | MOA and relevant stakeholders along the value chain. | Proportion of PHTs verified and adopted | Reduction of Post-harvest losses |
|---|---|--|--|--|---|----------------------------------|

SOE: Review and put in place new guidelines and regulations to enhance standards and practices to minimize PHL.

| S/n | Management intervention | Targets | Activities | Responsibility | Performance indicators | Expected outcomes |
|-----|---|--|---|---|--|--|
| 1 | Incorporate PHM aspects in existing legislation | Existing relevant legislations reviewed by 2022. | Identify and review relevant regulations, by-laws, to include PHM aspects. Identify and review guidelines. | MOA and other relevant stakeholders MOA& and other relevant stakeholders | Improved performance of PHM Post-harvest issues incorporated on existing legislations | Improved performance of PHM Improved performance of PHM |
| | | | Conduct sensitization to key stakeholders on reviewed guidelines and regulations. | MOA& and other relevant stakeholders | | Improved performance of PHM |

SO F: Strengthen coordination, partnerships, and stakeholders' participation to enhance strategy interventions

| S/n | Management intervention | Targets | Activities | Responsibility | Performance indicators | Expected outcomes |
|-----|---|--|--|---------------------------------------|---|--|
| 1 | Enhance coordination at all levels to improve involvement of key actors in various PHM issues | Coordination mechanism at National, Regional & LGAs levels enhanced by 2020. | <p>Identify and document institutions involved on PHM issues</p> <p>Sensitize and create awareness to institutions making decisions</p> <p>Strengthen the existing Tanzania PHM Platform</p> <p>Strengthen national coordination unit in the Ministry</p> <p>Form Thematic Working Groups (TWG) and appoint Focal Persons at RS & LGAs level</p> <p>Provide sufficient working tools to national coordination unit, TWG, etc.</p> <p>Support the operations of the national coordination unit, TWG, etc.</p> | MOA& and other relevant stakeholders. | Functional coordination mechanism | <p>Post-harvest losses reduced</p> <p>Food security improved</p> |
| | | | <p>Strengthen national coordination unit in the Ministry</p> <p>Form Thematic Working Groups (TWG) and appoint Focal Persons at RS & LGAs level</p> <p>Provide sufficient working tools to national coordination unit, TWG, etc.</p> <p>Support the operations of the national coordination unit, TWG, etc.</p> | MOA& and other relevant stakeholders | <p>Coordination unit strengthened</p> <p>SC established</p> <p>RS & LGAs Focal Persons in place</p> <p>Budget allocated increased</p> <p>Number of tools provided</p> <p>Number of meetings conducted</p> | Efficiency of performance improved |

| | | | | | | |
|---|--|--|--|-------------------------------------|--|--|
| 2 | Establish and manage investments incentive packages to increase private sector participation | Investment incentive packages developed and implemented by 2022. | Identify and resolve PHM investment barriers Create investment incentive packages on PHM value chain | MOA & other relevant stakeholders | Number of incentive packages developed and implemented | Post-harvest losses reduced Food & nutrition security improved. |
| 3 | Strengthen human resource base of the PHLM lead institution(s) | 80 percent of the human resource base available to address PHL by 2025 | Recruit human resources Conduct capacity building and human resource development on PHM Provide sufficient tools and improve working environment | MOA and other relevant stakeholders | Proportion of human resources base available | Efficiency of performance improved |

SO G: Strengthen post-harvest management systems to adapt and mitigate the effects of climate change

| S/n | Management intervention | Targets | Activities | Responsibility | Performance indicators | Expected outcomes |
|-----|---|--|---|-------------------------------------|---|--|
| 1 | Ensure provision of Climate Change – PHM relevant information, early warning systems | All key early warning information appropriate to the risks identified Climate Change along the PHM value chain are prepared and disseminated by 2027 | Sensitize farmers and other stakeholders on Climate Change effects on PHM Sensitize farmers on growing crop varieties which are less susceptible to CC effects Strengthen linkage and flow of agro-meteorological information and products from Tanzania Meteorological Agency (TMA), including Seasonal Climate forecast and Monthly Climate Outlooks. | MOA and other relevant stakeholders | Disseminated sets of information packages customized for PHM stakeholders | Increased integration of climate changes services in PHM planning and budgeting process Increased efficiency in PHM practices Adoption of climate-smart PHM. |
| 2 | Introduce innovative Post-harvest Climate Resilience technologies, and infrastructure | 80 percent adoption of CC compliant and resilience PHT mainstreamed by 2027. 80% capacity building to suppliers and beneficiaries in establishing and operating climate smart harvest and PHTs conducted by 2027. | Construction and rehabilitation of warehouses/ storage facilities, pack-house and cold storage facilities Supply and install of agro-processing facilities Support Utilization of improved storage technologies, e.g. Metallic silos Adopt best practices, including low-carbon technologies for drying and cooling | MOA and other relevant stakeholders | Adoption rates and diversification to recommended crop varieties Proportional of suppliers and beneficiaries trained and adopted climate smart harvest and post-harvest technologies | Availability of skills and technologies, as well as access to compliant and resilience PHT. |

SOH: Addressing inadequacy in PHM financing

| S/n | Management intervention | Targets | Activities | Responsibility | Performance indicators | Expected outcomes |
|-----|---|---|---|---|---|---|
| 1 | Introduce innovative financial mechanisms to support investments, promotion, distribution and utilization of PHTs | Share of lending to investors, SMEs and farmers to invest in PHTs increased by 50 percent by 2022. | Design and pilot new financial products that promote access to PHT e.g., lease financing for PHL reducing equipment Increase access to financial services through the use of low-cost and innovative ICT delivery mechanisms | Financial institutions, emerging donors & private sector NGOs | Percentage of loan disbursed to investors on PHTs | Increased investment boom Reduced drudgery and post-harvest losses Expanded access to financial products by farmers and SMEs |
| 2 | Establish mechanisms to de risk and introduce blended finance. | Traditional donor funding mechanisms supporting PHTs complimented by 2022 Mechanisms to reduce financial risks associated with Post harvest Management established by 2022 | Facilitate credit guarantee facilities to improve market terms & boost lending to SMEs Enhance revolving fund blending a credit line with grants for the manufacturing and distribution of PHT Promote instruments (crop insurance, index-based) to reduce weather risks for farmers and SMEs | MOA and other relevant actors MOA, MoFP; Financial Institutions, and other relevant actors MOA, MoFP; Financial Institutions, and other relevant actors | Amount of additional funds to support PHTs Number of insurance services created for safe-guarding actors against losses in PHM financing | Increased value of capital available to deliver PHT to the last-mile Expanded production scale of PHT Increased appetite of financial institutions to lend for PHT to low income SMEs & farmers |

| | | | | | | |
|---|---|--|--|-------------------------------------|---|------------------------------------|
| 3 | Ensure timely availability of adequate financial resources to the PHM lead institutions | Sufficient financial resources to support PH services obtained by 2025 | To advocate on the importance of financing PHM initiatives to the decision makers at all levels. To solicit funding from public and non-public sector for PHM. To mainstream PHM in different existing national and regional programs and projects. Develop the operational plan and budget to implement the strategy | MOA and other relevant stakeholders | Amount of funds allocated to PHM activities | Efficiency of performance improved |
|---|---|--|--|-------------------------------------|---|------------------------------------|

SO I: Develop standard methodologies for collecting data and estimating post-harvest losses in a country

| S/n | Management intervention | Targets | Activities | Responsibility | Performance indicators | Expected outcomes |
|-----|---|--|---|-------------------------------------|--|--|
| 1 | Review and harmonize existing PHLs assessment methodologies | Common methodologies including FAO FLAM broadly agreed and adopted for PHLs assessment | Identify existing methodologies for PHLs assessment Review and propose the standard methodologies for national PHLs assessment Incorporate agreed methodologies for PHLs assessment in training institute curricula | MOA and other relevant stakeholders | Developed Standard methodologies for PHLs assessment | Improved data collection methods and accurate data on PHLs |

Annex 4: Financial Performance Report

Financial Performance as at.....

| Category of Budget | Approved Budget | | Funds Disbursed | | Actual Expenditure | |
|--------------------|-----------------|-------------------------|-----------------|--|--------------------|--|
| | Amount in Tshs. | percent of Total Budget | Amount in Tshs. | Amount Disbursed as a percent of the Approved Budget (4/2) | Amount in Tshs. | Actual Expenditure as a percent of Approved Budget (6/2) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| TOTAL BUDGET | | | | | | |

Annex 5: list of task force members

| S/n | NAME | Position | Organization |
|-----|--------------------------|-----------------|---|
| 1. | Mr. Clepin Josephat | Chairperson | Ministry of Agriculture |
| 2. | Mr. Honest Mseri | Secretary | Agricultural Non-State Actors Forum (ANSAF) |
| 3. | Ms. Magreth Natai | Member | Ministry of Agriculture |
| 4. | Ms. Josephine Amolo | Member | Ministry of Agriculture |
| 5. | Mr. Daktari Hango | Member | Ministry of Agriculture |
| 6. | Mr. James Ngwira | Member | Ministry of Agriculture |
| 7. | Mr. Sadoti Makwaruzi | Member | Ministry of Agriculture |
| 8. | Ms. Zakia Lamwala | Member | Ministry of Agriculture |
| 9. | Mr. John Chassama | Member | Ministry of Industry and Trade |
| 10. | Ms Shamim Daudi | Member | HELVETAS Swiss Intercooperation |
| 11. | Mr. Audax Rukonge | Member | Agricultural Non-State Actors Forum (ANSAF) |
| 12. | Mr. Gungu Mibavu | Member | Ministry of Agriculture |
| 13. | Mr. Paschal D Vyagusa | Member | Prime Minister's Office |
| 14. | Dr. John K. Mduma | Resource person | University of Dar es Salaam |
| 15. | Dr. Anacieti K Kashuliza | Resource person | Private |
| 16. | Prof Henry Laswai | Resource person | Sokoine University of Agriculture |
| 17. | Dr. Mustaq Osman | Resource person | University of Dar es Salaam |





For more information about National Post-Harvest
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